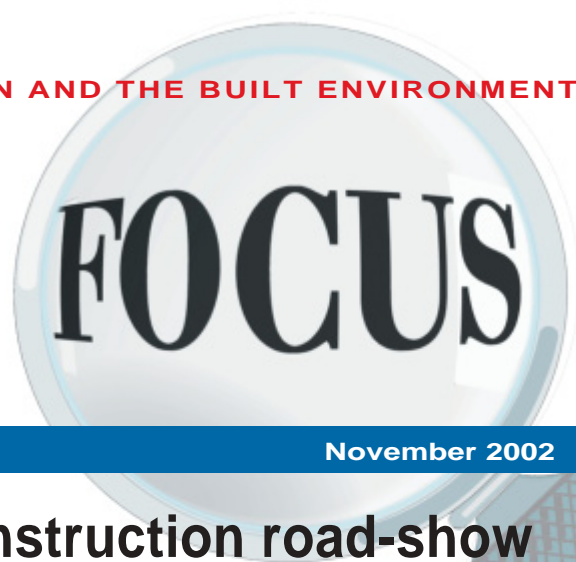


Innovation & Research



Issue No. 51 November 2002

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Sustainable construction road-show

If the objectives of sustainable construction are to be achieved, it is essential that the construction industry as a whole is involved in the process. To deliver the latest practical information on sustainable construction for infrastructure, TRL, with CIRIA and the Environment Agency, are running a road-show, known as SCiP (Sustainable Construction in Practice), sponsored by the DTI Partners in Innovation Programme.



Effective re-use of materials such as concrete is a vital element of sustainable construction

The road-show will visit ten locations around the UK, having started off in London in October. Workshops will include lectures, worked examples, case studies and feedback/discussion sessions, including:

- the waste management licensing regime, duty of care and hazardous wastes;
- waste minimisation;
- alternative materials and recycling;
- specifications and quality control;
- the oil storage regulations;
- environmental management systems;
- water pollution prevention and discharge consents.

The road-show will be valuable to a wide range of delegates, particularly those in small to medium sized enterprises who do not have ready access to information on sustainable construction practices, even though they could implement them in the course of their work. The workshops will also benefit engineers requiring knowledge on sustainability as part of their professional development.

For further information please contact Mary Treen at TRL (01344-770514; fax: 01344 770990; E-mail: mtreen@trl.co.uk).

INNOVATION & RESEARCH

New name & web service for our 2nd half-century

We are delighted to announce that, as *Focus* enters its second half-century of issues, it has a new name, a new by-line, and is now available on the web at www.innovationandresearchfocus.org.uk.

With many projects being undertaken by sponsors now being aimed at securing innovation in its broadest sense and not conventional research, *Research Focus* has become *Innovation and Research Focus*, to better reflect these changes. In addition, the new by-line reflects that broadening of coverage.

To enhance service to readers, and with the aims of winning new readers, and securing more involvement and improved service, IRF is now also at www.innovationandresearchfocus.org.uk, where it can be viewed and searched, and from which individual articles and whole issues can be downloaded.

The four most-recent issues are already available on the website and over the next few months, all of the still-current articles from the last five years' issues of *Research Focus* will be added to the site.

Paper copies will continue to be printed and distributed as now. However, we hope that many existing and new readers will log on to the website and register their interest in notifications about future issues and further information from IRF's sponsors.

For further information, please go to the new website or contact IRF's Editor, Roger Venables, at Venables Consultancy (020 8399 4389; fax: 020 8390 9368; E-mail: irf@venablesconsultancy.co.uk).



New guide to maintaining design quality in HVAC

BSRIA's latest publication, *Design Checks for HVAC – AG 1/2002*, addresses problems originating in the design of heating, ventilating and air conditioning systems. The publication arose from a Partners in Innovation project entitled *Technical design quality control*, which was aimed at tackling the growing problem of lost knowledge in an ever-faster-moving commercial world.

Design is a risky business. The loss of experienced staff through retirement and earlier construction market recessions means that there are far fewer people capable of performing the stringent quality control checks required before specifications or design drawings are approved. Coupled with the general demise of specialist higher education courses dealing with building services, the pressure for faster construction and higher productivity, it is not surprising that costly mistakes occur. BSRIA estimates that at least 50% of building defects and failures can be attributed to design errors, which is not surprising when a study of recent professional indemnity cases found that 45% of claims were down to errors in design concepts and parameters.

The new BSRIA publication has been written with financial support from the DTT's Partners in Innovation scheme and from 16 industry partners including ACE, CCF and CIBSE and with support from the design sector. It provides practical, easy to follow guidance on 60 building services topics, from the selection of internal design criteria through to the detailed specification of HVAC systems such as fan coils, radiant heating and controls.

There are two main elements to the guidance: design guidance sheets and pro-forma check sheets. The former provide information, guidance and detailed watch points for the design inputs and outputs when designing building services, while the latter provide a ready-made checklist for use in quality assessment procedures in line with ISO 9001:2000 and BS 7000 Part 4:1996.

When incorporated into company QA practices, *Design Checks for HVAC* can be used to demonstrate to professional indemnity insurers that the right design quality procedures are in place and has been specifically written to complement existing CIBSE Guides, in particular Guide B2 covering ventilation and air conditioning, Guide B3 for ductwork, Guide B1 for heating,



A primary target for the guidance is design of ductwork

and the CIBSE Concise Guide.

Although *Design Checks for HVAC* is primarily intended to provide guidance to practising building services design engineers, it is likely to be just as useful for those involved in the installation, commissioning and maintenance of M&E plant. Although the project and its output are clearly technical in their foundation, it will lead to improved construction quality, better buildings for people to live and work in, reduced risk for designers, and ultimately improvements in the fortunes of companies who embrace this help. Fewer mistakes, better design productivity, improved profits arising from improved quality and, possibly, lower insurance premiums should be the result.

Design Checks for HVAC is available in paper format from BSRIA, price £35 for BSRIA members and £60 for non-members. The publication is also available in electronic format to enable firms to adopt the pro-forma check sheets as part of a firm's quality assurance procedures (£350 for a single site licence).

For further information, please contact Gay Laurence Race at BSRIA (01344 426511; E-mail BSRIA@BSRIA.co.uk).

HIGHWAYS & R&D MANAGEMENT

Highways compendium of research updated



The Highways Agency (HA) has recently redesigned and updated its comprehensive Compendium of Research. The project team, led by TRL Ltd with specialist internet design by Vardus Ltd, have created a 'live', internet-based Compendium that will continually evolve to reflect new demands and user expectations.

The Compendium contains details of all projects funded out of the research budget of the HA since the Agency's inception in 1994. The project details are updated on a frequent basis and details are included as each project starts and finishes. The Compendium allows users to identify and locate relevant research concepts and results quickly and easily. Links are provided for obtaining further project and detailed information as well the ability to subscribe to an automatic update service.

For further information, please contact Dr V Ramdas at TRL (01344-770461; fax 01344-770356; E-mail: vramdas@trl.co.uk; website: www.highways.gov.uk/contracts/compendium/index.htm).

ABOUT RESEARCH FOCUS

Aims

The aim of *Research Focus* is to promote the application of research in building, civil engineering and the wider built environment.

Its articles on current research and innovation are written for a wide-ranging audience, including practising engineers, architects, surveyors, environment specialists and their clients. The objective is to disseminate research and innovation news as widely as possible. Its sponsors wish to promote the benefits of research and innovation, improve contacts between industry and researchers, encourage investment by industry in research and innovation and the use of results in practice, and facilitate collaboration between all the parties involved.

Formally, *Innovation and Research Focus* is

an unrestricted newsletter containing invited factual records or case studies of innovation or 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 organisation or person named at the end of the relevant article. Look on the back page for addresses, telephone and fax numbers of the sponsors and professional institutions. General information about their activities may be obtained from them directly.

We welcome your ideas on ways to improve Innovation and Research Focus – contact the Editor at irf@venablesconsultancy.co.uk.

Distribution

If you receive *Research Focus* by direct mail (i.e.

not with *Civil Engineering*) and the address it is sent to is incorrect please contact Kathleen Hollow at the Institution of Civil Engineers, 1 Great George Street, London SW1P 3AA (020 7665 2242; fax 020 7799 1325; E-mail: kathleen.hollow@ice.org.uk).

The Editor of *Innovation and Research Focus* is Eur Ing Roger Venables whose contact details are: Venables Consultancy, 12 Cranes Drive, Surbiton, Surrey, KT5 8AL (0208-399 4389; fax 0208-390 9368; E-mail: irf@venablesconsultancy.co.uk).

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Fluid-structure interaction



The SCI has been appointed by the Health & Safety Executive (HSE) to study fluid-structure interaction effects on – and the dynamic response of – pressure vessels and tanks on offshore installations that are subjected to dynamic loadings.

Recent advances in the fields of fluid-structure interaction and dynamic analysis have led to an increased understanding of these effects on large cylindrical storage tanks, dams and floating and submerged structures. However, this knowledge has not yet been extended and applied to vessels and storage tanks on offshore installations. Some of the issues that remain unresolved include:

- response of topside vessels and storage tanks to dynamic loading, including earthquake motion;
- sloshing response of various liquids due to horizontal excitation;
- the effects of the various equipment boundary



The topsides for the Hibiscus Offshore Platform, Trinidad

support conditions on their dynamic response during vessel impact or earthquakes;

- assessment of current design practice.

The study will examine these issues and provide guidance on modelling tank-liquid / vessel-liquid systems and the contribution of various dynamic deformation modes to the overall structural response.

For further information please contact Mr Karthi Karthigeyan at the HSE. (E-mail: v.karthigeyan@hse.gsi.gov.uk) or Dr Fadi Hamdan at the Steel Construction Institute, (01344 623345; Fax: 01344 622944. E-mail: f.hamdan@steel-sci.com).

ENVIRONMENT, DESIGN & CONSTRUCTION PROCESSES

Biodiversity and the business of building



The UK construction industry has a tarnished reputation with respect to nature conservation because of its often adverse ecological impacts. These impacts include direct loss of habitat, fragmentation and isolation of fragile habitats and species, and the killing and disturbance of wildlife. As a consequence, the role of the industry in the protection of sensitive sites and species, and the provision of new or improved habitats, is becoming more significant.

CIRIA and BRE, with sponsorship from DTI and project partners, plan to develop a practical, simple and

acceptable indicator for measuring the consequences of project design and site practices upon biodiversity. This will result

from a scoping study, consultation and subsequent testing phase on live construction projects. In particular, the project will seek to develop an indicator that is both practical and acceptable to both the industry and its relevant stakeholders. Those wishing to participate in the consultation and testing phases of this initiative should contact CIRIA citing RP662.

A second project, *RP661 Working with wildlife*, aims to develop a practical educational training pack on nature conservation and biodiversity issues applicable across the UK. The pack is being prepared by Crane Environmental Ltd and Ecology Consultancy Ltd under the management of CIRIA and the guidance of an independent steering group. Following the pack's development and publication next summer, a nationwide programme of training seminars will be held to promote its use within the sector. The training seminars will be conducted in collaboration with conservation bodies, local wildlife trusts and local planners to facilitate knowledge exchange, as well as the effective communication and adoption of best practice.



Artificial banks and nesting sites introduced to a new riverside development at Kingston upon Thames (photo courtesy of Crane Environmental Ltd)

For further information please contact CIRIA (020 7222 8891; fax 020 7222 1708; E-mail: irf@ciria.org.uk; website: www.ciria.org.uk).

Water for food – research outputs

One of the central themes of the World Summit on Sustainable Development (WSSD) in Johannesburg was water. Around 1.1 billion people lack access to clean water and four billion are without sound wastewater disposal. DFID's Knowledge and Research Programme supports those seeking to provide such services.

Water resources is one of the research sectors supported by the Knowledge and Research Programme (KaR) of DFID's Infrastructure and Urban Development Department (IUDD). In addition to the water sector, the KaR programme also supports Resource Centres in transport, geosciences, energy, small-scale technology and urban development. One of the key objectives in carrying out this research is to ensure that the outputs produced are disseminated effectively and in formats that are useable by practitioners in developing countries.

The importance of water was recognised at WSSD by a parallel event, WaterDome. Through the KaR programme, the DFID-commissioned Resource Centres are contributing to the "knowledge pool" at the WaterDome. One objective is to achieve wider dissemination and uptake of research outputs, to raise awareness amongst as wide an audience as possible and to ensure ready access to the outputs, so that potential users can make informed decisions. The DFID KaR programme aims to promote "Best Practice" in provision of infrastructure and capacity building that is pro-poor.

DFID's research in water resources is in 4 areas: (i) Water resources management, (ii) Combating the degradation of water resources, (iii) Water and sanitation and (iv) Water for sustainable food production.

To support the exhibition in the WaterDome and the dissemination initiative, DFID's Water for Food research programme published a catalogue detailing research outputs over the period 1990 to 2001. It also explains how potential users can obtain copies of those outputs, many of which are available for free download. The catalogue

and summary sheets are available without charge from HR Wallingford or via the Internet at: www.dfid-kar-water.net/w5outputs.html and the full text of most of the outputs can also be obtained here.

This article has been prepared through CIMRC, a new Resource Centre developing and helping to initiate a new improved communications and information

management strategy for staff and projects in DFID's Infrastructure and Urban Development Department.

For further information please contact Geoff Pearce, CIMRC Co-ordinator, International Development Group, HR Wallingford, (01491-822439 E-mail: grp:hrwallingford.co.uk).

GROUND ENGINEERING

Foundations for offshore wind turbines



One resource that the UK possesses in generous measure is wind. Land-based wind farms already exist in Cornwall, Wales and Cumbria, but there is also scope for building them in shallow (under 15m) water offshore. Staff at HR Wallingford are helping to investigate the use of novel foundations for such developments. The work is part-funded through the DTI's New and Renewable Energy Programme, with additional support from the project partners who include representatives from the energy sector, turbine manufacturers and designers.

Offshore structures have traditionally relied on piled foundations, which are expensive to install and decommission. One alternative might be to use suction caisson foundations to support wind turbines in offshore wind farms. These are (essentially) huge upturned steel buckets that are lowered onto the seabed, then pumped out to create a negative pressure. The resulting suction holds foundations in place, penetrating any sand or clay present. Single unit, suction caisson foundations can be installed within hours – whereas piling takes days and is more weather-dependent.

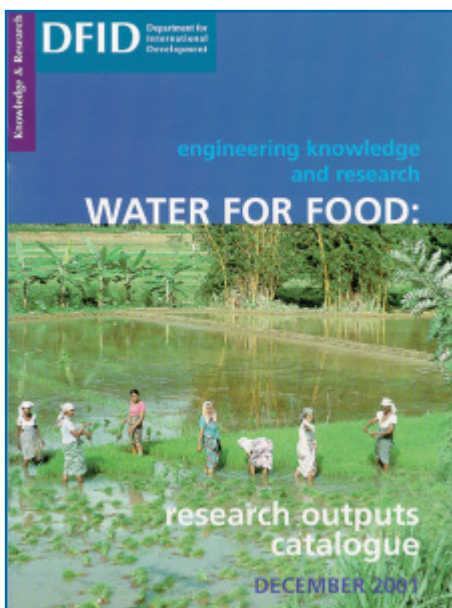
Staff at Wallingford have worked on many projects looking at seabed scour and are currently studying liquefaction around marine structures. During the Suction Caisson study, researchers will use their databases to collate existing information on seabed mobility and bed forms around the UK. 'We aim to identify ranges of seabed movement for typical development sites,' says Scott Dunn who leads HRW's input. Staff will also develop a numerical model to simulate the behaviour of suction caissons in waves. Modelling will involve identifying the main physical processes at work as well as the magnitude of cyclic stresses (structural movement versus direct wave pressure) and potential for liquefaction around the structure. 'In collaboration with Oxford University, we will also build a physical model to study wave-induced liquefaction for typical caissons.'

Suction caisson technology seems to offer an increased range of foundation solutions for

developing offshore wind farms. Results from this study will help to answer some of the questions still outstanding as well as informing the wider programme of research into renewable energy.

For further information please contact Scott Dunn at HR Wallingford (01491 822470; fax: 01491 825743; E-mail: sdu@hrwallingford.co.uk).

NEG Micon 2MW offshore wind turbines at Ytre Stengrund, Swedish Baltic Sea



Aiming for better synthetic sports pitches



As the Commonwealth Games hockey teams 'pushed off' at the Belle Vue Regional Hockey Centre in Manchester on synthetic 'water based' pitches, Loughborough University researchers were working to ensure that synthetic turf pitches are designed and constructed in the best way possible.

The research is being carried out by Dr Paul Fleming's team in the Department of Civil and Building Engineering, with support from the Sports Technology Research Group. Funding is provided from the EPSRC, English Hockey and Sport England. The team is transferring technologies, largely from road building, and has tested ideas out on the latest generation of hockey and football pitch facilities at the University. The 'perceptions' of the Loughborough premier league players are being measured with respect to hockey pitch facilities around the country.

Elite hockey players like the water-based pitches, which allow a fast, skilful game. However, there are few rigorous standards for their construction. There are many products available and various ways of constructing the pitch. "Some pitches are faster than others with a hard surface, some are softer, with a higher bounce. As engineers, we are trying to understand the link between the materials that the pitch is made from, how it is constructed, and how these factors affect the way it plays".

"The ultimate aim is to develop a set of guidelines and standards that will help to



Spraying water onto a synthetic pitch and (right) match play on a synthetic pitch

improve the quality of pitches and to ensure that a club is getting a pitch with the kinds of playing characteristics that it wants. We also want to develop tests that would enable (simple) monitoring of the performance of a pitch throughout its lifetime. The findings will be transferable across the range of

synthetic turf pitches, such as those used for cricket, football and multi-use games areas".

*For further information please contact:
Dr Paul Fleming at CICE (01509 222616;
E-mail: p.r.fleming@lboro.ac.uk).*

MATERIALS, SAFETY & DESIGN

Cardington concrete frame fire test results



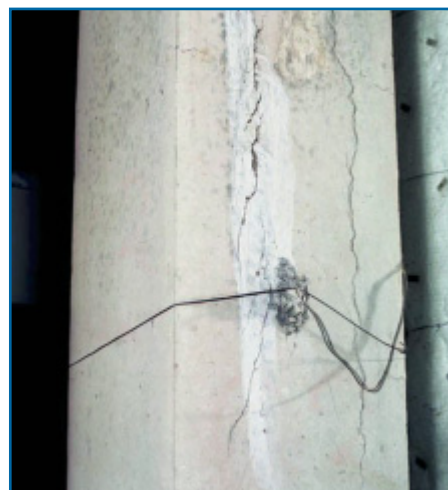
Results from the full-scale concrete fire test on the 7-storey concrete frame have now been published in a BRE Test Report. Although the focus of the research on the thin lean frame was to investigate process issues, the opportunity was taken to investigate the behaviour of the concrete frame when subjected to a realistic compartment fire together with realistic applied static load (*Research Focus*, February 2002).

There are five main results and observations from the BRE test report.

- The building satisfied the relevant performance criteria of load bearing function (R), Insulation (I) and Integrity (E), when subjected to a realistic fire, as defined in the forthcoming Eurocode EN 1992-1-2.
- The maximum atmosphere temperature recorded was 950°C, before malfunction of some of the instrumentation. It is likely that higher temperatures occurred during the test.
- Spalling of the soffit to the first floor slab was observed; however, this did not compromise the structural integrity of the floors under the imposed loads. The spalling was not surprising when considering: i) the slab was of high strength concrete (74 N/mm²) and ii) as a result of the unique closed environment around the building in the Cardington hangar, the measured moisture content in the concrete was unusually high (3.8%, by

weight), i.e. higher than the 3% limit where, as given in the Eurocode, spalling can be ignored.

- In spite of the spalling and loss of cover,



High strength column after fire test

the slab was able to carry the full-imposed service loads with very low residual vertical displacements (maximum 78mm). The floor slab was acting in compressive membrane action. This type of behaviour needs to be considered more fully in fire, and simple design methods need to be developed to include this beneficial effect.

- The high strength concrete columns (103 N/mm²) which contained polypropylene fibres, performed very well during the fire.

The test is part of a wider programme of development on the fire design of concrete structures. The aim is to put into practice the design benefits to be gained from previous and new research in order to deliver more-economical concrete frame construction whilst maintaining the current high levels of safety.

For further information contact Dr Pal Chana at BCA (01344725746; fax: 01344 727203; E-mail: pchana@bca.org.uk).

Improved hydraulic design of large paved areas



Changes in the way that we travel, shop and spend our leisure time have resulted in the creation of increasingly large paved areas – including car parks, airports, precincts and out-of-town shopping centres. During heavy storms, such areas generate large volumes of surface water run-off. This provides an engineering challenge – current drainage standards were developed for smaller areas (< 600m²) and it is uncertain how well they represent larger ones.

Staff at HR Wallingford recently led a DTI-funded study to investigate the situation. This collaborative research included partners Aco Technologies, BAA, Pinnacle Consulting, TPS Consult and Whitby Bird & Partners.

The aims of the project were to:

- identify acceptable design criteria for draining large paved areas (e.g. maximum acceptable water depths and duration of ponding);
- develop a procedure for estimating runoff rates and water depths on pavements;
- prepare design guidance for applying the new procedure;
- promote adoption of the design procedure.

The study team identified a suitable test site at Heathrow Airport, where (after fulfilling strict security and safety requirements) they set up ultrasonic probes to measure runoff depth, rain gauges and data logging equipment. 'The site consisted of an 83m-long brushed concrete pavement, with a single gradient, draining to a large capacity slotted system,' explains Manuela Escaraméia, the project coordinator. It



Installing monitoring equipment at Heathrow Airport

proved difficult to find a second test site, representative of car parks. 'We needed a site with a single gradient, so that accurate measurements could be taken of very shallow water depths – just a few millimetres. Car parks tend to have uneven gradients and many are in constant use, so installing instrumentation long-term was inconvenient'. To overcome these problems, a special test

surface was built at Wallingford. 'We created an outdoor pavement representing a section of an asphalt car park,' says Manuela. 'The gradient was 1 in 60 – typical of the slopes actually found.'

Field data was collected from each study site and used to verify a new computational model, developed by HRW for this study and based on kinematic wave theory. The model calculates variations in water depth and flow rate with time-varying rainfall.

Researchers have produced a simple design procedure for estimating flow rates and water depths on impermeable pavements, knowing site characteristics such as the type of surface, catchment length/slope and rainfall conditions (see www.hrwallingford.co.uk/projects/paved_areas for details).

Their results should help engineers to plan paved areas that drain efficiently – reducing the risk of flooding whilst avoiding wasteful (and costly) over-design.

For further information please contact Manuela Escaraméia at HR Wallingford (01491 822337; fax: 01491 832233; E-mail: mme@hrwallingford.co.uk).

BUILDINGS & DESIGN

Guidance on façade design



CWCT is adding new Technical Notes to the series originally published under the DETR-funded Partners in Technology scheme. The existing Notes provide guidance on issues relating to façade performance including wind loading, glass, glazing and sealants. New titles recently published cover pressure effects on insulating glazing units and ventilation. A further Note on the inspection of curtain walling is in preparation.

By their nature, insulating glazing units have a sealed cavity containing air or other gas. At the time of manufacture the pressure of the gas in the cavity will be the same as the external pressure. Changes in the external pressure after manufacture due to changes in altitude or weather conditions will therefore set up pressure differences across the glass panes. Pressure differences will cause deflection of the glass that may result in aesthetic problems, typically distorted reflections, as well as affecting thermal and acoustic properties. In extreme cases failure of the glass may occur. Technical Note 31 considers the significance of the potential effects of pressure on insulated glazing units.

It has been estimated that up to 90% of our time is spent indoors. With the introduction of more airtight building construction, and modern lifestyles generating increased amounts of moisture and air pollution within both domestic and commercial buildings, the provision of effective ventilation has become more of a concern. It has been proven that



Glazing Units stored carefully on site to avoid damage

adequate ventilation is essential for the well-being and health of building occupants and to the fabric of the building itself. Correct ventilation of domestic and commercial buildings is therefore essential.

Quality of curtain walling is often assessed by visual inspection. However, disputes may arise over the procedures to be used for such inspections. This is particularly the case where a specification does not set out details of the procedures to be used. Technical Note 32 gives advice on the visual inspection of curtain walling and sources of guidance for such inspections. It is concerned with inspection of new construction and does not cover condition surveys after a period in service.

A full list of the notes (available individually or as a set) is maintained on the CWCT website: <http://www.cwct.co.uk>.

For further information please contact Brenda Apted at CWCT (01225 826 541; fax 01225 826 556; E-mail: cwct@bath.ac.uk).

Improving quality and minimising risk in ground work using the new AGS-M modules

Ground engineering operations are fundamental to building works, for example piling, dewatering, ground treatment and embedded retaining wall construction. Construction operations can however also affect existing buildings by tunnelling, deep excavations and the need for compensation grouting to protect buildings.

All of these works include instrumentation and monitoring as an intrinsic part of the working process and design. The monitoring is to control quality, to check safety and/or to manage potentially adverse impacts on nearby property. There is a need for rapid, unequivocal sharing, of the raw, time-based data between organisations, so that engineers can process, analyse and examine what is happening in the field and use the in-situ measurements to inform decision-making.

During the construction of the Jubilee Line Extension (JLE) in the 1990s a CIRIA research project investigated the effect of tunnelling-induced subsidence on buildings. An extensive monitoring programme generated several gigabytes of geotechnical data. To handle the data a database called GEMINI – GEotechnical Monitoring INFORMATION Interchange – was developed by London Underground and CIRIA, based on the existing AGS (Association of Geotechnical and Geoenvironmental Specialists) format for the storage and transfer of ground investigation data.

After completion of the JLE there was widespread industry discussion about how the GEMINI module could be converted into a form that could be made widely available to the industry. To answer this need, CIRIA and the AGS began a project in late 2000 to modify the GEMINI format to produce an 'instrumentation module' compatible with the current version of the AGS format (AGS3), widely used by the construction industry for the storage and transfer of site investigation data. The work was funded by the DTT's Partners in Innovation scheme, the Institution of Civil Engineers' Research & Development Enabling Fund and CIRIA Core Members.

By mid-2001 a new instrumentation module (AGS-M) had been created. During subsequent site trials, data from a wide variety of geotechnical monitoring instruments were put into AGS-M format and sent to the project team. The project team was able to re-create the original data with ease, proving the validity of the new AGS-M module.

AGS-M allows the receiver to re-create the factual engineering plots included in the producer's monitoring report. The majority of these plots take the form of the variation with time of a measured physical parameter or a geotechnical determinand. The format consists of a number of 'tables', which are organised in a hierarchy with an inverted 'tree-like shape'. To structure the data in a consistent and logical manner, they have been divided into Data Groups within which a series of fields are defined. The Data Groups relate to specific elements of data that are obtained, (for example project information, reference point, and monitoring point details). Fields within



An Athens metro tunnelling machine – AGS-M is being used to help monitor geotechnical data.



Taking measurements underground

each Data Group identify specific items (for example instrument response zone, pressure, and reading). The format is not intended for the transfer of raw data, calibration information, or derived interpretations.

The new AGS-M module was placed onto the AGS web site in an easily downloadable form in March 2002. Example files for many common geotechnical monitoring instruments have also been placed on the web to help users to create the appropriate files to store and

transfer data in AGS-M format. The module is already being used to store and transfer geotechnical monitoring data on major construction projects including the Channel Tunnel Rail Link and the Athens Metro.

For further information see the AGS website: www.AGS.org.uk or contact CIRIA, 6 Storey's Gate, Westminster, London SW1P 3AU (020 7222 1708; E-mail: irf@ciria.org.uk; website: www.ciria.org.uk).

INNOVATION & DESIGN

CPD by CD



Some SCI courses are now recorded on CD, so that designers can undertake CPD at their own convenience. Two CDs are currently available covering the amendment to BS 5950-1: 2000 and an introduction to BS 6399-2.

Each CD contains all the presentational material of the original course, with an audio commentary by the lecturers. Questions are included so that anyone using the CD can test their understanding of the material, and the completed answers are provided as worked examples. The CD has built-in tracking, and on completion of the course, will invite the designer to request a CPD certificate.

To purchase the CDs please contact education@steel-sci.com.

For further information please contact David Brown at The Steel Construction Institute; (01344 623345; fax: 01344 622944; E-mail: d.brown@steel-sci.com; website: <http://www.steelbiz.org>).



TNT FastTrack, Magna Park, Lutterworth (Courtesy of Barrett Steel Buildings) is typical of projects on which the CPD CDs could be used.

CRC Jointcast: joining pre-cast concrete components



Recent research by BRE has shown that CRC Jointcast can be successfully used for joining wholly pre-cast concrete building components together.

CRC Jointcast is a very high strength concrete incorporating a high proportion of steel fibres, which give the material enhanced ductility and greatly improved bond strengths for ribbed bars.

The testing of CRC Jointcast has been part of a project undertaken to support the DTI's objectives of promoting innovation, performance, process improvement and best practice in the construction sector. The project aims to make the use of prefabrication in pre-cast concrete more practical and the construction process more efficient.

As part of a desk study of existing practice and available techniques for joining concrete, steel, timber and masonry elements, a number of generic joint types that lend themselves to the use of alternative jointing approaches have been identified. Based on these the following were tested:

- a beam-column connection that might occur at the corner of a building at roof level;
- a beam-column connection with beams framing in from either side, a situation that might occur at an edge of a building in one of the lower storeys;
- a column-column connection in a continuous pre-cast column – the joint was formed at a convenient working height of 1m above the ground, which resembles current practice;
- testing a flat-slab-to-column connection involving the joint between the lower column and the slab;
- a flat-slab-to-flat slab connection, for example formed at the centre of a flat-slab panel.

The performance of CRC Jointcast in these tests led to the following conclusions.

- 1 CRC Jointcast has been shown to work successfully for the purposes of joining wholly pre-cast concrete components together.
- 2 This conclusion can, in principle, be extended to other similar materials, which are also now being developed, but there is not the test data from the work completed so far to recommend these alternatives unreservedly.
- 3 This programme of testing has dealt with assembly processes and structural integrity only under static loads and other aspects, such as performance in fire, have not been considered.
- 4 The results should give confidence to engineers to specify use of CRC Jointcast for joining pre-cast components together, at least initially at less-critical locations.
- 5 The intention now is to work with the members of the Steering Group to develop the concepts demonstrated in the tests into practical joint details that could be used in real buildings.



1 Testing a jointed column
2 Flat slab connection
3 Column connection

The material has been used for a variety of applications in other European countries. It is now hoped to use the recent test work to support use of the material in practical applications in the field, for example on the St George Wharf project.

For further details please contact Richard Moss of BRE (01923 664557; E-mail mossr@bre.co.uk).

SPONSORING ORGANISATIONS

GOVERNMENT

Department of Trade and Industry,
Construction Industries Directorate
Department of Trade and Industry
Bay 276, 151 Buckingham Palace Road
London SW1W 9SS
(020 7215 0848 or 0826)
Website: www.dti.gov.uk
E-mail: terry.boniface or shawn.weekes@dti.gsi.gov.uk

Department for International Development,

1 Palace St, London SWE 5HE
(020 7023 7000; fax: 020 7023 0072)
Website: www.dfid.gov.uk
E-mail: enquiry@dfid.gov.uk

RESEARCH ORGANISATIONS

British Cement Association,

Century House, Telford Avenue, Crowthorne,
Berkshire, RG11 6YS
(01344 762676; fax: 01344 761214)
Website: www.bca.org.uk
E-mail: library@bca.org.uk

BRE,

Garston, Watford, Hertfordshire, WD2 7JR
(01923 664000; fax: 01923 664010)
Website: www.bre.co.uk
E-mail: enquiries@bre.co.uk

Centre for Innovative Construction Engineering,

Loughborough University, Loughborough,
LE11 3TU (01509 228549; fax: 01509 223982)
Website: www.lboro.ac.uk/cice
E-mail: j.c.brewin@lboro.ac.uk

Centre for Window and Cladding Technology,

University of Bath, Claverton Down, Bath,
BA2 7AY (01225 826541; fax: 01225 826556)
Website: www.cwct.co.uk
E-mail: cwct@bath.co.uk

Construction Industry Research and Information Association,

6 Storey's Gate, Westminster, London, SW1P 3AU
(020 7222 8891; fax: 020 7222 1708)
Website: www.ciria.org.uk, E-mail: rfocus@ciria.org.uk

HR Wallingford Ltd,

Wallingford, Oxfordshire, OX10 8BA
(01491 835381; fax: 01491 832233)
Website: www.hrwallingford.co.uk
E-mail: hrinfo@hrwallingford.co.uk

The Steel Construction Institute,

Silwood Park, Ascot, Berkshire, SL5 7QN
(01344 623345; fax: 01344 622944)
Website: www.steel-sci.org
E-mail: reception@steel-sci.com

TRL Ltd,

Old Wokingham Road, Crowthorne, Berkshire,
RG45 6AU (01344 773131; fax: 01344 770356)
Website: www.trl.co.uk. E-mail: marketing@trl.co.uk

PROFESSIONAL INSTITUTIONS

Institution of Civil Engineers,

1 Great George Street, Westminster, London, SW1P 3AA (020 7222 7722; fax: 020 7222 7500)
Website: www.ice.org.uk
E-mail: enquiries@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
E-mail: mail@istructe.org.uk

INDUSTRY

Ove Arup Partnership
Geotechnical Consulting Group
Mott MacDonald Group Ltd
Pick Everard
Southern Testing Laboratories
Wilde & Partners