ENBRI in Europe

Autumn 1997 Issue 7

Quarterly digest of news from the members of the European Network of Building Research Institutes (ENBRI)

ENBRI: At the heart of European construction research

The ENBRI network brings together the principal building research institutes of the European Union (EU) and of the wider European Economic Space (EES) – 12 institutes from the Union and 2 from the EES. Member institutes play a major part in construction-related research funded by the European Union's collaborative Research and Technical Development (RTD) programme, the Fourth Framework Programme (FP4). This article briefly describes FP4 and the part that ENBRI member institutes play in projects within the programme. The article is based on information received by the ENBRI Secretariat in mid-1997.

FP4 comprises 15 specific research programmes and four other horizontal programmes, these are outlined below (with acronyms where appropriate). Note that not all specific programmes have opportunities for the construction industry, the ten which do are highlighted. All four horizontal programmes have opportunities for the construction industry.

Specific Programmes in FP4

Information Technologies (ESPRIT)
Telematics
Advanced Communication Technologies (ACTS)
Industrial and Materials Technologies (Brite-Euram)
Standards Measurements and Testing (SMT)
Environment & Climate
Marine Sciences & Technologies (MAST)
Biotechnologies
Biomedicine & Health
Agriculture & Fisheries (FAIR)
Non-nuclear Energy (JOULE & THERMIE)
Nuclear Fission Safety
Controlled Thermonuclear Fusion
Transport
Socio-economic Research

Horizontal Programmes in FP4

Stimulation Measures for SMEs (CRAFT)
Training & Mobility of Researchers
Innovation Programme
International Scientific Co-operation

ENBRI members are currently active in over one hundred projects within FP4 and associated programmes. These projects are in eleven of the specific programmes outlined above. The table below shows the participation of ENBRI members by programme :

Specific programme in FP4	Number of projects in which ENBRI members are involved
ESPRIT	12
ACTS	1
Brite-Euram	20
SMT	25
FAIR	10
JOULE	15
THERMIE	9
Nuclear Fission Safety	1
CRAFT	4
Innovation	2
Training & Mobility of Researchers	3
INFO 2000*	3

** not in FP4 but an associated activity*

This is a very significant level of activity and illustrates a very high level of commitment and success in securing involvement in EU funded collaborative projects by ENBRI members.

Participation by ENBRI member varies according to size, and national or corporate strategy towards EC funding. The table following indicates the involvement in projects by individual ENBRI partners. Note that in many cases there are more than one ENBRI partner within each project consortium. The table also indicates how many consortia each partner leads. ENBRI partners lead a total of seventeen of the one hundred projects in which they are involved.

Analysis of Activity

ENBRI members are represented in a high proportion of all the construction-related projects within FP4. It is difficult to say precisely how many of these there are but it the figure is estimated to be about 150.

ENBRI Partner	Number of projects	Number of projects Led
BRE (UK)	45	8
CSTB (Fr)	31	2
VTT (Fin)	25	1
TNO-BOUW (Nl)	21	3
CSTC (Be)	11	3
LNEC (Port)	11	0
SP (Swe)	11	0
ICCET-CSIC (Sp)	6	0
SBI (Den)	5	0
BAM (Ger)	5	0
NBI (Nor)	3	0
ICITE (It)	1	0
IBRI (Ice)	1	0
FORBAIRT (Ire)	1	0

The programmes in which ENBRI members are most active are the SMT, Brite Euram, JOULE, and ESPRIT programmes with 25, 20, 15 and 12 projects respectively. It is to be expected that these four programmes have attracted the greatest response from ENBRI members for the following reasons:

SMT: The programme supports research to develop European Standards. There is currently considerable activity to complete the Single European Market in the field of construction products. As principal national building research institutes, the members of ENBRI play a significant part in the development of these standards and so tend to participate in research to support this activity.

Continued on page 8.

This is a special issue of *Construction Technology in Europe* which focuses on the activities of the ENBRI member institutes within the European Commission's Fourth Framework programme. All the projects described in this issue are collaborative projects, comprising a number of European partners (not all ENBRI members) with the European Commission funding up to 50% of the costs of the research (100% of the costs of universities).

in brief

Conference on Industrial Technologies

The Commission is holding a Conference in Toulouse between 27 and 30 October.
The Conference of Industrial Technologies has three themes, one of these *Towards a better living and working environment* will be of particular interest to the construction industry. Within this theme there will be a focus on economic and sustainable construction, restoration of the cultural heritage, measurements to support quality control of materials and products, waste recovery and recycling, and life cycle assessment. Further information on the event can be found on the Internet site address: http://europa.eu.int/en/comm/dg12/dg12tst2.html

Competitiveness in the Construction Sector

The Commission plans to develop a Communication on the competitiveness of the construction sector. As a first step in this process a source document has been drafted in which the main elements that shape the competitiveness of the sector are analysed, and a set of recommendations to improve the situation are made. Some recommendations relate to developments in the Commission's innovation strategy. Comments on this first paper have been sought from the industry before work begins on the Communication. The work is being co-ordinated by Mr J Campos in DGIII-D-3.

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Using daylight to reduce artificial

A JOULE project, consortium:
Esbensen Consulting Engineers, Denmark (Co-ordinator); The Martin Centre, UK; UPC-Architecture, Spain; ENTPE/DGCB, France; Norwegian Inst. of Technology, Norway; LNEC, Portugal; University of Athens, Greece; Fraunhofer Institut fur Bauphysik, Germany; EPFL/LESO-PB, Switzerland; University of Strathclyde, UK; BBRI, Belgium; BRE, UK; Royal Institute of Technology, Sweden; Conphoebus s.c.r.l., Italy; Chalmers Univ. of Technology, Sweden; SBI, Denmark; UCD, Ireland; A.N. Tombazis and ass. Architects, Greece; Univ. Catholique de Louvain, Belgium.

The use of daylight in buildings to reduce artificial lighting and improve indoor visual comfort and working conditions is the main topic of research addressed by the JOULE II project Daylight Europe.

The project, which started in 1994 and will finish by the end of 1997, involves 19 European scientific partners, from 12 countries, among which are four ENBRI members (BBRI, BRE, LNEC and SBI).

The main objective of Daylight Europe is to produce relevant information in the Daylighting Design of Buildings, to be used by architects, engineers and building designers in general. The main deliverables of this project will take the form of two publications: *Daylight Design Guidelines for Europe* and *Daylighting Performance of Buildings – 60 European Case Studies*.

Pharmacy Faculty –
Daylighting of the central circulation area

The project, now close to its conclusion, was based on the analysis of the daylight performance of about 60 European buildings.

Among the different types of buildings monitored, covering different architectural periods, we can distinguish the following:

Concurrent design and engineering in

A Brite-Euram project, consortium:

Taylor Woodrow Construction Limited, UK (Co-ordinator); SKANSKA,Sweden; KTH ,Sweden; IVO Power Engineering, Finland; STABU, Netherlands; TNO-Bouw,Netherlands; Technical University of Delft (Faculty of Civil Engineering),Netherlands; VTT Building Technology, Finland.

The main objective of CONCUR is to compose, develop and implement integrated systems for Computer Integrated Construction (CIC). The scope stretches from the inception stage of construction projects, through design and into the final cost estimation and preliminary construction planning activities.

Systems will be based on open standards for information exchange and sharing. Standards may include ISO-10303 (STEP), UN/EDIFACT and the evolving IAI IFC[1] definitions. The partners intend to significantly improve their business processes through the project, thereby making them more competitive on the international market.

CONCUR is funded by the European Commission Brite-Euram programme which encourages the uptake and use of Information Technology in a business environment.

As one of the first of a new genre of IT activities it focuses on Deployment for Use in Industry. It will build on past and current European and worldwide research, marrying it with the anticipated results from individual and collaborative commercial developments.

The overall project cost is 5.5 MECU – with matching contributions from the project participants and the European Commission .

In today's business environment clients and facility operators demand better quality, faster and cheaper built facilities incorporating more complex technology. At the same time, governments have increased the regulatory constraints on safety, waste and energy consumption.

To overcome the challenge of a changing business environment integration strategies are being developed based on electronic information sharing and exchange using open international standards. Project, Product and Production modelling Technology (PDT) is generally perceived as

lighting and improve indoor visual comfort

Pharmacy Faculty West Façade: 'split window pattern' for additional summer protection

Interior view of the 'split window pattern'

historical (e.g. Pantheon of Rome), religious (e.g. Notre-Dame du Haut), academic, museums and art galleries, libraries (e.g. Biblioteque Nationale de France), office buildings, and other types of buildings (e.g. Stansted Airport and Waterloo Railway Station).

The daylight performance was accessed through detailed monitoring of the buildings with field measurements of daylight factors in reference planes, luminances and measurements (daylight relevant) materials properties.

The analysis of the results obtained by LNEC in the four buildings selected as the Portuguese Monitoring Case Studies (two university buildings, an office building and a museum) emphasised the climate differences between Southern and Northern European countries in the daylight/sunlight strategies adopted.

In the South of Europe the daylighting strategies are mostly constrained by the thermal effects of sunlight exposure of the buildings.

This aspect was particularly clear on two of the monitored buildings (Pharmacy Faculty and Teacher's Training College), where the architecture itself shows the commitment between Daylight and Sunlight (taking advantage of the benefits of daylighting and avoiding simultaneously the excess of Summer sunlight).

The results obtained with the monitoring of the European case studies will also be used as input for the *Daylighting Design Guidelines for Europe* book.

For further information please contact the co-ordinator of the project Prof. P. Kristensen (Esbensen Consult. Eng., Virum, Denmark) or António Santos, LNEC, tel. +351 1 848 21 31, fax: +351 1 840 15 81,

building and civil engineering

a key-enabler of business integration.

In the fourth CONCUR year systems will be deployed in live construction projects. The systems will be based on formal models, or specifications, of project information shared and exchanged by software applications in the building and civil engineering industry. The models will be used to:

- integrate design, engineering and construction support tools currently used by the industrial partners, but also new and innovative commercial applications;
- improve internal integration of the industrial partners;
- implement and demonstrate concurrent design and engineering in distributed, multi-partner projects;
- implement, evaluate and deploy electronic information exchange and sharing, focusing on (1) the downstream delivery of comprehensive tender information to the construction stage and (2) the upstream availability of alternative technical solutions to the inception (client brief) stage.

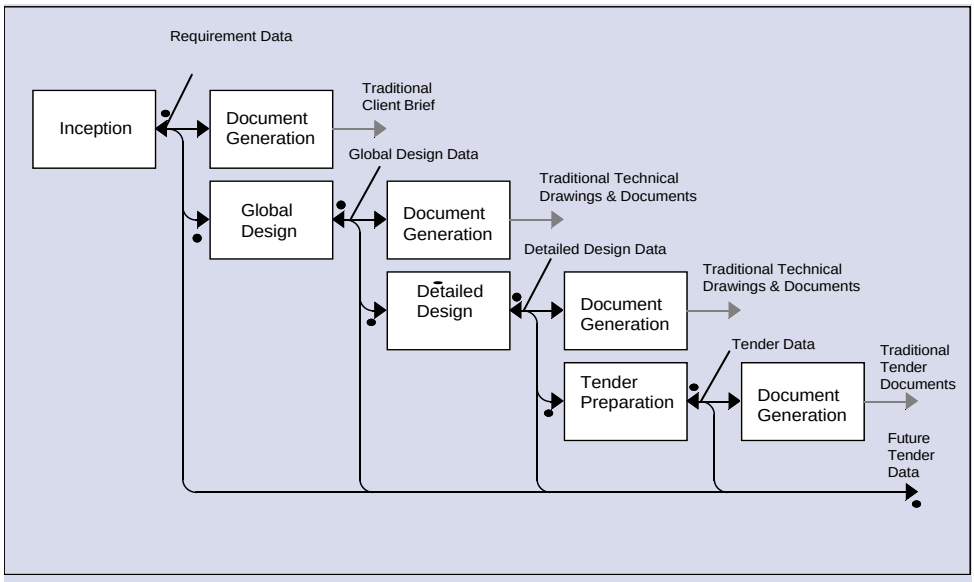

Diagram of the information exchange among four life-cycle stages. Arrow heads with dots indicate two-way information exchange.

The CONCUR partners will be appraising and selecting software partners to work collaboratively to obtain improved integrated systems.

1: STEP - Standard for the Exchange of Product model data. EDIFACT – Electronic Data Interchange for Administration, Commerce and Transport. IAI – Industry Alliance for Interoperability. IFC – Industry Foundation Classes.

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European research project on recycling of buildin

A Brite-Euram project, consortium: Lemona Industrial, Spain (Co-ordinator); Pruftechnik,Germany; Taywood Engineering, UK; Philip Holzmann, Germany; BAM,Berlin; LABEIN, Spain and BRE, UK

The Federal Institute for Materials Research and Testing (BAM), Berlin, is taking part in a Brite/Euram project on the reuse of building debris as a partner of six European companies and institutes.

The proposal for the R & D project titled *Construction Recycling Technologies for High Quality Cement and Concrete* was submitted at the beginning of 1995 and started on the 1st January 1996 with a planned duration of four years. The total budget is about 2.41m ECU, including about 1.29m ECU funding by the EC.

The partners are four companies working in the building and building material industry: Lemona Industrial in Spain, being the project leader, Pruftechnik in Germany, Taywood Engineering in the UK and Philip Holzmann in Germany and three research institutes. Besides BAM they are LABEIN in Spain and BRE in the UK.

The target of the project is to develop suitable technologies for the high quality reuse of building demolition debris and to recommend the respective guidelines or standards.

This means, above all, the extensive use of the material's quality for avoiding the current "downcycling" i.e. the reuse in lower level fields.

Whilst most of the previous studies were restricted to building rubble from laboratory made concrete or similar well defined origin, in this project the only material used is that produced in large amounts in processing plants in the three participating countries.

The total of 14 selected materials represent the actual status of processing technology. The main constituent is concrete, but three materials contain considerable proportions of masonry or asphalt, respectively.

The reuse strategy in the project follows two different lines. The first approach is the reuse in cement manufacturing, partially replacing the raw meal. The second approach is the

Demolition waste from old buildings is crush
Energy Efficient Office of the future now bu

Smoke gas analysis by Fourier transform infrared spectroscopy

A Standards, Measurement and Testing project consortium:

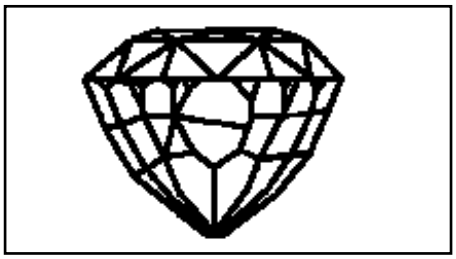
VTT, Finland (Co-ordinator); SCTB, Belgium; Groupement de Recherches de Lacq, France; BRE, FRS, UK; Laboratoire national d'essais, France; L.S.F. SUD srl - Laboratorio di Studi e Ricerche sul Fuoco, Italy; RAPRA Technology Limited, UK; SP,Sweden; Universiteit Gent, Belgium; University of Greenwich, UK

The technical objective of the SAFIR project is to further develop the FTIR gas analysis of smoke gases to be an applicable and reliable method for the determination of toxic components in hot combustion gases related to fire test conditions.

In addition, a code of practice for FTIR analysis of smoke gases will be produced. This includes techniques of sampling, calibration, analysis as well as precision and application areas in different fire test scenarios.

A draft standard including repeatability and reproducibility data will be also prepared in a form suitable to be forwarded to the European standards organisation (CEN, CENELEC) as well as to the international standards organisations (ISO, IEC, IMO).

The industrial objective is to prepare a draft standard to be a cost-saving tool for product development work and for life cycle assessment of products. This would also be the basis for a harmonized standard in the Member States. A method is needed to produce toxic gas concentration and yield data from products which industry wants to promote as safe products. A well-defined procedure for the FTIR techniques in smoke gas analysis will increase the number of instruments quickly and hence allow much better availability of measuring and testing facilities for industry either in their own laboratories or in testing institutes.



The crystal logo for the SAFIR project

Combustion toxicity data of a variety of industrial products is of growing concern to industry and to the safety and well-being of humans and the environment. Accurate and economically beneficial measurement methods will be widely applied as soon as they are available and standardized. When toxic potency models are improving the availability of toxic potency data means that animal testing will be less frequently used as the FTIR approach becomes more widely accepted.

In the small and large-scale sampling studies the optimum probe design and the most suitable sampling lines in terms of flow rate, diameter, material of construction and operating temperature are specified. The adsorption of gases onto the filter and the soot will be determined. Also, the optimum gas cell response time and peak values will be determined as a function of cell operating and gas sampling variables. In large scale special concern is given to the probe design and the effects of the probe location in relation to the fire source.

In the data analysis, calibration and software task the construction of quantitative calibration and prediction methods will be studied for the different components present in smoke gases. Recommendations on how to deal with interferents, non-linearities and outliers will be provided and a verification method for the spectrometer for unexpected variations and for the different models will be described.In the verification task FTIR measurement procedures in different fire test scenarios will be studied including optimum resolution range, filtering system, measurement locations and techniques, and real precision values for specific test scenarios will be estimated. Finally, a draft standard for use in different conditions and a code for practice will be prepared including the repeatability and reproducibility of the method from the interlaboratory trial.

For further information please contact Mr Esko Mikkola, D.Tech. Tel. +358 9 456 4825, e-mail Esko.Mikkola@vtt.fi

ng rubble uses past to build the future

hed on site to provide hardcore for the lt at the home of BRE in the UK

reuse as aggregate in concrete production replacing natural aggregates. In both cases the environmental effect is to be seen in avoiding the dumping of waste and in saving natural resources. For this purpose, new technologies for the manufacturing processes are necessary.

In cement manufacturing, effects on the clinker formation and on the incorporation or risk of pollution of minor and partially harmful constituents will be studied. Investigations on the cement properties will complete this task.

The tasks on the reuse in concrete willanswer questions on production technology of concrete if natural aggregate is mostly or totally replaced by crushed recycled concrete, and the properties and durability of those concrete samples. At first the "recycling aggregate" is characterized in order to type and place of the processing plant. Particular interest is paid to optimizing the concrete mix design and mixing procedure. An important point here will be to meet the requirements on the water:cement ratio.

Furthermore the development of strength and modulus of elasticity and values of creep and shrinkage will be determined.

The durability will be assessed by investigations on capillary suction, carbonation and resistance against freeze / thawing with salt impact. Another important task is to find out the effects of impurities like glass, bricks and tiles, and gypsum on the properties of the fresh and hardened concrete.

The results of all the partners will help to establish recommendations covering needs concerning processing, concrete technology and the respective development of standards, as well as the gradual elimination of restrictive prescriptions and legacy.

The project is proceeding well and is in the first decisive technical term.

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Model educational buildings for integrated energy efficient design

A THERMIE project, consortium: Cenergia, Denmark (Co-ordinator). There are three work groups: analysis, performance monitoring and evaluation and dissemination. Greece Centre for Renewable Energy Sources, Greece is responsible for the work group on analysis, SP, Sweden for the work group on performance monitoring and evaluation and Norway/Sweden Norwegian Institute of Technology/Christer Nordström Architects, Norway/Sweden for the work group on dissemination.

MEDUCA – Model EDUCAtional Buildings for Integrated Energy Efficient Design – is a new THERMIE Integrated Quality Targeted Demonstration Project. It was started in the beginning of this year and will be finished in year 2000. The project covers co-ordinated design, construction, monitoring and evaluation of educational building projects in seven countries (Denmark, Germany, Norway, Sweden, Italy, Greece and Spain) comprising five refurbishment projects and four new buildings. The building types are: six schools, two university buildings and one educational centre. The overall aim of the project is the energy-efficient provision of air, light and thermal comfort to achieve energy-efficient and healthy educational buildings.

The overall aim of the MEDUCA-project is to demonstrate energy efficient educational buildings, where the requirements for an attractive and healthy indoor environment are fulfilled. This is to be achieved in new construction and refurbishment combining conventional and innovative technologies. The main characteristic of an education building is its intermittent occupancy. An education building can contain classrooms, auditoria, a library, a cafe, a gymnasium, laboratories, office spaces etc. The requirements on educational buildings can be different, but some basic requirements are valid for all educational buildings – the need of air, light and thermal comfort.

Spending their time in energy-efficient and healthy school buildings, the students and pupils will learn about energy-efficient and healthy buildings. Educational buildings are often a meeting point not only for students and pupils, which means that schools have a demonstrative effect on others as well. Educational buildings have been, are being and will be refurbished, often to improve upon the indoor environment. It is therefore an excellent opportunity to demonstrate that this can be done in an energy-efficient way and at the same time improve the indoor environment.

Below are listed all the innovative technologies from all the participating countries. No individual project will, of course, include all the technologies.

- Super low energy windows
- healthy materials
- heat recovery
- advanced building energy management systems
- advanced control systems
- natural cooling
- evaporative cooling
- optimum daylight
- energy-efficient lighting devices
- energy-efficient fans
- photovoltaics
- natural and mechanical ventilation
- passive solar energy
- sunpaces
- atria
- active solar heating for preheating outdoor air
- active solar heating for hot water
- active solar energy for a swimming pool
- biomass
- geothermal energy
- heat pumps.

The expected result, for all participating educational buildings, is based on a total energy optimisation to reduce the yearly use of energy for space and hot water heating by 50 - 60 % compared with standards and local practices, and at the same time obtain a 30 - 50 % saving of electricity for lighting in comparison with normal practice in buildings. The environmental impact will be considerable, it is expected that $C0_2$ emissions will be reduced by 50%.

This collaborative project will have a significant impact on the general perception ofenergy-efficient buildings, and in particular will serve as the basis for improved energy (and comfort) standards for educational buildings in the participating countries and Europe.

For further information contact Åke Blomsterberg, Swedish National Testing and Research Institute, Tel +46 33 16 51 01, Fax +46 33 16 50 10

Automated Air Void Analysis in hardened concrete

A Standards, Measurement and Testing project, consortium: BBRI, Belgium (Co-ordinator); CSTB France; Dansk Beton Teknik A/S Denmark; Kontron Elektronik, Germany; FMPA Germany.

The objective of this European-funded three-year research project is to develop, standardise and evaluate automated methods for the determination of air void characteristics in hardened concrete.

An air void analysis is the only method available on hardened concrete to evaluate the air void structure of concrete. This air void structure is a critical parameter for the durability of concrete subjected to frost / thaw action and de-icing salts.

The air void system is traditionally assessed in terms of the total air content and the spacing factor of the air bubbles. These parameters are traditionally determined following ASTM C457 wherein a manual method is described using either a point count or a linear traverse method.

These measurements are made on fine ground sections of the hardened concrete mounted under a microscope.

The air void structure is examined by scanning along a series of traverse lines.

Recently, automated methods have been developed using image analysis (IA) methods. These methods are not only capable of measuring chord lengths but also diameters, section areas and the perimeters of the air voids.

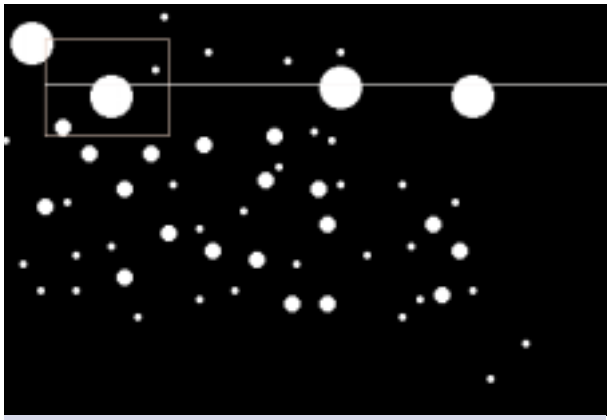
Automated IA methods for air void analysis improve the existing methods by reducing the measurement time from four to six hours manually to 10 to 20 minutes automatically and by improving the precision of the measurements.

The project's objectives are:

- to develop, standardise and evaluate automated Image Analysis methods for air void analysis in hardened concrete.
- to assess the precision of automated test methods and the comparability of automated versus traditional manual.
- to prepare guidelines for the preparation of samples.
- to produce standard samples.

It is expected that this project will result in new specifications for the measurement procedure and for the calculation methods for automated air void analysis, which will be included in a future European standard.

For further information please contact Mr Jan Elsen (CSTC-WTCB) – Rue de la Violette 21-23 – 1000 Brussels. Tel 32 2 655 78 68. Fax 32 2 653 07 29.



Implementation of the ASTM-C457 standard for air void analysis; 1 traverse line of 3.3 meters is measured by automated image analysis techniques at the BBRI on polished and colour enhanced concrete sections of 10x10cm.

Creating a pan-European construction components digital library

An INFO 2000 project, consortium: Autodesk Data Publishing Europe (project leader); Wise & Loveys Information Services Ltd, UK; CSTB, France; Building Information Centre, Ireland.

The SABLE (Specifying Architectural and building components across Europe) project strives to increase productivity of the European building industry.

The project plans to provide architects and engineers working on the design and construction of commercial buildings across Europe with instant information in an intuitive and integrated manner.

The European Commission estimates that the gross output of the construction industry accounts for 10-12 percent of EU GDP. The sector is a major employer with about nine million employed in contracting and directly generates employment for three to four million people in construction products.

SABLE is expected to boost business opportunities for SMEs in the construction industry by helping them export their expertise throughout the European Union.

Autodesk and its partners will provide a service linking building component manufacturers, architects and engineers to instantly integrate industry-standard components in design and construction projects.

Jan Walle Nauta, Director of ADP Europe, a division of Autodesk, Inc. said: "The European integration process is opening up construction markets for companies based in other EU states. Manufacturers and building component specifiers therefore have an urgent need for information about building materials and their applicability in other EU markets".

SABLE will provide a multi-lingual, pan-European, CD-ROM and Internet-based service that will give users access to a cross-border set of building components that meet national regulatory standards in EU member states. SABLE will bring major benefits to building companies bidding for contracts in other European countries.

Similar in nature to CD-ROM- based libraries of information published by Autodesk Data Publishing in the US through the Autodesk Mechanical Library and the Autodesk Design and Construction Library, the output of the SABLE project will allow an architect, engineer, facilities manager or builder to check whether the building component meets either specific national standards and automatically insert the information required into a CAD (dwg-format) drawing or into a word processing document or a spreadsheet.

This new service, linking building component manufacturers with architects and building engineers, will increase their productivity considerably.

The SABLE project is part of the INFO 2000 program, a European Union initiative to stimulate the development of a European multimedia publishing industry. SABLE is focused on providing growth-oriented business services to Small and Medium-sized Enterprises.

The first phase of the SABLE project, now underway, will involve compiling information on heating, ventilating and air conditioning (HVAC) systems, doors and windows.

For further information, please contact Benoit Vinot, CSTB Sophia-Antipolis,tel: 33 (0) 4 93 95 67 10fax: 33 (0) 4 93 95 67 33 Email: vinot@cstb.fr

Four nations combine to research foundation designs

A Brite-Euram project,

consortium:

BRE ,UK (Co-ordinator);LCPC, France; NGI, Norway;DGI, Denmark..

Four major European consultancy and research organisations are undertaking a research project aimed at developing direct design procedures for foundations from results of different in situ devices.

Design procedures are being developed to predict bearing capacity and settlement of piles and shallow foundations, and behaviour of laterally loaded piles.

At present, routine foundation design is largely carried out in many countries using design procedures based on conventional soil properties such as su, ø' and mv determined from laboratory test data, usually supplemented by some level of in situ testing.

Soil properties determined in the laboratory are dependent on the quality of both the sampling and testing methods, while soil properties determined from in situ tests are either derived empirically or using idealised models of soil behaviour.

The design procedures in which these soil properties are then used usually involve some level of empiricism as they are either empirical in the first in the first place or are based on the theoretical behaviour of idealised soils. Consequently the process involves a high level of uncertainty and requires high factors of safety.

The traditional site investigation and design process is time-consuming and costly. Given the empiricism involved in traditional methods of foundation design, the concept of using the results of in situ tests directly in empirical or semi-empirical foundation design procedures make sense; the approach is more efficient in terms of time and cost, whilst being no less rational.

The idea is not new; in France, the majority of foundation design is carried out using semi-empirical rules for the Menard Pressuremeter.

Elsewhere, the design of foundations based on conventional soil properties is well established and accepted, and, with the ever present fear of claims within the industry it is easy to understand why the existing procedures based on in situ tests have not been more widely applied. Unfortunately this means that experience in the use of these types of procedures is not built up, proposed procedures are neither refined nor adapted, and consequently scepticism persists.

The project partners are receiving 50% of their funding from the Commission of the European Communities under the Brite-Euram programme. The project started in July 1994, and will be completed in 1997.

Procedures will be based on trials using the cone Pressuremeter (CPM), the Triple Element Piezocone (CPTU3), the Marchetti Dilatometer (DMT) and the Menard Pressuremeter (MPM).

The project includes field testing with these devices on fourteen sites across the participants' countries, covering a range of soil types including soft and hard clays, hard, very overconsolidated aged clays and sand.

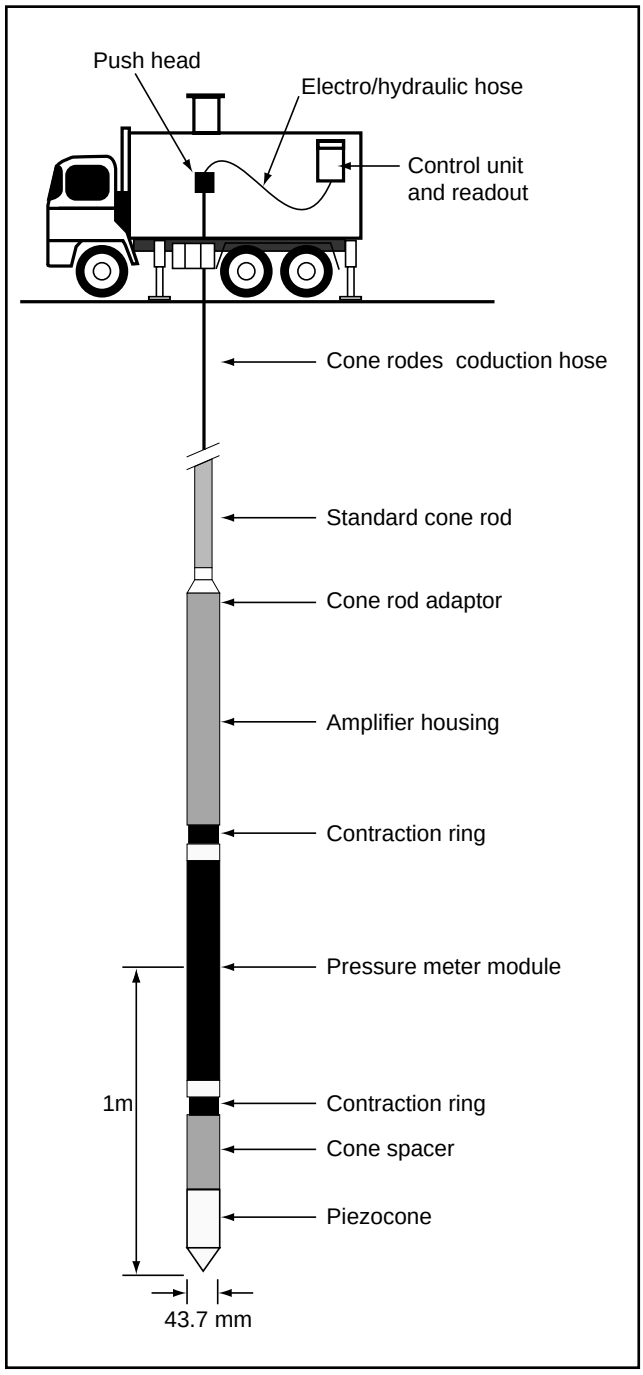
In addition there are a few sites included where testing with one or more of the devices has been carried out in the past. The sites are all well characterised through laboratory and in situ tests.

Each site has been chosen because well-documented foundation performance information is available against which the design procedures will be correlated. The database of foundation behaviour includes axially loaded piles, laterally loaded piles and shallow foundations. In the majority of cases the information is from tests or observations carried out in the past by the organisations themselves. At several of the sites there is information from different foundations.

To date the application of CPM, CPTU3 and DMT testing has been limited. Therefore, an additional important aspect of the work is that it significantly increases the experience in different soil types of the performance of the equipment and of the results obtained.

The fieldwork and processing of results for the four in situ test devices was largely completed in 1995. The establishment of the database of foundation performance and detailed site characterisation data, was also completed in this period and the project group has now started the main part of the project - the challenging task of establishing the design procedure.

For further information contact John Powell at BRE. Tel +44 (0)1923 664181 or email powellj@bre.co.uk



The CMP cone pressuremeter shown schematically and not to scale. CPMs are site investigation tools in which a pressuremeter module is mounted behind a standard cone or piezone penetrometer and is installed as part of internationally standardised cone penetration testing (CPT) operations.

ENBRI: At the heart of European construction research

Continued from page 1

Brite-Euram: The programme offers opportunities for projects in the general fields of materials and production technologies, areas at the heart of construction research. Projects in this programme which involve ENBRI members tend to focus on innovative construction materials.

However, there is an increasing number of projects in the fields of the construction process and design

ESPRIT: The projects involving ENBRI members in the ESPRIT programme are aimed at producing supporting IT platforms in the design of major buildings and the management of the construction process. The projects indicate the importance that ENBRI members and the European construction industry places on the use of IT in the future.

JOULE: Buildings represent almost 50% of the national energy consumption in Northern European countries. The JOULE programme recognises this by providing two specific research themes focused on buildings (rational use of energy and renewable energy). This is a natural place for ENBRI members to focus activity.

Less expected is the appearance of ENBRI members in projects in other areas, in particular:

FAIR: The FAIR programme includes the use of non-food agricultural products. A particularly important example is the use of timber in construction. ENBRI members (particularly those in Scandinavian countries) make full use of this important opportunity.

The Future

The European Commission are already well advanced in their planning for FP5, which will run from 1999 to 2003. Although much work remains in developing these plans, the Commission are proposing that FP5 will comprise three Thematic Programmes and three Horizontal Programmes. Specific activities within these programmes currently include proposals for research into *The City of Tomorrow, Products, Processes and Organisation*, and *Advanced Energy Systems and Services*. It would appear that there will continue to be considerable opportunity for ENBRI members to participate in European collaborative research.

Summary

ENBRI members are participating in a large number of construction sector projects currently underway in FP4. Participation covers a broad range of specific programmes with SMT, Brite-Euram, ESPRIT and JOULE being the most common. All projects include the active participation of industrial partners.

This high level of broad-based participation in EU funding illustrates that ENBRI members:

- are at the heart of leading-edge European construction research
- are in tune with the needs of the European construction industry
- are recognised widely as an excellent choice of project partner
- recognise the importance of a wide range of research disciplines for developing innovative concepts in construction

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