Issue 6 September 2002

newsletter

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SAMCO NEWS

Structural Assessment Monitoring and Control Issue 6 September 2002

contents

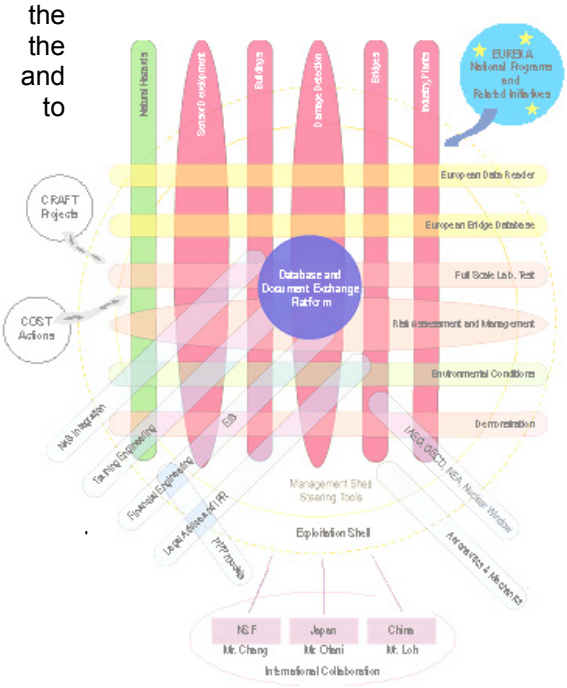
European Structural Assessment and Health Monitoring Initiative

Health monitoring and risk assessment of structures has gained importance considerably world wide. Several very successful projects under European framework programmes have indicated that there are promising new ways to deal with those issues. In our vision ten years from now the world should look different in this field. It is ideally suited for an integrated project approach, because it covers such different areas like GROWTH, IST, Environment, Traffic and even Aeronautic and Nuclear issues. An integrated project would therefore help to sort out the different programmatic areas into vertical and horizontal activities that can be allocated accordingly. By that approach a critical mass can be created for each of the items avoiding the fragmentation into several programmes. Furthermore the necessary infrastructure for the project can be concentrated and reasonable approaches to internationalisation are feasible.

Find the conception of an Integrated Project for Monitoring and Assessment on the following page.

Europe's leading position in health monitoring is challenged by recent decisions made in NSF to drastically reinforce research on these topics. European projects have been of exceptional quality so far, but addressed narrow specific subjects only. Follow up proposals containing integration issues were not successful in subsequent calls.

The next major step can be taken when all sources are mobilised and an integrated European approach is taken. Recent success in establishing a National Bridge Inventory in the US shows how this subject might also look like in a unified Europe (http://www.nationalbridgeinventory.com) Such an activity in Europe will provide closer relations between various organisations of scientific and technological cooperation



published by vce

EMOI

The integrated project European Structural Assessment and Health Monitoring Initiative (EMOI) is designed to generate the knowledge required to increase Europe's competitiveness in the subject of health monitoring and structural assessment. It is an objective driven research initiative, where the primary deliverable is new knowledge generated through targeted basic research, and developed till a realistic exploitation level. It contains long term or "risky" research objectives down to societal needs driven methodology. A structuring effect of European research is achieved by all relevant resources and parties into a single initiative.

In order to reach the ambitious objectives the critical mass of activities, expertise and resources have to be assembled at an enormous scale. All European universities active in the field shall be involved in a coordinated manner. As many end users and owners of structures as possible shall participate where in many cases financial support will not be necessary. It is intended to involve resources from other research institutions whenever a suitable proposal is made.

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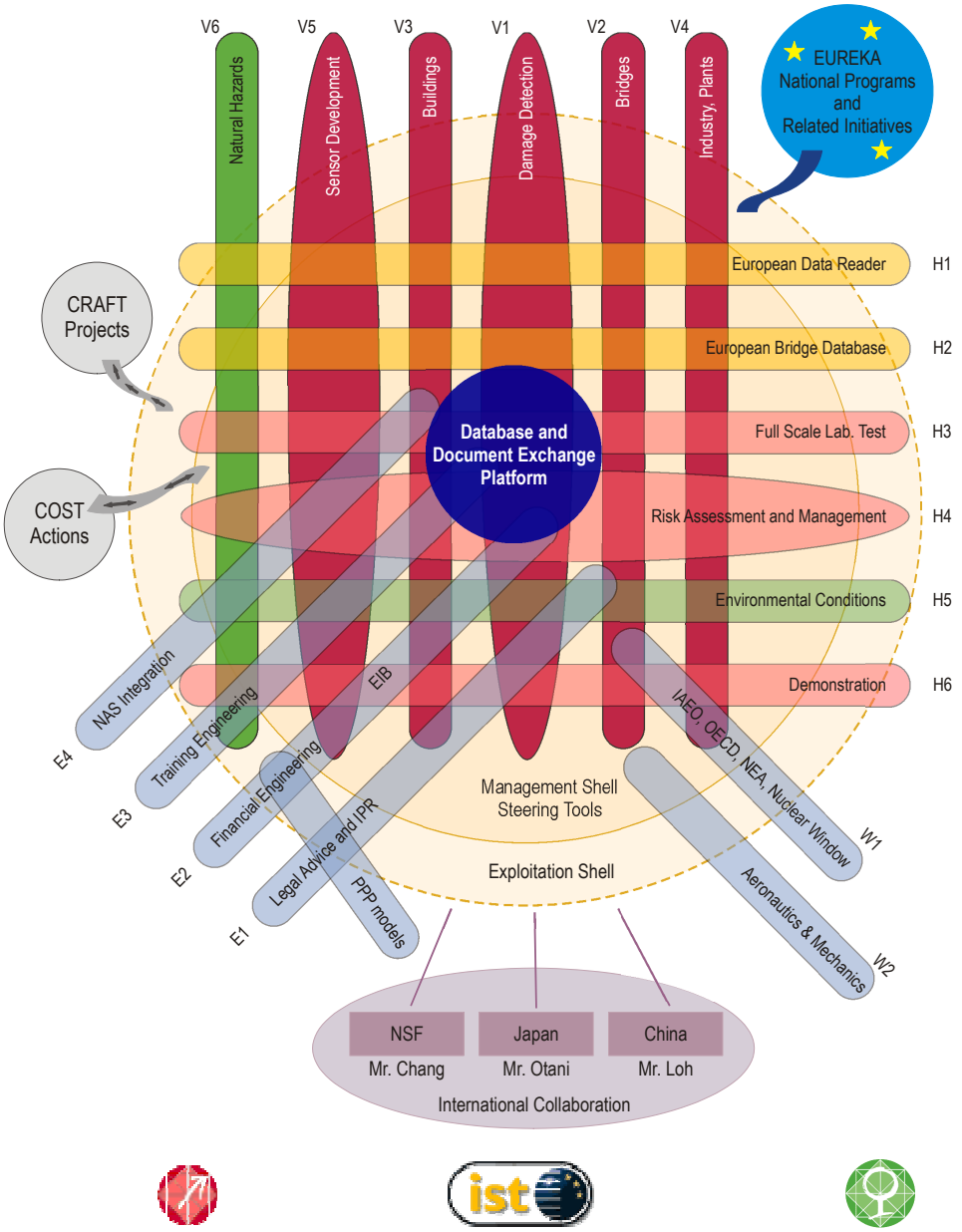


▲ Figure EMOI : Structure of the Project with Programme Relationships

Vertical Approach - **Core Technologies:**

- **Damage Detection (V1)** methodologies linked to mechanical and aeronautics engineering
- **Bridges (V2)** in the European transportation network.
- **High-Rise Buildings (V3)**: structural assessment and health monitoring
- Structural safety of **Plants and Industry (V4)** is reassessed under the conditions of the Eurocode 8.
- **Sensor Development (V5)**, which concentrates on promising approaches already started.
- **Natural Hazards (V6)**: Threat by dams and landslides.

Horizontal Approaches – **Means for the Application and the Implementation:**

- A **European Data Reader (H1)** offered free of charge via the web, which translates data into standard formats.
- **European Bridge Database (H2)** comparable to the US, to achieve a breakthrough in the application of new methods.
- **Full Scale Laboratory Tests (H3)** to validate some of the methods related to information gained from the structures. Tests shall be concentrated on 2 locations carrying out work for all vertical activities.
- **Risk Assessment and Management (H4)** is a further generic scene representative for all items.
- **Environmental Standards (H5)**: establishment of a set of references that enables a normalisation of the separate national records.
- A **Demonstration (H6)** activity shall bring the national players together and demonstrate the power of the new methodologies.
- **Training and Education (E3)**: to distribute the knowledge and information to the broad engineering community.
- **Financial Engineering (E2)** to help the ideas becoming a business, covering venture capital issues, insurance issues and legal advice.

SMART STRUCTURES

Integrated Monitoring System for Durability Assessment of Concrete Structures

The SMART STRUCTURES project (BRPR-CT98-0751) was carried out in the period 1998-2002 and focused on the development of an integrated monitoring system for durability assessment of existing concrete structures, with models, sensors and Internet-based software (SMAPP).

The project was divided into seven main tasks:

- System Specification
- Deterioration Mechanisms
- Portable System
- Sensors
- System Design and Software
- Monitoring System
- System Applications

The relevant deterioration models were improved, focusing on extrapolation of assessments of existing structures and also include the structural effects of the deteriorations.

The sampling from presumed homogeneous areas in the structures has enabled a determination of the basic coefficient of variation of the monitored parameters, which determined the required accuracy of the sensors.

The project developed the following sensors to cover the most relevant deterioration mechanisms and their structural consequences:

- HUM (humidity)
- MRE (moisture)
- CW (corrosion risk)
- ERS (corrosion risk)
- PH (pH level)
- CHL (chloride)
- VIB (vibrations)
- DED (dynamic deformation)
- DEF (static deformation)
- CRACK (crack width)

The sensors were tested in the laboratory and on-site to calibrate the sensors and to verify their performance and durability.

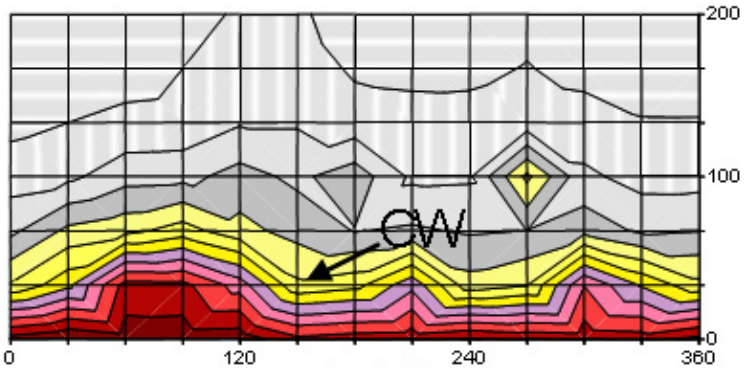
The accuracies of the sensors were satisfactory, compared to the natural variation of the parameters in the presumed homogeneous areas in the structures. The accuracies of the fiber-optic sensors were far better than required and actually enabled registration of vibrations up to 30 Hz, which cover the relevant frequency range in concrete structures.

The sensors and the acquisition and transfer system have been tested on-site for two years at the *Skovdiget bridge* in Denmark, where all the deterioration mechanisms are active.

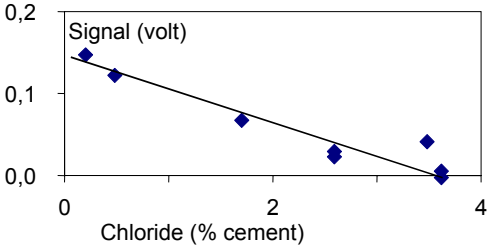
A portable NDT-equipment (*Galvapulse*) for mapping receptivity, corrosion potential and corrosion rates was developed and tested during the project.

▲ Test bridge Skovdiget in Denmark

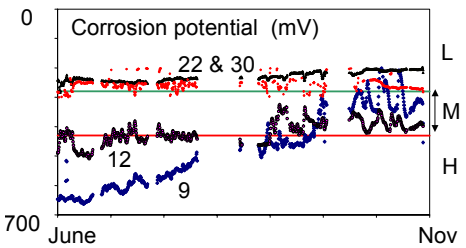
▲ Installation of 5 m long optical fibre sensor (DEF) for deformations



▲ Mapping of corrosion risks in the lower 2 m of a column at Skovdiget using Galvapulse.



▲ Calibration of chloride sensor



▲ Monitored corrosion risks by the CW-nails in column at 9, 12, 22 and 30 mm depth from June to November 2001. The low, medium and high risk ranges are indicated.

The results from the sensors (MRE, ERS, HUM, CW) and the *Galvapulse* correspond to each other and register the same variations of moisture and of corrosion risks. Integration of the information from the mapping and the sensors has been found to be essential for the interpretation and the monitoring results.

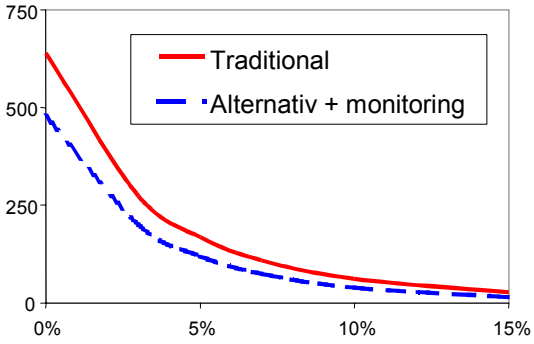
As a result of this, the monitoring continues for another five years as a part of the normal inspection of this bridge and as a long-term, on-site testing of the sensors long-term performance.

A number of practical case studies were carried out, focusing on the economic consequences of monitoring. These showed in most cases that the monitoring should be used as an integrated part of the bridge inspection and assessment, focusing on tailoring the repairs. By delaying and reducing the repair to the required, it is possible to reduce the maintenance costs with typically 10 %.

Consortium

The project consortium consisted of
RAMBOLL (coordinator)
FORCE Institute
Danish Road Institute
Bundesanstalt für Materialforschung und –prüfung,
OSMOS DEHA-COM,
Deutsche Zentrum für Luft und Raumfahrt
S+R Sensortec
Autostrade

For more information:
http://smart.ramboll.dk



▲ Net Present Value in 1000 EURO for repair of bridge deck at different discount rates.

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I A B M A S '0 2

First International Conference on Bridge Maintenance, Safety and Management

The International Association for Bridge Maintenance, Safety and Management was founded in 1999 to answer to the specific needs of the international bridge community (universities, operators, owners, consultants and engineering companies) and to approach, in an integrated way and the largest possible consensus, the problems of the management of bridges, especially that of maintaining the safety of existing structures, whose deteriorated number is constantly increasing, by making a better use of the available resources, generally limited.

Therefore the objective of the Association is to promote the international co-operation in the fields of bridge maintenance, safety and management by encompassing all the related aspects such as repair and rehabilitation, management systems, whole life costing, financial planning, etc, with the purpose of enhancing the welfare of society.

The First International Conference on Bridge Maintenance, Safety and Management, IABMAS '02, was organized in the friendly atmosphere of Barcelona with the local enthusiastic support of the International Center for Numerical Methods in Engineering (CIMNE) of the University of Catalonia.

More than 200 papers were presented during the 42 sessions of the conference, attended by more than 300 people from 29 countries.

All different major aspects in bridge maintenance, safety and management were addressed, such as assessment and evaluation, bridge management systems, inspection, repair, high performance materials, safety and serviceability, monitoring, reliability and risk, whole life costing and deterioration among others. A special session was dedicated to the presentation of the results from the SMART STRUCTURES project.

The next conference IABMAS '04 is announced to be held in Kyoto, Japan, 19-22 October 2004.

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For more information
http://ceae.colorado.edu/IABMAS

▲ IABMAS Conference

▲ IABMAS Conference

EUROSEIS-RISK

Seismic Hazard Assessment, Site Effects & Soil Structure Interaction Studies in an Instrumented Basin

EUROSEIS-RISK promotes integrated experimental and theoretical research on state-of-the-art topics in engineering seismology and soil dynamics (i.e. ground motion variations, 2D/3D site effects, soil non-linearity), in earthquake engineering (i.e. SSI effects in the presence of buildings or bridges yielding, validation of retrofitting techniques) and in seismology (i.e. seismic hazard assessment). The project generates a set of high quality data from weak, moderate and strong motion recordings in a dense surface and down whole accelerographic network and forced vibrations of R/C structures, in an existing test site located at a region of high seismic activity. Moreover, construction of a multi purpose database, together with the establishment of an International Network of Experts and a Workshop for the evaluation of the results and the investigation of potential code implications, will act towards seismic risk mitigation.

Core and Scope of Project

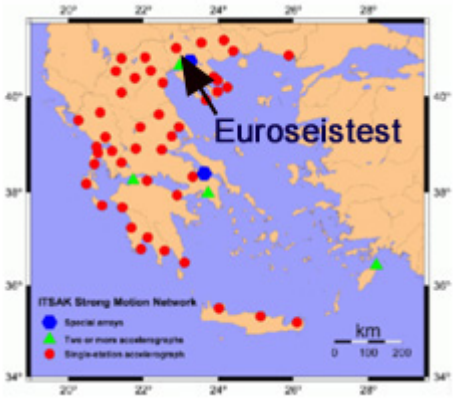
The core of the proposed research activities which are performed in the existing test site is fivefold:

- to conduct experimental and theoretical research for understanding the physics of ground motion variations due to 1D/2D/3D site effects for engineering applications,
- to validate, improve and develop methods, models and tools_for ground motion variations, SSI effects, hazard assessment and risk mitigation
- to enhance the earthquake resistance of ordinary *R/C buildings and bridges*
- to contribute to the ongoing elaboration of the new generation of *Eurocode 8* in terms of site *specific response spectra, soil amplification, and SSI phenomena* as well as
- to create a *database of high quality and well constrained* data, easily accessed from European and International researchers through Internet that may be used not only for validation and/or improvement of existing methods but also for the development of new approaches in many aspects of earthquake engineering.

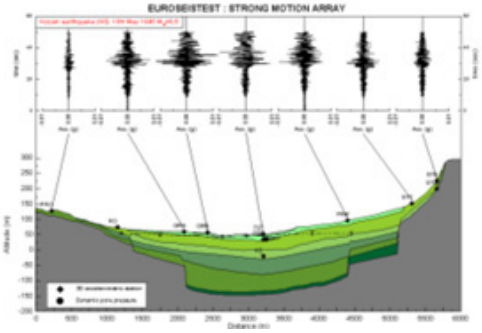
▲ Test Area in Thessaloniki, Greece

The Work Programme of **EUROSEIS-RISK** is broken down into six Work Packages:

- Performance of complementary geophysical, geotechnical and geodetical surveys to provide a well defined 3D description of the basin.
- Monitoring of the seismic activity of the area. Performance of seismological studies related to focal mechanism, attenuation and wave field. Creation of earthquake catalogue. Seismic hazard assessment.
- Investigation of the use of micro tremors for soil and site characterisation. Development of innovative techniques for monitoring transient and permanent ground deformations.
- Extension of the free field ground motion network. Experimental and theoretical ground motion research studies on 1D/2D/3D site effects analysis, complex basin effects, soil non-linearity, liquefaction and spatial variation of ground motion. Validation and improvement of existing models and tools to estimate ground motion and development of advanced new ones.
- Study on the structural behaviour and SSI effects both in the elastic and inelastic range through forced vibration tests and actual earthquake excitations of model structure-foundation-soil systems. Application and validation of rehabilitation techniques.
- Critical evaluation of the results in terms data, methods, tools and obtained know-how towards seismic risk mitigation. Data dissemination and investigation of possible code implications. Creation of a complete database, joint publications, establishment of an International Network of Experts and Users and organisation of a Workshop.



▲ Location of the Euroseis test



▲ Strong Motion Array

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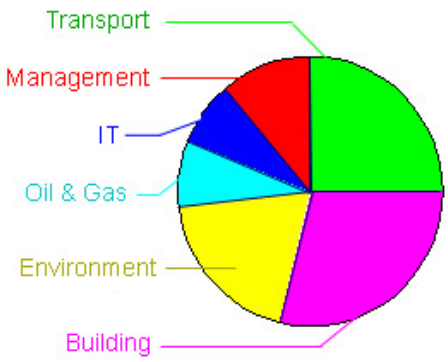
Company Profile

Rambøll, Hannemann & Højlund A/S

Areas of Business

Founded in 1945. **RAMBØLL** has grown to be one of the largest consulting engineering companies in Europe with more than 2000 employees. **RAMBØLL** provides solutions in all fields of consulting engineering, with a strong basis in construction and maintenance.



▲ Activities of RAMBØLL

Maintenance Management (M&M)

Today one of **RAMBØLL**'s main areas is M&M (Maintenance Management) involving planning, inspection, assessment and rehabilitation as integrated parts of the maintenance of infrastructure. **RAMBØLL** has developed M&M-systems for bridges, tunnels, roads and harbours using the latest IT-tools.

The aspects of M&M are also taken into account in the design of new structures, leading to reduced maintenance costs and increased service life.

RAMBØLL coordinated the SMART STRUCTURES-project. An integrated monitoring system for durability assessment of existing concrete structures was developed, along with the necessary NDT-equipment and permanent sensors. The system uses an Internet-based programme for storing and presenting the data and the additional information, required for the interpretation of the results.

The Research and Development is currently focused on maintenance aspects and is carried out by personnel with a scientific background and substantial experience from practice. This approach results in a faster implementation of R&D-results in practice as well as in the codes, specifications and guidelines.

Thanks to this **RAMBØLL** works all over the world in the field of M&M.

RAMBØLL activities

- **RAMBØLL** carries out on-site inspection with NDT-equipment (here determining the corrosion rate with the Galvapulse equipment). (See picture 1) ►
- **RAMBØLL** has a well-equipped laboratory for analysing samples. (See picture 2) ►
- **RAMBØLL** is responsible for M&M on the concrete structures at the Great Belt Link in Denmark. (See picture 3) ►
- **RAMBØLL** plans the rehabilitation of the Danish Main Central Station in Copenhagen (simulated view). (See picture 4) ►

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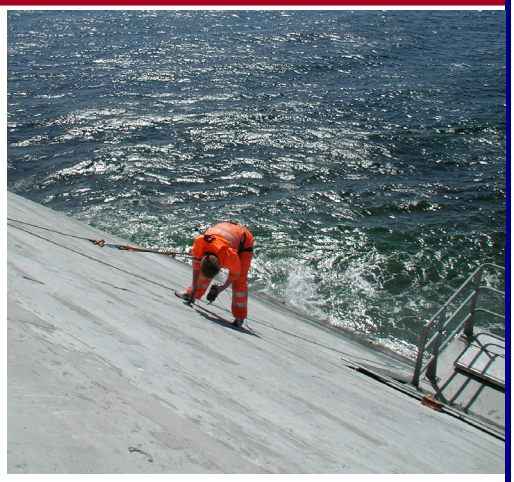
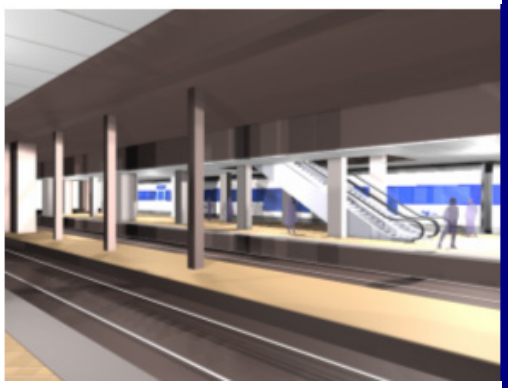


▲ 1.: On-site inspection with Galvapulse equipment

▲ 2.: RAMBØLL laboratory

▲ 3.: M&M at the Great Belt Link



▲ 4.: Main Central Station - Simulation

Announcement

FMGM 2003

6th International Symposium on Field Measurements in GeoMechanics

Date of Symposium

September 15-18, 2003

Location and Target Group

The symposium will be held in Oslo, Norway and is of interest to all civil, geotechnical and mining engineers and geologists working with instrumentation or having to interpret field data. FMGM is an acronym derived from the name of a series of international symposia titled Field Measurements in Geo-Mechanics. These symposia deal in the broad sense with the use of instrumentation by civil engineers, geotechnical engineers, mining engineers, engineering geologists and geophysicists to measure the properties of soil deposits and geological formations and/or to quantify the performance and behaviour of man-made structures and other engineering works by taking physical measurements. The applications include, for example, dams, the foundations of structures, tunnels and other underground openings, embankments, natural slopes, land reclamation, mining facilities, repositories for industrial or nuclear waste, offshore structures and field testing to determine soil and rock properties.

Organization

Norwegian Geotechnical Society
Norwegian Geotechnical Institute
Norwegian Public Roads Administration
Norwegian Society of Chartered Engineers
Norwegian Tunnelling Society

Symposium Subjects

The 3-day symposium will concentrate on geotechnical, structural, environmental and geophysical instrumentation methods and applications. Focus will be on the following themes:

- **Case studies** with a story to tell, or a lesson to learn, about the role of field measurements in problem solving, research, safety assessment or improving the design of civil engineering structures and works.

- **Present state-of-the art** and trends in measurement technology, equipment, communication methods and data management and interpretation.

- **Planning, administration and quality** assurance of instrumentation systems and monitoring programmes. Education and training of personnel. Viewpoints as seen by the owner, the designer of the monitoring system, the installation contractor, the equipment manufacturer and, last but not least, the user of the measurement data.

Background

The need for a speciality conference of this kind has been clearly manifested by the interest and large attendance at the first five symposia held in Switzerland (1983), Japan (1987), Norway (1991), Italy (1995) and Singapore (1999). In keeping with this traditional 4-year interval between symposia, the 6th symposium, FMGM 2003, will be held in Oslo, 2003.

The symposium will consist of keynote lectures, presentation of selected papers and discussions. To promote interest in field instrumentation among newcomers a special lecture on each topic will be presented by a young engineer. The traditional role of Poster Sessions and small discussion groups will be enhanced to provide a flexible forum where both experts and novices can meet in small groups for exchange of ideas and experience.

Call for papers

Prospective authors are invited to submit a one-page summary of not more than 300 words outlining the scope of their paper, and the principal points which they consider would benefit from discussion. The official language of the symposium will be English.

Deadline for abstracts:
September 30, 2002

Notification of acceptance:
November 30, 2002

Submission of final manuscripts:
April 30, 2003

Registration

All who are interested in participating in the Symposium are requested to complete the e-mail preliminary registration form found in the FMGM website.

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More information:

http://www.fmgm.no

FMGM 2003
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Telefax: (+47) 22 23 04 48

Calendar Of Events

SEPTEMBER / OCTOBER 2002

■ **30-1.** SAMCO Workshop, *Brussels, Belgium.*
URL: http://www.samco.org/workshop

■ **2.** SAMCO Steering Committee Meeting, Brussels, Belgium.

OCTOBER 2002

■ **2.** ECCREDI CEO Workshop, *Brussels, Belgium.*
URL: http: //www.e-core.org

■ **3-6.** Hazards 2002 Symposium, *Antalya , Turkey.*
URL: http: //www.hazards2002.metu.edu.tr

■ **3-4.** Second E-CORE Workshop, *Brussels, Belgium.*
URL: http: //www.e-core.org

■ **6-10.** International Conference on Concrete in Marine Environments, *Hanoi, Vietnam.*
URL: http: //www.iabse.ethz.ch/conferences/calenddrevents/Hanoi/PIhanoi.pdf

■ **9-12.** SEWC Congress on Structural Engineers World Congress, *Yokohama, Japan.* URL: http://www.sewc2002.gr.jp/english/e_right.html

■ **13–18** *fib* Congress - Concrete Structures in the 21st Century; *Osaka, Japan.*
URL: http://www.fib2002.com

■ **17–18** OECD-NEA -Workshop; *Istanbul, Turkey.*
URL: http://www.nea.fr

■ **23-26.** Earthquake Loss Estimation and Risk Reduction; *Bucharest, Romania.*
URL: http://www.utcb.ro/conferin/conference.html

NOVEMBER 2002

■ **18-26.** Activities of the Asian Seismological Commission , *Kathmandu, Nepal.*
URL: http://www.nset.org.np

■ **20-22.** International Conference on Design and Dynamic Behaviour of Footbridges, *Paris, France.*
URL:
http://otua.org/footbridge/Default_eng.htm

DECEMBER 2002

■ **10-13.** ACI 5th International Conference: Innovation in Design with Emphasis on Seismic, Wind and Environmental Loading, Quality Control and Innovation in Materials/Hot Weather Concreting, *Cancun, Mexico*
URL: http://www.aci-int.org

■ **16-18.** 12th Symposium on Earthquake Engineering, *Roorkee, India.*

■ **17-20.** International Conference on Structural Composites for Infrastructure, *Aswan, Egypt.*
URL: http://www.geocities.com/acm_egypt_2002

FEBRUARY 2002

■ **3-6.** IMAC Conference and Exposition on Structural Dynamics; *Kissimmee, Florida.*
URL: http: //www.sem.org

■ **5-8.** EERI Annual Meeting; *Portland Marriott Downtown, Portland, Oregon.*
URL: http://www.eeri.org/news/Meetings/eerimeet.html

■ **13-15.** Pacific Conference on Earthquake Engineering, *Christchurch, New Zealand.*
URL: http://www.nzsee.org.nz/pcee

MAY 2003

■ **6-8.** Concrete Structures in Seismic Regions, *Athens, Greece*
URL: http: //www.fib2003.gr

■ **7-9.** Structural Studies, Repairs & Maintenance of Heritage Architecture, *Halkidiki, Greece*
URL: http: //www.wessex.ac.uk/conferences

■ **12-14.** Fourth International Conference on Earthquake Engineering and Seismology, *Tehran, Iran.*
URL: http: //www.iiees.ac.ir/see4/

JUNE 2003

■ **2-5.** ICWE International Conference on Wind Engineering; *Lubbock, Texas.*
URL: http: //www.icwe.ttu.edu

■ **9-12.** Fourth International STESSA Conference – Behaviour of Steel Structures in Seismic Areas; *Naples, Italy.*
URL: http: //www.stessa2003.unina.it/

Imprint

SAMCO News

SAMCO News is a digital newsletter accompanying the SAMCO Network. It is funded by the European Commission in the frame of the GROWTH project SAMCO CTG2-2000-33069. It is an information and communication platform for the participants of SAMCO. It is issued periodically every second month.

SAMCO News is available at
http://www.samco.org/news

Funding

The SAMCO Network is funded by the European Commission (http://europa.eu.int) within the *"Fifth European Framework Programme",FP5,* (http://www.cordis.lu/fp5) which covers Research, Technological Development (RTD) and Demonstration activities. FP5 has a multi-theme structure, consisting of Specific Programmes. These Specific Programmes are further divided into Horizontal Programmes and Thematic Programmes. One of these Thematic Programmes is the *"Competitive and Sustainable Growth"* Programme (http://www.cordis.lu/growth/) under which SAMCO is running.

SAMCO is running under the exact term:
CTG2-2000-33069
Shared-cost RTD and Demonstration project, Concerted Action/Thematic Network
Duration: 48 months

Publisher

VCE

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