newsletter



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published by VCC



Structural Assessment Monitoring and Control Issue 5 July 2002

Simple, Robust, Reliable and Affordable

Today's requirements on monitoring can be expressed in four terms as written in the headline. This is the conclusion that can be drawn from the First European Symposium on Health Monitoring, held in Paris from July 10th to 12th.

Many promising scientific approaches have been identified but a lack of practical applications is obvious. There is a major gap between the scientific community and the end users needs. A practical approach, demonstrated in another contribution this newsletter, namely the to BRIMOS Recorder, is presented for the wide field of dynamic monitoring. The future will show how such concepts fit in the growing market of health monitoring.

On the other hand the need for more research and demonstration is obvious and the attempt to define an

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integrated project within the Sixth Framework Programme is acknowledged by everyone. The key point will be to get the critical mass of research together with end users willing that are to guide development work.

A proposal for the project "European Initiative for Monitoring and Assessment of Structures" (E-MOI) submitted to the call for was "Expression of Interest". It can be downloaded from the SAMCO Document Exchange Platform (DEP).

Everyone is invited to contribute and to submit proposals for specific work packages with in the project.

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SAMCO Network "ONLINE"

State of the SAMCO Web Site

Since the SAMCO web site is online the number of visitors has considerably increased. The home page counted 2385 hits until July. But how many users does the site actually have?

140 Users and 246 Sessions per Month

Starting with only 7 users and 15 sessions¹⁾ in *October*, the web site has become established within the user community in the following months: looking back at the period from November until June, the web site has a continuous number of users. Until the end of June there were on average 140 different users / month, who held around 246 sessions / month - with the trend to increase.

World Wide Interest

The SAMCO web site has been of interest for parties all over the world. Until May we could identify *38 different nations* having visited the site. The nations using the site most are: Austria, Belgium, Germany, Great Britain, Italy, France and the United States. A considerable part of the users is from the *US*. In February and June they were even leading the list of sessions at the site with 53% and 23% of all sessions. Although *Japanese* sessions are only below the 5% limit per month, they are a steady factor, too.

The Most Popular Pages of the SAMCO Site

About SAMCO

http://www.samco.org/about

Database

http://www.samco.org/database

Newsletter

http://www.samco.org/news

Mapping (National Key Players)

http://www.samco.org/mapping

DEP- Document Exchange Platform

The SAMCO network has had two web-based information tools so far: namely the online newsletter and the SAMCO database, which is in development at the moment. Since July the network has a third web-based tool at its disposal. A Document Exchange Platform, short DEP, which serves the SAMCO partners and members for the *internal management* of the network. It contains minutes of meetings, agendas, mailing lists, etc. Authorized users (a username and password are given by the DEP administrators) are able to download the documents and add their own documents to the DEP. The DEP knows different kinds of user groups, so the document provider can decide which group should have access to the document.

http://samdoc.jrc.it and http://www.samco.org/web

¹⁾ A session is a continuous browsing by a user, in which he/she visits several or all sites of the page. The single sites visited are not counted here; they are included in the session.



▲ Samco web site - URL: http://www.samco.org

Published by

Year	Month	Users	Sessions ¹⁾	Countries	Nation - Ranking				
		Total	Total	Total	1	2	3	4	5
2001	Oct	7	15	1	AT	-	-	-	-
2001	Nov	81	164	16	IT	AT	US	UK	BE
2001	Dec	235	374	34	US	AT	DE	FR	IT
2002	Jan	98	204	20	IT	FR	AT	US	DE
2002	Feb	312	433	34	US	IT	FR	AT	JP
2002	Mar	118	168	23	AT	US	UK	IT	FR
2002	Apr	126	265	25	IT	AT	FR	US	BE
2002	May	128	313	27	US	IT	AT	FR	ES
2002	June	150	280	29	US	IT	AT	FR	СН



▲ DEP - Document Exchange Platform

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News from the Profession & Practice

Health Care for Structures: Dynamic High Precision Monitoring with BRIMOS Recorder

Health Care for Structures

BRIMOS is health care for bridges and other structures. Comparable to a patient seeing a medical doctor, measurements are taken by highly sensitive instruments, whose results are interpreted by an expert. The BRIMOS Recorder is such a sensitive instrument with the conception of simple use and operation. The diagnosis is taken by an expert through interpretation of the measurement results in combination with information about the patient (structure). The process is simple. The BRIMOS Recorder is placed at the structure to be analysed and a measurement is taken. The data are transmitted together with information about the structure, the conditions during the measurement and the existing pains (damage assumptions). The raw data are evaluated and reconciled with the symptoms. This either results in a clear classification or a recommendation for a deeper examination.

Applications

Monitoring and assessment - the health care for structures - has gained considerable importance worldwide. In the meantime the applications have covered a wide field from maintenance of infrastructure to disaster prevention. Currently the most important purposes are:

Classification of quality of structures

Determination of vibration intensities (kB-values)

Identification of seismic vulnerability

Assessment of structures upon earthquake resistance

System identification of engineering structures

Lifetime prediction of bridges

Vibration and noise problems on railways

Vibration and damage assessment of cables

Damage detection in post-tensioned bridges

Classification of traffic induced vibrations

- Condition rating
- And many more

An Economic and Simple Tool

In order to make these new methods economically competitive VCE has designed and built the BRIMOS Recorder[®] which combines high precision monitoring with data acquisition and storage facilities.

This simple instrument makes high precision measurements possible for virtually everyone. Most of the applications can be directly carried out by the structure owners and local authorities themselves. However in case of state-of-the-art methodology cooperation with VCE is recommended.

The advantages of the equipment are: It is simple, it is robust and last but not least it costs only 50% of compatible monitoring equipment. Therefore this method enables the investigation of a large number of structures in short time, which leads to a higher safety level for the users.

Assessment Approach

The base for applied vibration monitoring is that each structure has its typical dynamic behaviour, which may be addressed as vibration signature (see picture below). Any changes in a structure, such as all kinds of damages which lead to a decrease of the load-carrying capacity, have an impact on the dynamic response.

This suggests the use of the dynamic response characteristic for the evaluation of quality and structural integrity.











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News from the Profession & Practice

The measured vibration signature of the structure gives information about the current condition, the structural integrity and the quality of the structure. Practicing engineers highly desire a feedback from structures for more economic design and better understanding of the performance.

BRIMOS-Recorder[®] The monitors ambient vibration and allows acquiring knowledge on the current condition of the examined structure very quickly. The vibration signal is measured in three

dimensions and is saved on the internal data loggers for further assessment.

How to use the recorder

The application of the BRIMOS $\mathsf{Recorder}^{^{(\!\!R\!)}}$ is very simple. It can be managed even by laymen. In long-term benchmark tests and research projects VCE found out that only one sensor, located at a specific point of the structure, leads to a good impression about the structural performance.

Therefore locating the sensor is one of the major tasks for a correct assessment and classification of the investigated structure. The best location was found by assessing the results from the artificial damage tests. The following rule was defined for placing the BRIMOS recorder on the structure: $\tilde{S} = 0.4$. L_{max}

Technical Data

Size:

390 mm x 245 mm x 170 mm

Resolution: 19 bit with 1 kHz sampling rate

Sensor :

- Triaxial Epi-Sensor forced balance accelerometer

- Full scale range: ± 2g
- Bandwidth: DC to 200 Hz
- Dynamic Range: 155 dB



Temperature: -20°C up to +60°C

Humidity:

0% up to 95% at +50°C, noncondensing



▲ Location of the Brimos Recorder on the Structure

Contact

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More information: http://www.brimos.com http://www.vce.at



Reliable Data Acquisition

BRIMOS-Recorder[®] The provides reliable data acquisition of the highest quality. It has the added convenience and flexibility that today's monitoring technology offers. Thus it has a high value for the interpretation by structural engineers.

Superior Equipment

The standard **BRIMOS-Recorder**[®] is equipped with an internal 3-dimensional Forced Balanced Accelerometer built by Kinemetrics, which provides superior technology for structural health monitoring, seismic applications and vibration monitoring

"All-in-one" Solution

Our **BRIMOS-Recorder**[®] represents an entirely new conception in compact monitoring and assessment equipment. The main innovation of our development is the design as "all-inone" equipment containing all required component parts as well as a simplified and very user-friendly operating concept.

Quick and Easy Data Transfer

Developed for Microsoft Windows, the BRIREC software provides quick and easy data transfer to your home office and also covers a user-friendly environment, providing fast and accurate knowledge about the dynamic characteristic of the structure.







Relevant Projects for the SAMCO Network – Part III



SIMONET

The Structural Integrity Monitoring Network

Is a joint venture between Industry and the EPSRC to facilitate communication between workers, researchers and all those interested in the field of Structural Integrity Monitoring and Non-destructive Testing. The network has the following aims and objectives:

■ To develop a web based information source for structural integrity monitoring and areas of peripheral interest.

■ To establish the appropriateness of the economic and technical aspects of monitoring techniques for the management of the structural integrity of large structures and plant safety.

To identify the latest available technology, experience in use and methods of retrieving and interpreting data.

■ To encourage harmonisation of data storage and retrieval, by identifying incompatibility within systems.

■ To propose general guidelines for the practice and application of structural monitoring, and to identify priorities for further development.

Application:

Oil and gas platforms, Floating Offshore Structures, Jack-ups, Industrial Process Plants, Bridges and Ships.

Participants:

Industrial Steering Group Representatives from companies involved in providing the technology, users, consultants, researchers etc. Currently these are British Gas Ltd., BP Oil Co., The Welding Institute, Railtrak, Ove Arup and Partners and Jubb Associates with coordination from University College London and Cranfield University (http://www.simonet.org).



SIDANET

Structural Integrity and Damage Assessment Network

One of the fundamental problems currently facing a wide range of industries is the identification and assessment of structural damage using continuous or periodic monitoring. The cost of monitoring and the associated maintenance strategies can form a substantial component of the cost of ownership of a structure or machine. For example, the current approach in the aerospace industry, is to regularly inspect the vehicle using Non-Destructive Evaluation (NDE) procedures. This involves taking the vehicle out-of-service after a fixed number of flight hours. Often the vehicle lies idle unnecessarily as no faults are these detected during routine inspections. It is clear that reliable, inservice damage detection and monitoring techniques are needed to reduce costs. The early detection of damage also improves safety and perception of safety. Similar problems exist in the construction and offshore industries where it is of the utmost importance not to disrupt the service of the structure during routine inspections. Also, development of effective health monitoring schemes will have major effects techniques for risk on management of large structures.

This network draws together experts from a variety of Engineering disciplines to focus attention on the problem of damage assessment. The network includes participants from both academic and industrial backgrounds and has four main objectives:

■ To fuse the disparate approaches adopted by the almost disjoint communities concerned with Structural Health Monitoring (SHM), machine Condition Monitoring (CM) and Non-Destructive Evaluation (NDE). ■ To evaluate and document the currently used approaches. To examine any limitations to these methods imposed by basic Physics or Engineering and propose research to mitigate problems. To provide best practice guidelines.

■ To introduce new techniques suggested by the mathematical and statistical analysis of data and promote an interdisciplinary approach to the problem.

■ To lay down lines of communication between Academia and Industry. Where possible, to establish guidelines for industrially based experimental programmes and to establish demonstrators of the methods on realistic industrially-supplied data sets.

The initial three-year phase of the network was funded by the EPSRC. The network will now continue on a self-funding basis with revenue raised from meeting fees (http://www.sidanet.org).



European Strong- Motion Database

Strong-Motion Data from Europe and the Middle East can be downloaded from the web site:

http://www.isesd.cv.ic.ac.uk. Further mirror sites exist.

At present there are **1,974 records** from **805 earthquakes** recorded at 622 different stations available for download. All necessary details are provided on the web site.





Company Profile

Road and Bridge Research Institute

The Road and Bridge Research Institute in Poland is a research and development organization subordinated to the *Ministry of Transport and Maritime Economy.*

Research and Development

The Institute is involved in research and development projects concerning *construction and maintenance of the transportation infrastructure*, particularly: roads and road bridges, railway sub grade, railway bridges, road and other pavements and underground structures. The Institute's research covers materials, methods, equipment, organization and economic problems, issues of the environment protection, the management strategies and others.

Organization and Tasks

The research and implementation works are realized by 10 divisions and 1 section:

- Economic Research Section
- Concrete Division
- Pavement Diagnostic Division
- Foundation Division
- Geotechniques Division
- Bridge Division
- Pavement Technology Division

Organization and Mechanization Division

Bridge, Concrete and Aggregate Research Center, Branch "Wrocław"

Bridge Research Center, Branch "Kielce"

Innovation and Implementation Division "VERUM"

The Institute's activities include also a creation of Polish standards, instructions and specifications, issues of approval and quality certificates of new materials and methods for road and bridge construction, edition of the periodical and non-periodical publication, organization of the conferences and courses.

The center of scientific and technical information and the secretariats of the road and bridge standards committees



are also included into the Institute's activity. These works are carried out by four teams:

- Standardization and Normalization Section
- Certification of Products Section
- Branch Center of Scientific, Technical and Economical Information
- Promotion and International Relations Division

The Institute co-operates with Polish and foreign scientific and technical organizations and participates in activity of following international organizations:

PIARC, IABSE, OECD, ECMT, ERRI, ECS/CEN, AAPT, FEHRL, RILEM, EUROBITUME, ISSMGE, DECHEMA, FGSV.

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A Glance at the World

Greenville Bridge in Mississippi: It will be the longest cable-stayed span in the US

Project Name: US 82 Greenville Bridge Location: Mississippi, USA Project start date: 2001 Expected finish date: 2006 Expected Cost: ~ 206 Million USD

The construction of a bridge across the Mississippi River is a grand spectacle. The people of Greenville, Mississippi, and Lake Village, Arkansas, celebrated such an event on September 17, 1940, when more than 5000 people gathered to dedicate the new US 82 Benjamin G. Humphreys bridge, one of the longest spans anywhere on the river (picture right at the bottom).

In 2006, such a celebration will occur again when the newest US 82 bridge opens. The new Greenville bridge's main span of 420m will be the longest cable stayed span in the United States, the third longest cable stayed span in North America, and one of the longest bridge spans of any type on the Mississippi River. With more than 2-1/2 miles of bridge deck, two concrete towers soaring 130m above the Mississippi River, concrete piers anchored 36m into the riverbed and four fans of prestressing strand steel cable, the new bridge will be a spectacular crossing over America's most storied river (picture above).

Some features of the project:

The new bridge will have three spans, of 180/420/180 meters. The Mississippi approach to the bridge includes 905 m of new roadway and 1952m of approach bridge. The Arkansas approach to the bridge includes 1143m of roadway and 1402m of approach bridge. The total length of the project (bridge, approaches and new roadway) is 6182m. The new bridge will be located some 853m downstream from the existing bridge, greatly decreasing the likelihood of barge collisions. The new bridge will carry four lanes of traffic (two in each direction). Each lane will be 3.7m wide.

Some Construction details:

The 2006 Greenville Bridge is designed by HNTB (Howard Needles Tammen and Bergendoff) of Kansas City, the same firm that designed the original Greenville Bridge.

The construction of this gigantic bridge began with concrete mat placement in January, 2002. One month later, in



▲ In comparison the old and the new bridge

December, construction work on the Greenville Bridge reached into the waters of the Mississippi River as the U.S. Army corps of engineers began laying prefabricated ribbons of concrete called Articulated Concrete Mattress (ACM) on the bottom of the river (picture right). ACM was laid in the areas where support caissons and piers for the new bridge will eventually be located. The concrete mattress stabilizes the river bottom and will prevent scouring - the erosion and excavation of soil caused by river current - when caissons and other structures needed for construction are sunk through the mattresses and into the river floor.

Historically, bridge builders have used a basket-like mattress of woven wood planks to control scouring during caisson work. Timber mattresses are built on shore and floated into position, then piled with enough crushed stone to sink them to the river floor - a time consuming process that requires expert control. The placement of timber mattress would have taken about three months: laving of articulated concrete mattresses took less than 5 days. Articulated concrete panels are typically used by the Corps of Engineers in river bank stabilization or "revetment" operations. The Greenville project represents the first use of ACM in bridge construction - another footnote in the history of Mississippi River bridges (http://www.greenvillebridge.com).

For more information:

www.greenvillebridge.com www.icivilengineer.com/Big Project Watch



▲ New bridge under construction: laying of the concrete mat on the bottom of the river. © www.greenvillebridge.com



▲ Old Benjamin G. Humphreys bridge (1940) © www.greenvillebridge.com



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Calendar Of Events – Year 2002

JULY/AUGUST

■ **31-2.** CSCE International Conference on Short & Medium Span Bridges, *Vancouver, BC, Canada.* URL: <u>http://www.bridgeconference.com</u>

SEPTEMBER

2-5. Fifth European Conference on Structural Dynamics - eurodyn 2002, *Munich, Germany.* URL: <u>http://www.eurodyn2002.de</u>

8-11. Dam Safety 2002, *Tampa, Florida.* URL: <u>http://www.damsafety.org</u>

■ 9-13. 12th European Conference on Earthquake Engineering, *London, UK*. URL: <u>http://www.12ECEE.org.uk</u>

■ 19-20. Eurosteel – 3rd European Conference on Steel Structures, *Coimbra, Portugal.* URL: <u>http://www.dec.uc.pt</u>

■ 11-13. IABSE Symposium-Towards a Better Built Environment, *Melbourne, Australia.* URL:<u>http://www.iabse.ethz.ch/</u> <u>conferences</u>

SEPTEMBER / OCTOBER

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

OCTOBER

2. ECCREDI CEO Workshop, Brussels, Belgium. URL: <u>http://www.e-core.org</u>

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

3-4. Second E-CORE Workshop, Brussels, Belgium. URL: <u>http://www.e-core.org</u>

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

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

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

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

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

NOVEMBER

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: <u>http://otua.org/footbridge/Default_eng.htm</u>

DECEMBER

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

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

FEBRUARY

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

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



Register for the workshop at: http://www.samco.org/workshop

Date September 30 - October 1, 2002 in Brussels

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

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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 Specific of Programmes. These Specific Programmes are further divided into Horizontal Programmes and Thematic Programmes. One of these Thematic Programmes is the *"Competitive and* Growth" Programme Sustainable (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

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vce

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