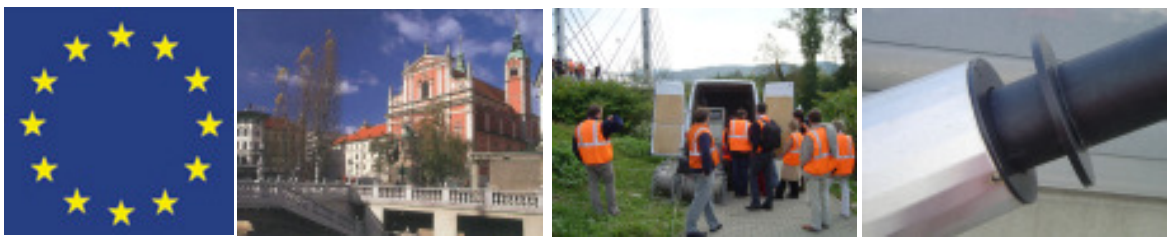
October 10th – 11th 2005

Ljubljana / Slovenia

REPORT

NAS Workshop in Slovenia

13th SAMCO Workshop



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1. List of Contents

2. Introduction

31 persons mostly from Slovenia participated in the 13th SAMCO Workshop dedicated to the newly associated states (NAS) of the European Union and which took therefore place in Ljubljana / Slovenia from October 10th to October 11th 2005.

The venue was situated in the city of Ljubljana on the premises of the company ZAG (Zavod za gradbeništvo Slovenije), Slovenia's national building and civil engineering institute. It was founded by a decree, promulgated by the Government of the Republic of Slovenia on April 21st, 1994, by transfering a part of ZRMK Ljubljana (the former Institute for Testing and Research in Materials and Structures) into a governmental research and testing institute. ZAG Ljubljana was entered into Slovenia's official List of Companies on March 17th, 1995.

Lectures were given in the big auditory on the 5th floor of the building.

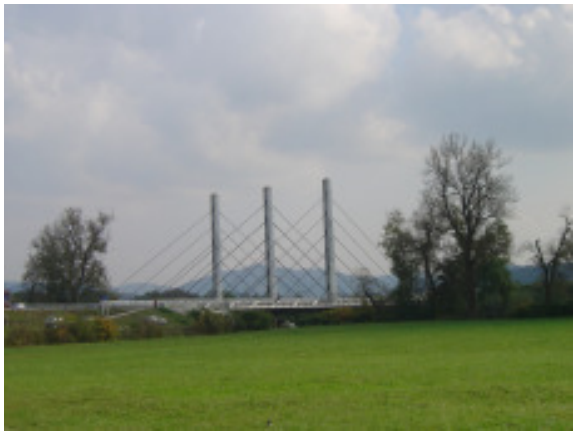
The aim of the Workshop was at first to bring together experts in structural assessment, monitoring and control from Slovenia and the bordering countries to build connections between the former and the new EU member states and to inform each other about the state-of-the-art in bridge monitoring.

The expectancy regarding this meeting was high, due to the fact that experts from Slovenia were invited to report on the practical experience in their country and to discuss current research activities with people from the former EU member states.

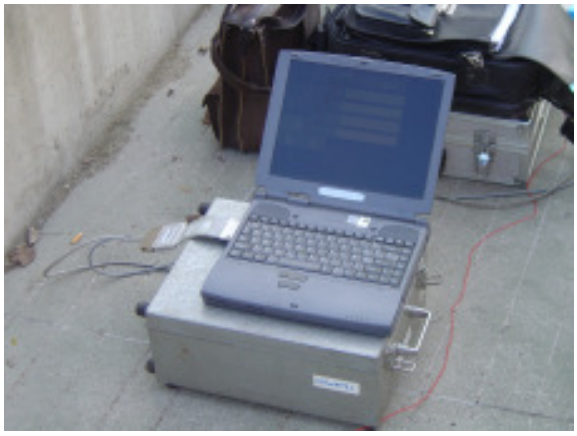
In a very fruitful environment the participants had also the possibility to get to know the company ZAG with its research laboratory.

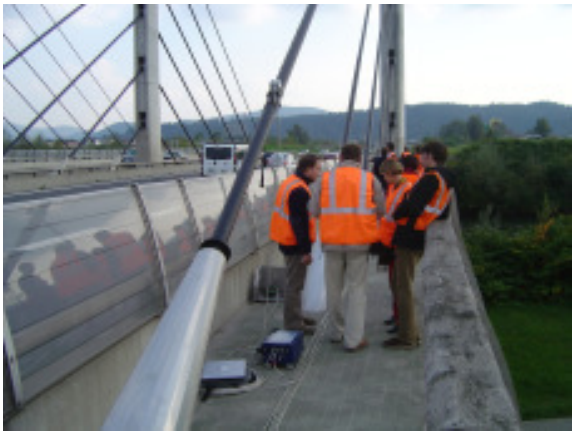
After the introduction of ZAG by the director of the Slovenian National Building and Civil Engineering Institute in the morning of the first day, the SAMCO-coordinator Mr Wenzel and Mr Marcellini of IDPA / Italy spoke about monitoring and control of civil engineering structures.

In the afternoon of the first day a practical demonstration of bridge monitoring was carried out on the cable stayed Lubljanica Bridge, the so called “Harfa”, by the team of VCE / Austria.



The BRIMOS-Recorder and the BRIREC software, used for ambient vibration measurements and evaluation of bridges as well as the full BRIMOS equipment with sensors linked with the data logger to measure the vibration behaviour of the structure and the BRIMOS software for evaluation and presentation of results as well as the GREEN-Eye – software for conversion of measured data was shown to the participants.

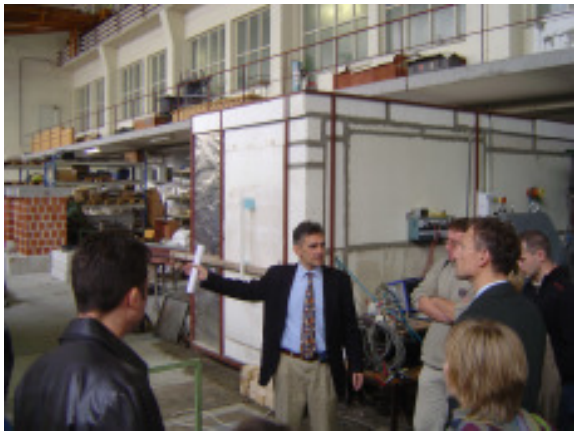




The results of those measurements (graphs, tables and calculations) were presented and discussed by VCE on the second day of the workshop. As to Mr Wenzel's speech it is unavoidable to improve some construction details of the small cable stayed bridge in order to guarantee the safety of the bridge (see chapter 3).

The lectures of the second day gave insight into the activities of ZAG Ljubljana in the area of structural monitoring and control, such as geotechnical, corrosion or bridge and traffic monitoring or monitoring of buildings.

In the course of a visit to the laboratories of ZAG, guided by Mr Bevc and Mr Bosiljkov the participants got to know different practical research applications and testing methods for structures used by the civil engineering institute.



Other topics touched on at the workshop were activities at the University Maribor, the SiWIM bridge weight-in-motion system, the compensation of environmental influences, decision support systems and future developments of monitoring and control.

Contributions and photos of the 13th SAMCO Workshop can be downloaded from the SAMCO Database:

http://samco.jrc.it/

3. Demonstration at the Ljubljana Bridge

During the NAS workshop a demonstration has been performed at the bridge to show the potential of current practice monitoring systems. This is an executive summary of the results obtained for information to the bridge owner and operator.

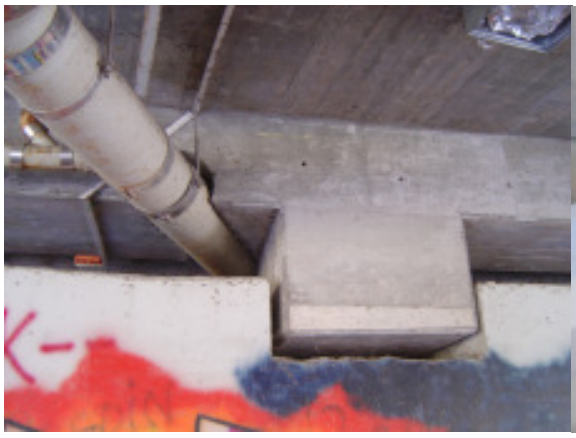
The bridge has an unusual design characteristic. This is represented in the results obtained from the measurements. The following has been observed:

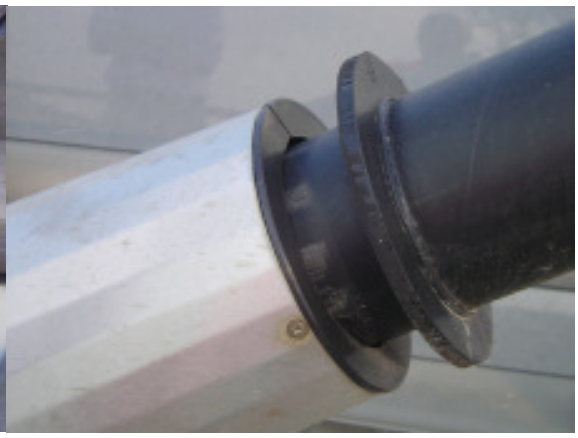
- The calculated eigenmodes of the structure show an uplift of the bridge at the abutments during normal operation. This should not happen in a normal case and is already potentially dangerous during a moderate earthquake. Retrofitting is therefore recommended.
- The bridge shows vibrations in all 3 directions at the same vibration level. This is rather unusual because vertical vibrations are usually dominant. The result is a visible vibration in horizontal direction that can be observed by a movement of about 3mm in the expansion joints with a frequency of about 2-4 Hz. This is potentially damaging to the expansion joints and might lead to structural problems.
- The vibration intensity recorded during this short period is rather high. Overstressing of the bridge structure at extraordinary loading situations might be expected.
- The detailing at the cables does not represent the minimum international standard and should be improved. Particular the water problem should be treated in order to avoid cracking by freezing water in winter.
- The system damping values are unreasonably high and indicate that the bridge will have a short lifetime.

The following is recommended:

- Immediate action should be taken to treat the problem of uplifting at the abutments. A retrofit is recommended.
- A change of detailing of the cables water protection is recommended. Particular before the winter period a higher protection level should be reached to avoid damage.
- A detailed measurement campaign is recommended in order to record all necessary phenomena to understand the bridge behaviour and the seriousness of the problem. It is estimated that a 2day campaign is sufficient to do so. Further investigation work will also help to deepen the knowledge and justify the necessary measures.

It is further recommended to include a cable stayed bridge expert into the investigation team to profit from existing experience.





4. FINAL PROGRAMME OF 13th SAMCO WORKSHOP

Monday, October 10, 2005

08.30 – 09.00	registration of participants
09.00 – 09.10	Welcome and introduction of ZAG Ljubljana Dr. Andraž Legat, director of the Slovenian National Building and Civil Engineering Institute
09.10 – 10.30	Monitoring and control of structures Dr. Helmut Wenzel (VCE), SAMCO project coordinator
10.30 – 11.00	Coffee break
11.00 – 12.30	Monitoring of bridges: Dr. Helmut Wenzel (VCE) Monitoring of buildings: Dr. Helmut Wenzel (VCE) Monitoring of other civil engineering structures: Alberto Marcellini (IDPA) Discussion
12.30 – 14.00	Lunch break
14.00 – 14.30	Transfer to the test structure (bridge over Ljubljanica River – “Harfa”)
14.30 – 16.30	Practical demonstration of bridge monitoring: *BRIMOS-Recorder: Ambient vibration measurements of bridges* *BRIMOS-"Big"-System: Ambient vibration measurements of bridge decks* *BRIREC software* *BRIMOS software for evaluation and presentation of results* *Data acquisition equipment and software for permanent monitoring* *GREEN-Eye – software for conversion of measured data*
16.30 – 17.00	Control and verification of in-situ measurement results
17.00 – 17.30	Transfer of participants to the hotel / to ZAG Ljubljana

Tuesday, October 11, 2005

08.30 – 09.00	Registration of participants
09.00 – 10.00	Activities of ZAG Ljubljana in the area of structural monitoring and control: Geotechnical monitoring: Mojca Ravnikar Turk Corrosion monitoring: Dr. Andraž Legat Monitoring of buildings: Dr. Vlatko Bosiljkov Bridge and traffic monitoring: Aleš Žnidarič
10.00 – 10.30	Visit to the laboratories of ZAG Ljubljana: Lojze Bevc
10.30 – 11.00	Coffee break
11.00 – 12.30	Activities at University Maribor: Dr. Andrej Štrukelj (Univerza v Mariboru) SiWIM bridge weigh-in-motion system: Robert Brozovič (Cestel) Presentation of monitoring results of bridge over Ljubljanica: Peter Furtner (VCE) Discussion of the results and their applicability: Martin Stöger (VCE)
12.30 – 14.00	Lunch break
14.00 – 16.00	Compensation of environmental influences: Dr. Helmut Wenzel (VCE) Decision Support Systems: Dr. Helmut Wenzel (VCE) Future developments of monitoring and control of civil engineering structures and buildings: Dr. Helmut Wenzel (VCE) Discussion
16.00	Workshop closure

5. List of Participants

No.	FirstName	Surname	Organization	URL
1	Nives	Bartol Pohl	GI	www.gi-zrmk.si/
2	Sonja	Bogatin	FGG	www.fgg.uni-lj.si/
3	Vlatko	Bosiljkov	ZAG	www.zag.si
4	Robert	Brozovič	CESTEL	www.cestel.si/
5	Bojan	Čas	GI	www.gi-zrmk.si/
6	Franci	Čepon	FGG	www.fgg.uni-lj.si/
7	Dušica	Drobnič	ZAG	www.zag.si
8	Peter	Furtner	VCE	http://www.vce.at/
9	Julijana	Jamnik	DDC	http://www.dd-ceste.si/
10	Jan	Kalin	ZAG	www.zag.si
11	Srečko	Kokelj	DDC	http://www.dd-ceste.si/
12	Igor	Lavrič	ZAG	www.zag.si
13	Andraž	Legat	ZAG	www.zag.si
14	Ksenija	Marc	DARS	http://www.dars.si/
15	Alberto	Marcellini	CNR-IDPA	http://www.idpa.cnr.it/
16	Erik	Pagon	ZAG	www.zag.si
17	Martin	Poljanšek	GI	www.gi-zrmk.si/
18	Mihajlo	Popovič	GI	www.gi-zrmk.si/
19	Andrej	Praček	ZAG	www.zag.si
20	Mojca	Ravnikar Turk	ZAG	www.zag.si
21	Jürgen	Schindler	VCE	http://www.vce.at/
22	Katja	Slanc	ZAG	www.zag.si
23	Anton	Štampfl	GI	www.gi-zrmk.si/
24	Martin	Stöger	VCE	http://www.vce.at/
25	Andrej	Štrukelj	UM	http://www.uni-mb.si/podrocje.aspx?id=0&langid=1033
26	Gregor	Trtnik	IGMAT	http://www.igmat.si/
27	Gregor	Vilhar	ZAG	www.zag.si
28	Judith	Wallisch	VCE	http://www.vce.at/
29	Polona	Weiss	ZAG	www.zag.si
30	Helmut	Wenzel	VCE	http://www.vce.at/
31	Aleš	Žnidarič	ZAG	www.zag.si

6. List of Presentations

Nr.	Title of Lecture	Organisation	Lecturer
1	On-Site Investigation and Monitoring of Historical Masonry Structures Case Study: Pišece Castle / Slovenia	ZAG Ljubljana / Slovenia	Bosiljkov
2	SiWIM Bridge Weihging-in-Motion System	Cestel / Slovenia	Brozovič
3	Results of Cable Measurements on Bridge over Ljubljanica River	ZAG Ljubljana / Slovenia	Lavrič
4	Corrosion Monitoring of Structures	ZAG Ljubljana / Slovenia	Legat
5	Evaluation of Fundamental Frequency of Soil and Building by Ambient Vibration Technique	C.N.R.-IDPA, Milan / Italy	Marcellini
6	Monitoring Structures during Construction Phases	Univerza v Mariboru	Štrukelj
7	Geotechnical Monitoring	ZAG Ljubljana / Slovenia	Turk
8	Advanced Bridge Monitoring (Part 1)	VCE Holding GmbH / Austria	Wenzel
9	Advanced Bridge Monitoring (Part 2)	VCE Holding GmbH / Austria	Wenzel
10	Ambient Vibration Monitoring of Cables	VCE Holding GmbH / Austria	Wenzel
11	Compensation	VCE Holding GmbH / Austria	Wenzel
12	Decision Support Systems	VCE Holding GmbH / Austria	Wenzel
13	I M A C - Integrated Monitoring and Assessment of Cables	VCE Holding GmbH / Austria	Wenzel
14	Monitoring	VCE Holding GmbH / Austria	Wenzel
15	Monitoring Overview	VCE Holding GmbH / Austria	Wenzel
16	Bridge Assessment and Monitoring; Traffic Monitoring	ZAG Ljubljana / Slovenia	Žnidarič