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NEWSLETTER

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Dynamic Measurements of the Second Severn Crossing

John Macdonald outlines a study comparing field measurements of the SSC with results from wind tunnel tests and finite element models.

The construction of the Second Severn Crossing gave the Earthquake Engineering Research Centre at Bristol University a unique opportunity to monitor the dynamic behaviour of a cable-stayed bridge at various stages of erection. This bridge was particularly suitable as the construction programme involved building the two balanced cantilevers from the pylons sequentially, leaving one cantilever complete but isolated for a considerable period of time. An extensive instrumentation system was installed to monitor movements of particular parts of the structure along with wind and temperature conditions.

Dynamic excitation was purely ambient, from wind, construction operations and, latterly, traffic, except for some cable measurements for which manual excitation was used. The monitoring covered various stages of construction as the balanced cantilevers grew and modal surveys were conducted just before and after connection to each intermediate support. There was a particular focus for several months on the completed English cantilever, before closure of the main span, this being potentially the most vulnerable state. Each critical stage had been modelled in a wind tunnel, so comparisons were able to be made.

The objectives of the monitoring and associated work included:

- Identification of natural frequencies and mode shapes for comparison with predictions from the wind tunnel studies and design numerical model.
- Development of finite element models and comparison with the measured data to improve modelling techniques.
- Analysis of the magnitude of response of the structure in different wind conditions and comparison with the wind tunnel studies.
- A study of cable vibrations, particularly in relation to damping and interaction with the deck and pylons.
- The development of a computer vision system for remote measurement of displacements.
- A study of the changes to modal parameters as construction proceeded.
- The effect on the structure of the addition of the wind barriers.
- The effects of the temperature distribution.

Over the monitoring period several different types of test were performed. Brief modal surveys were conducted using two accelerometers and a spectrum analyser on the Welsh side on the free-standing pylon, and just before and after connection of the deck to each of the supports in the backspan. Similar tests were also performed previously on the English section at two intermediate stages.

A more detailed modal survey was carried out on the completed English cantilever using equipment in the locations indicated in Figure 1. The accelerometers were used in sets of three at each cross section, from which pure vertical (or for the pylon, longitudinal), torsional and lateral components of motion could be distinguished. For each position half hour time histories were recorded.

Data were also recorded over longer periods, typically a few days. Thus the response was monitored in varying wind conditions, often with no construction loads. Also a finer frequency resolution could be achieved and errors in the spectra could be reduced from averaging over these longer periods.

A key part of the monitoring programme was the development of a computer vision displacement measurement system. It digitises images from standard video cameras and tracks the co-ordinates of targets at points of interest. The targets comprise simple circles or rings of reflective material on a black background. The targets were illuminated to permit tracking at night and to reduce the adverse effects of the variation in image brightness. Using lenses with a focal length of 1.6m, a displacement measurement accuracy of 0.5 mm has been achieved at a distance of over 200m.

A basic system was previously used on the Humber Bridge. Improved features include multiple camera

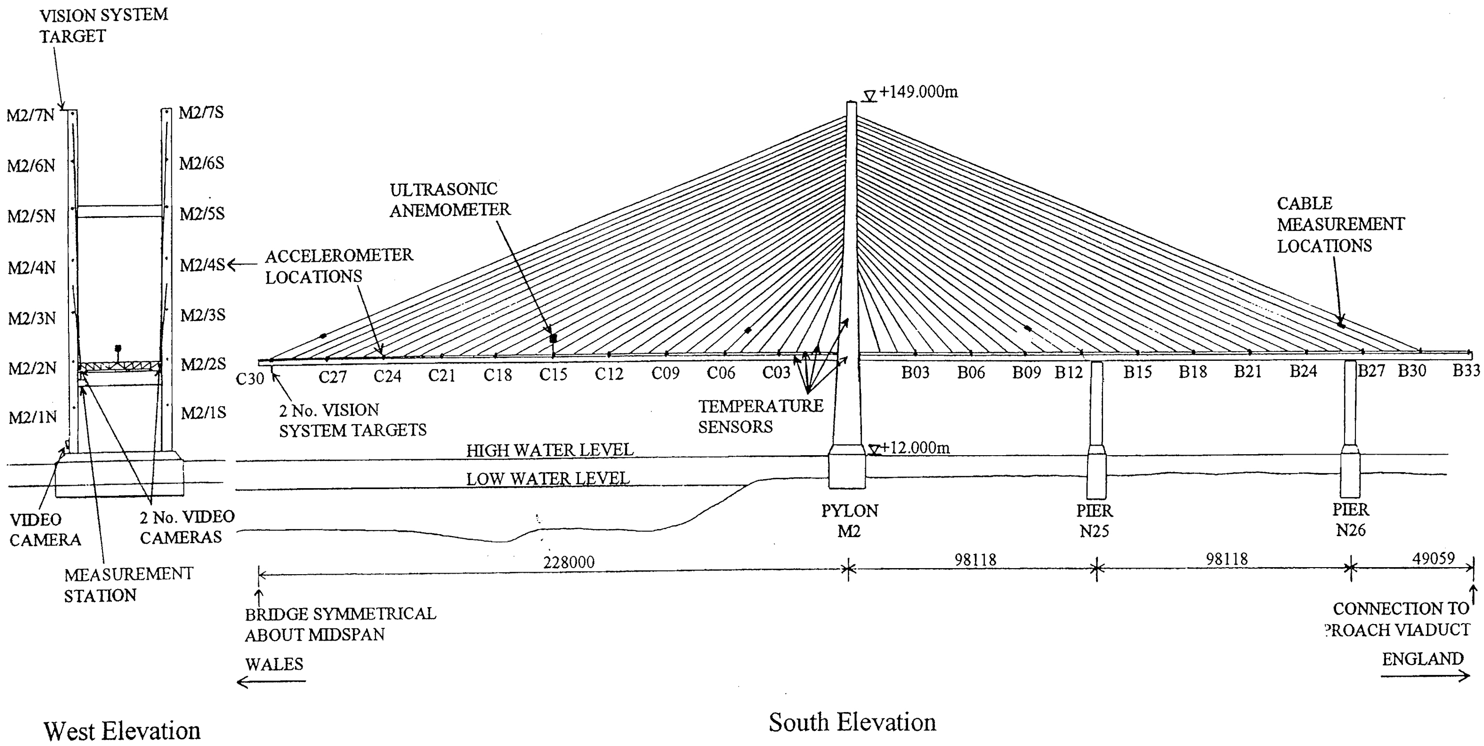


Figure 1 Measurement Locations on Completed English Cantilever

tracking, stereoscopic three-dimensional tracking and full synchronisation with the rest of the acquisition system. For the purposes of this application, the pictures were recorded onto video tape to permit further development of the tracking system and later reprocessing. However, the system is capable of giving direct displacement outputs in real time.

Video signals from up to three cameras, trained on targets at the midspan of the deck on each side and at the top of one of the pylons, were recorded onto one video tape by multiplexing alternate image fields from each camera. Thus an image was captured from each camera at a frequency of 12.5 Hz, which was quite adequate to detect the significant displacements, which all occurred below 1 Hz.

To minimise the processing time required, and to enable real time operation, the system predicts the position of the target in each frame based on its previous trajectory. Different target sizes and shapes can be used, along with various matching, sub-pixel interpolation and prediction algorithms. These can be optimised for a particular application to obtain the maximum accuracy within the processing time available.

The accuracy and reliability of the system, and the choice of tracking parameters was investigated using known displacements on the EPSRC Earthquake Simulator at Bristol University. The output from the system has also been compared with integrated accelerometer readings from site (Figure 2). There is very good agreement for periods up to 10s. For longer periods the accelerometer measurement and integration errors become significant but the vision system remains reliable. The system can therefore be used to obtain influence lines of displacement at a point due to a travelling load, and allows measurement of pseudo-static displacements due to temperature effects or steady wind forces, as well as low frequency oscillations.

There are essentially six types of mode of vibration of the bridge (excluding cables), namely vertical, torsional and lateral deck modes, and longitudinal, torsional and lateral pylon modes. In most cases two or more of the different mode types are coupled. Vertical and torsional deck modes (and longitudinal and torsional pylon modes) were distinguished using the sum and difference of accelerometer or vision system readings from each side.

Preliminary tests showed that modes up to 5 Hz could be measured and identified, while only those below 1 Hz contributed significantly to the displacements. The frequency of the first mode was always within 25% of 0.3 Hz throughout construction, since the stiffness and mass of the structure increased at similar rates. The acceleration response was often relatively large in the frequency ranges 3 - 6 Hz and 11 - 16 Hz during construction, being typically five times the response outside these ranges. This was believed to be due to excitations from construction operations (e.g. cable tensioning). After opening, traffic produced significant excitation in the 2 - 5 Hz frequency range.

Comparison of the magnitude of vibration of one part of the structure with another was achieved by keeping one set of accelerometers at one cross section (normally the end of the cantilever or the top of the pylon, which were generally anti-nodes) as a reference set, while moving a second set to different cross sections. The frequency response function relating the travelling set to the reference set, was then calculated (as it was not possible to obtain genuine frequency response functions since the input force was not known). The mode

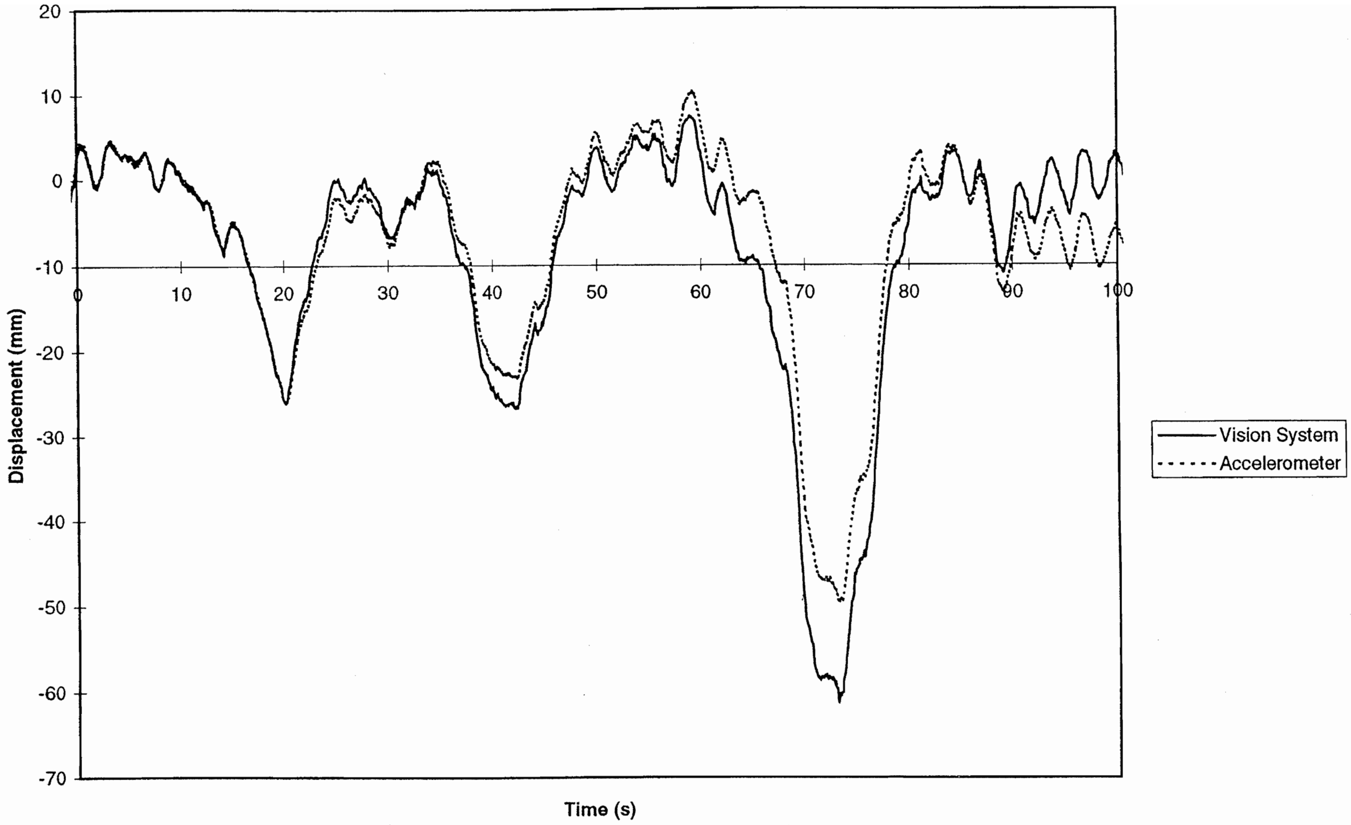


Figure 2 Typical Vertical Deck Displacement from Computer Vision System and from Integrated Accelerations

shape corresponding to each natural frequency was then obtained by plotting these relative magnitudes.

These mode shapes and their corresponding frequencies have been compared with those obtained from a very detailed finite element model based on the construction drawings and assumed material properties. Table 1 compares the frequencies of the first seven measured modes for the completed cantilever, along with the frequencies obtained from the wind tunnel studies. It can be seen that very good agreement has been achieved between the measured and calculated frequencies for the deck modes. The pylon torsional modes have been predicted but with less accuracy in the frequencies. Improved modelling methods, particularly of the pylon for torsion, are currently being considered. The wind tunnel study also achieved good agreement for the lower modes, although those involving torsion of the pylon were not identified.

The author gratefully acknowledges the assistance of Laing-GTM in facilitating the monitoring work and for providing construction information, Halcrow-SEEE for supplying design information, RWDI for providing the wind tunnel results, and the Engineering and Physical Sciences Research Council for its financial support under grant no. GR/H/82808.

John Macdonald is a lecturer in the Department of Civil Engineering at Bristol University.

This article is a extract of a longer paper that will appear in the November Issue of the ICE "Transport" Journal. The full paper also includes a discussion about the interaction between the cable and bridge dynamics.

Table 1 Comparison of Natural Frequencies

Mode No.	Principal Component	Other Components	Measured Freq. (Hz)	FE Model Freq. (Hz)	FE Model % error	Wind Tunnel Freq. (Hz)	Wind Tunnel % error
1	Deck Lateral	Deck Torsional	0.34	0.34	0	0.313	-8
		Pylon Lateral					
2	Deck Vertical	Pylon Longitudinal	0.35	0.38	+9	0.373	+7
3	Pylon Torsional	-	0.45	0.59	+31	-	-
4	Deck Vertical	-	0.52	0.54	+4	0.595	+14
5	Deck Lateral	Pylon Torsional	0.56	0.45	-20	-	-
6a	Deck Torsional		0.56	0.59	+5	0.512	-9
6b		Pylon Lateral				0.477	-15
7	Deck Vertical	Pylon Longitudinal	0.61	0.66	+8	0.906	+49

SECED Chairman's Annual Report

May 1996 to April 1997

1 INTRODUCTION

1996/97 has been another good year for SECED. In this brief report I will pick out some of the highlights of last year, look forward to next year and invite you all to continue to support our activities.

2 LOOKING BACK

2.1 Meetings - our 9 meetings of last year covered a wide technical spectrum, each attracting between 30 and 100 attendees. Evening meetings accounted for 7 of the 9, the other two being fee paying events, namely "Seismic Assessment of Existing Nuclear Structures" at Risley and the two-day short course "Practical Seismic Design and Repair of Structures" at Imperial College. Special thanks are due to Peter Merriman and Julian Bommer for their efforts in organising these events. Our meeting in Glasgow attracted significant interest and has encouraged us to plan future meetings outside of London in 1997/98.

2.2 Newsletter - during the year our former editor Tony Blakeborough handed over to Adam Crewe after two years in post, and we thank him for his efforts. During each of the calendar years 1995 and 1996 three issues were produced, with a continued emphasis on quality rather than quantity. We are very conscious that many of our members rate the Newsletter as our most valuable deliverable.

2.3 Register of Members - at the start of 1997 we issued a first draft Register of (Individual) Members as an information service. This initiative has been welcomed but we realise we still have some work remaining to make it complete and consistent.

2.4 Membership - over the last 3 years our membership has remained fairly steady at, apparently, over the 300 mark. However, as a result of an in-depth financial scrutiny we have identified a number of regular non-payers and removed them from our list, leaving a revised total of 248 active members at December 1996. This number, coupled with our resources of over £25K, gives us a very solid base from which to operate. Continued thanks are due to Chris Browitt, our treasurer, for keeping a close eye on our accounts.

2.5 Interaction with the ICE - over the last 6 months we have responded to all twelve of the Future Framework Presidential Commission discussion papers, which entailed a considerable number of man hours of effort, particularly by your Chairman, Vice-Chairman and David Mallard. We have also continued to support the ICE via our involvement in the Structural and Building Board.

2.6 Interaction with other Societies - as well as our joint meetings held with other ICE societies we have continued to work closely with EFTU (Imperial College) and with EEFIT (IStructE). Discussions are currently underway to attempt to rationalise the overlapping interests of SECED, EFTU and EEFIT.

2.7 Secretariat - in February Mary Kinsella, our secretary from 1993-1997, left to develop her career overseas. On behalf of all members the Committee thanked her for her efforts and presented her with a leaving gift and our best wishes. In her place we now have Alison Bullen to whom we extend a warm welcome.

3 LOOKING FORWARD

3.1 Meetings - we are planning for 8 technical meetings in 1997/98, two of which will be outside of London.

3.2 Newsletter - we are planning for 4 issues per year in the foreseeable future, with simultaneous publication on the World Wide Web (contents list only).

3.3 Conferences in 1998 - preparations are also well underway for our next conference in Oxford, 26 & 27 March 1998, entitled "Seismic design practice into the next Century - research and application". Ed Booth and his committee have already been working on this for some time and have laid down solid foundations.

3.4 European Conference 2002 - we have decided to bid to host the European Association of Earthquake Engineering (EAEE) conference in 2002 here in the UK. Professor Amr Elnashai will co-ordinate our bid, with active Steering Committee Support - the bid will be presented at the 1998 EAEE conference. If successful this will mean hosting around 1500 delegates, our most ambitious undertaking to date, with many potential benefits to both SECED and other UK engineers.

3.5 Design Guide - our joint venture with the Wind Engineering Society, an ICE Design and Practice Guide entitled "Dynamics - An Introduction for Civil and Structural Designers", is nearing completion and we hope to have it published by Thomas Telford in the near future. The contributions of Alan Watson, Brian Ellis, Maurice Petyt, Brian Skipp, Ed Booth and David Key are acknowledged.

3.6 Directory of Practitioners - we have started work on updating our Directory to a 1997 (6th) edition, and plan to complete this over the next few months. A print run in excess of 1000 is envisaged, distribution being to selected clients, consultants, contractors, researchers, academics, libraries and others.

3.7 Research/Education/Training - we are planning to hold a workshop in Autumn 1997 in London to review current and recent earthquake engineering research in the UK, identify the needs of the UK civil engineering industry in terms of earthquake engineering, and to explore more efficient means by which to communicate the research needs of engineering practice to academic and research institutions and research findings to industry. All those interested should communicate with Julian Bommer at Imperial College.

3.8 Technical Reporter Contributions - we look forward, on an ad hoc basis to continued topical reports from our technical reporters Tianjin Ji, Andrew Chan, Gordon Woo, Alan Watson and David Smith.

4 YOUR CONTRIBUTION

Any club is only as good as its members and their input, and you will have seen from the above that many individuals and companies have put a lot into SECED in recent years. I have mentioned many names in the preceding sections, and I would like to add a few more to the list, namely some of our experienced members such as Robin Adams, Brian Skipp, Nigel Hinings and John Inkester who have helped keep us on the right track, and some of our newer members such as Bill Murphy, Dina D'Ayala, Andreas Kappos and Graham Roberts who have already begun to contribute actively to our Committee and technical meetings. I would also like to record a special thank you to Peter Merriman for his continued support and for keeping things going when I have been unavailable. To the rest of our members I encourage you to contribute to SECED wherever and whenever you can, and remind you of the adage that the more you put in to a club, the more you will get out of it.

5 CONCLUSION

1996/97 has been another good year for SECED, and we can look forward to the future positively.

John Maguire
SECED Chairman
April 1997

Meeting of the EC8 panel in Lisbon: 5/6 May 1997

Amr Elnashai and Brian Skipp report of the latest developments regarding Eurocode 8

This meeting was intended to be the final stage of drafting EC8 at the ENV stage. It was attended by delegates of Portugal (2), France (2), Spain (1), Italy (1), Germany (3), Greece (1), Ireland (1), Denmark (1), Norway (1), Switzerland (1) and the UK (2), in addition to the chairman and secretary of EC8. It was held at the National Civil Engineering Laboratories, hosted by LNEC and the Higher Council for Public Works. The main item of work was the assessment, discussion and further developments of Part 4: Silos, Tanks and Pipelines, leading to a formal vote. The meeting started on Monday 5 May 1997 at 2:00pm, and ended at 4:00pm on Tuesday 6 May.

Extensive discussion of the various national comments took the major part to the meeting. National comments were submitted by all the above participants in writing with the exception of Portugal, Spain, Greece and Ireland, who, however, gave verbal comments during the meeting: a large number of modifications were accepted by the author of the most recent draft. The majority of the UK comments were accepted. One of the most controversial points for discussion was the comparison between the design forces from EC8 and API, with the latter being much lower. A French proposal for the introduction of behaviour factors in excess of 1.0 (up to 3.0) was discussed in detail. It was agreed that a general statement allowing the identification and quantification of sources of energy dissipation, leading to behaviour factors other than unity should be added. Many other points of substance and of presentation were discussed in detail. The consensus of opinion at the end of the discussion was that the document is a vast improvement over previous drafts and is of an acceptable standard in comparison with existing international documents. The UK delegation voted in favour of adopting the draft, subject to the resolutions agree being implemented.

With regard to the formation of the project teams for ENV to EN conversion, the chairman and secretary first summarised the current administrative situation. The modified mandates have not been signed yet. It would be July or September 1997 before the mandates are signed. On the positive side, the mandates include all parts of EC8, hence in principle there will be six project teams (for parts 1, 1.4, 2, 3, 4 and 5).

The discussion on forming project teams was initiated by the chairman with a brief description of the context of forming PTs, in response to a perceived need by TC250. The situation, officially, is that the CEN chairman makes a selection, but informal discussions are allowed. Various national delegates proposed names, in addition to the list suggested by the chairman. Further discussion lead to the following preliminary list, subject to confirmation by the chairman:

PT1: Parts 1.2, 1.3 (Concrete and Masonry) Carvalho, Bossenmeyer, Dyrbre, Fardis, Kappos, Bisch

PT2: Parts 1.1, 1.3 (Steel, Composite, Timber) Bauwkamp, Elnashai, Cosenza, Plumier, Oliveira, Wenk

PT3: Foundations Faccioli, Pecker, Skipp, Coueliar

PT4: Bridges Calvi, Kolias, Plakas, Barr, Amir-Mazaheri, Vaz

There will be two further project teams on Silos etc. and Tower etc. Alarcon and Castellani will be in Towers; Schwartz will be in Tanks.

In conclusion, the comments tabled by the UK have been adopted in their majority and the UK in now well-represented in the new project teams. Our contribution to the work of EC8 will not only continue, but is bound to increase.

AS Elnashai, BO Skipp

Seismic design methodologies for the next generation of codes:

Edmund Booth reports on a Workshop held 24th - 27th June 1997.

A four day workshop was held at the end of June in the beautiful setting of Lake Bled, Slovenia. Its aim was to attempt to reach a consensus on the framework for the seismic codes of early in the next century, and to make recommendations for the research and other work needed to construct this framework. After two days of presenting papers, the participants divided into working groups for two days, charged with the task of drawing up conclusions and recommendations.

The workshop was organised by Professor Peter Fajfar of Ljubljiana University, and Professor Helmut Krawinkler of Stanford University. There were 31 invited participants and 16 observers; in addition to the organisers, some of the best known and respected names in earthquake engineering were there. Although the US delegation, at 10, formed the largest group, 12 other countries were represented. Professor Amr Elnashai and Dr Andreas Kappos (Imperial College) and Edmund Booth (independent consultant) were the UK participants.

The Workshop was held in the context of a major American effort in the last few years to review US seismic codes. The review has been heightened by the perception of both the engineering community and the general public in the US (and elsewhere) that while the Northridge, California earthquake demonstrated that current US codes are satisfactory with respect to life safety, they provide an inadequate level of economic protection. There have been three significant results from this review. Firstly, an agreement was reached that the 1997 edition of UBC, a radical revision of its 1994 predecessor and for the first time adopting the NEHRP provisions, should form the basis for a new "International Building Code" in the year 2000. This IBC will replace the three model codes which currently operate in the States. Secondly, a report by SEAOC's Vision 2000 Committee, chaired by Chris Poland of Degenkolb

1997 UNIFORM BUILDING CODE RELEASED

The 1997 Uniform Building Code (UBC) has been released by the International Conference of Building Officials (ICBO). Chapter 16: "Structural Forces" of the three volume UBC contains provisions for earthquake resistant design as well as appendices that include: specifications for earthquake recording instrumentation; a listing of seismic zones for locations outside of the United States; and newly-added earthquake regulations for seismic-isolated structures. The 1997 UBC is available in both paper copy and on CD-ROM. For price and ordering information contact ICBO, 5360 Workman Mill road, Whittier, CA 90601-2298 (telephone: 800-284-4406; toll free fax: 1-888-329-4226).

EARTHQUAKE PREDICTION COMPETITION

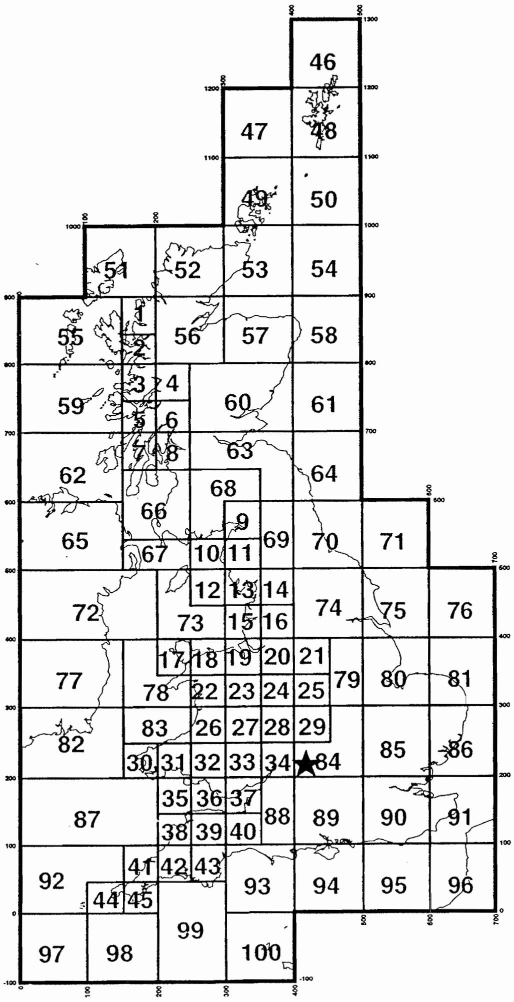
For those of you who attended the SECED AGM and entered the earthquake prediction competition we can now confirm that Dr A Blakeborough correctly predicted the location of the next significant earthquake to occur in the UK. The location and size of the earthquake is shown on the map opposite

EARTHQUAKE COMPETITION RESULT

Winner - Dr A. Blakeborough

★ Carterton, Oxfordshire

19 May 1997 2.8 ML



Engineers, has published radical new proposals for seismic code format for new buildings. Thirdly, a new set of guidelines for upgrading existing buildings, FEMA 273, produced by a committee chaired by Ron Hamburger of EQE International, has been agreed and will be published this autumn. The two chairs, Poland and Hamburger, were both present at the Bled Workshop; apart from your reporter, they were the only participants entirely in private practice.

The Vision 2000 and FEMA 273 share a radical vision of codes based on "performance based" engineering. This involves well defined performance goals under specified levels of seismic loading; the goals include immediate occupancy and no loss of function under frequent earthquakes, while life safety and collapse prevention goals apply under rare earthquakes. In many cases, the documents encourage the use of non-linear methods of static or dynamic analysis for checking that these performance goals can be achieved. The current equivalent static loading - "force based" design - is viewed in both documents as having severe limitations; "displacement based" methods, where the structure is checked for levels of deformation rather than load, is seen as one of the more promising ways of checking that the performance targets can be achieved.

Given the strong US presence at the Workshop and the recent effort in the States, it was perhaps inevitable that the US ideas on performance based engineering and displacement based methods should set the agenda. There was however a surprising consensus that this is the right way to go. There was also a consensus that the code targets should be probability based, and that non-linear methods of analysis will find an increasingly well defined place in future codes. While some of this may sound familiar and already achieved ground to Europeans, Eurocode 8 would need radical changes to adjust to all of these new ideas. This is because direct displacement based methods are not included in EC8, no guidance is provided on non-linear analysis and (perhaps more arguably) although performance based engineering is limit state design by another name, the definition and checking procedures in EC8 for the limit states, especially at serviceability levels, would need significant changes if they were to meet the US ideas.

Other interesting recommendations from the Workshop included proposals to develop standard demonstration buildings and bridges on which new codes could be tried out and compared, development of internationally agreed seismic experimental testing standards and (perhaps most idealistically) development of a common international framework for seismic codes.

While some important and useful work was done at the Workshop, it also left an abiding impression of the great hospitality and efficiency of our Slovenian hosts, and of the beauty of their country. The Workshop was small enough to allow good interaction between all the participants, which was conducted in an atmosphere of real international friendship and co-operation.

All 35 papers presented at the Workshop, as well as the recommendations and conclusions of the Working Groups, will be published by Balkema by the end of 1997. Further details of the Workshop can be obtained from the Website:

http://www.ikpir.fgg.uni-lj.si/bled97/

Edmund Booth

EASY - EArthquake Engineering Slide Information SYstem

A new slide collection showing earthquake damage is now on-line and available on CD ROM

An information system containing over 500 slides related to earthquake engineering has been developed by Institute of Structural Engineering, Earthquake Engineering and Construction IT at the University of Ljubljana. The core of the system is a set of slides depicting structural damage after four major earthquakes. Contrary to some of the existing similar libraries, all slides are commented in detail, classified and labelled with keywords. Additionally typical damage and background information is elaborated on. The system offers state-of-the-art navigation, browse and search options using a combination of database technology and friendly Web hypertext interface. The system is available on the Web and on CD ROM and can be used as a teaching tool in earthquake engineering.

Earthquake engineering is a semi-empirical science and the study of the behaviour of structures during recent earthquakes provides an important source of knowledge and progress. The slides, taken after earthquakes, are suitable media to achieve this goal. Digital images offer several advantages over conventional slides, regarding availability, distribution, enhancement, annotation, and integration with text. But most importantly they can enable better and faster access to relevant information as well as providing efficient links and cross references. If carefully prepared commentaries and an efficient user interface are added, such a slide library becomes a teaching tool rather than a reference source only.

The EASY system includes five hundred slides covering various aspects of 4 important earthquakes that have taught us many lessons. While the Mexico City, Northridge and Kobe earthquakes are well known and covered, the system includes about a hundred slides from the 1979 Montenegro earthquake which is less known to the earthquake engineering community. The slides were scanned in at 1296 x 864 pixels with 16 million colours using a scanner. The contrast, colour and sharpness of the images was then enhanced using various image processing packages to improve the picture quality.

Extensive commentaries then make EASY more than just a slide collection. They include short captions, detailed descriptions and general descriptions of different causes of failure.

Short captions, like "Shear failure of a column, Note large spacing of stirrups", are essential for the identification of the slide and its basic information.

There are several topics, however, which demand more detailed and longer explanation, e.g. "Structural aspects of traditional wooden houses in Kobe". These commentaries are usually related to several slides with similar information. Such detailed global descriptions have been prepared separately and are linked to (several) slides.

The most important part of the system is the explanation of the typical causes of failure. These general descriptions, e.g. "Shear behaviour and failure", have also been linked to the failure keywords. Together they cover a significant part of the information contained in classical text books on earthquake engineering.

The result of a search or browse is a list of slides with relevant information. The earthquake is indicated and the short caption is added. Thumbnail images are provided for better review. When a specific slide is chosen, a somewhat greater (but still small) image appears with all the relevant key works and a short caption. The image can be enlarged to full screen size. A specific feature of the system are the extensive links to related slides and commentaries.

EASY was first installed on the Internet in March 1997 at
http://www.ikpir.fgg.uni-lj.si/EASY/ but is now also available on CD ROM. The CD enables faster access and better resolution images. The Internet version is free of charge but a nominal charge is made for the CDs.

The work was supported by the Institute of Structural Engineering, Earthquake Engineering and Construction IT at the University of Ljubljana. The distribution of the system is partly supported by the Rector Fund of the University. The scanner, other equipment and software were funded by TEMPUS Joint European Project 3008: Integrated CAD of Earthquake Resistant Buildings and Civil Engineering Structures.

For more information please contact:

Matej Fischinger
University of Ljubljana
Department of Civil and Geodetic Engineering (FGG)
Institute of Structural Engineering, Earthquake Engineering and Construction IT (IKPIR)
Jamova 2, POB 3422
SI-1000 Ljubljana
Slovenia
Tel.: +386 61 1768593, 1768602
Fax.: +386 61 1250693
E-mail: matej.fischinger@ikpir.fagg.uni-lj.si

Edmund Booth reports that he has used the CD version of EASY and found it very instructive, he also notes that it is very easy to use. Well worth investigating.

The Sixth SECED conference, Oxford 26-27 March 1998

"Seismic design practice into the next century: research and application"

Plans are progressing well for next year's SECED conference, which takes place in the excellent facilities provided by the St Cross building at the University of Oxford. There was an encouraging response to the call for abstracts; 91 were received on a wide range of subjects, half from the UK and the rest from 20 other countries. There was also a good response from non-academic organisations, which provided 40% of the abstracts. Clearly, there had to be a selection and some excellent papers could not be included because of the limitations of time in a 2 day conference. There will be 9 keynote lectures and 30 poster presentations in plenary sessions, and 48 oral presentations in parallel sessions. Magdalen College, with its magnificent setting, will provide the accommodation and also the banquet, during which Dr Mazaheri, the current president of SECED's French counterpart society, AFPS, will give one of the keynote lectures.

The charge for the conference to authors will be £315, to include the Proceedings and lunch, but excluding the banquet and accommodation; the latter will be available at Magdalen from £31.50 per night bed & breakfast. Similar charges will apply to other applicants registering early, but a reduced fee of £150 will apply to student members of SECED and to delegates from Central & Eastern European countries and from the Former Soviet Union. A limited number of bursaries for UK and overseas students will also be available, to cover both the cost of the conference and travelling & accommodation; please contact Alison Bullen at the Institution of Civil Engineers if you would like further details.

An important meeting will take place in Oxford on the afternoon of Wednesday 25th March, the day before the conference begins. The subject to be discussed is the changes that might be desirable in Eurocode 8 (Design provisions for earthquake resistance of structures) when it is converted from its current "draft for development" stage into a full Euronorm. Four UK engineers have been recommended to serve on the European Project Teams charged with drafting the necessary revisions; they will give their views on what the changes should be, and then opinions will be invited from the floor. The meeting will be chaired by David Lazenby, who is the Chairman of the main European committee responsible for the structural Eurocodes (see New Civil Engineer, 15th May 1997). The presence in Oxford of so many engineers with informed views from both the UK and elsewhere promises to make this a very interesting meeting. All are welcome, whether or not they are attending the conference.

Edmund Booth

ICE "Structures and Buildings Journal"

All members of SECED are reminded that the editors of the ICE Journals are always on the look out for interesting papers. SECED members are invited to submit papers for the "Structures and Buildings Journal" and it should be noted that short (technical note) contributions are especially welcomed.

NOTABLE EARTHQUAKES APRIL - JUNE 1997

Reported by British Geological Survey

YEAR	DAY	MON	TIME UTC	LAT	LON	DEP KM	MAGNITUDES ML	MB	MS	LOCATION
1997	11	APR	05:34	39.53N	76.97E	15		5.9	6.1	XINJIANG, CHINA
			At least nine people killed, 60 injured and 100,000 left homeless.							
1997	21	APR	12:02	12.50S	166.20E	33			7.9	SANTA CRUZ ISLANDS
			This earthquake was followed by numerous aftershocks, including a magnitude 6.1 event nine minutes after this event.							
1997	27	APR	15:20	53.57N	1.20W	2	1.7			DONCASTER, S YORKS
			Felt throughout Doncaster, South Yorkshire.							
1997	08	MAY	02:53	24.89N	92.25E	35		5.6	5.6	INDIA - BANGLADESH
			Several people injured and damage occurred throughout Sylhet, Bangladesh.							
1997	10	MAY	07:57	33.83N	59.81E	10		6.4	7.3	NORTHERN IRAN
			At least 1,500 people killed, 2,300 injured and 50,000 people left homeless.							
1997	13	MAY	22:07	60.90N	3.50E	15	3.4			NORTHERN NORTH SEA
1997	19	MAY	08:02	51.76N	1.64W	6	2.8			CARTERTON, OXON
			Felt throughout Carterton, Bampton, Burford and Witney.							
1997	21	MAY	22:51	23.08N	80.04E	36		6.0	5.6	SOUTHERN INDIA
			At least 38 people killed, 1,000 injured and extensive damage occurred throughout the Jabalpur area.							
1997	17	JUN	21:03	51.30N	179.40W	33		6.6		ANDREANOF ISLANDS
			Felt throughout Adak.							
1997	22	JUN	16:50	49.25N	2.28W	11	2.1			JERSEY, CHANNEL ISLES
			Felt throughout Jersey, Channel Islands.							

Issued by Bennett Simpson, British Geological Survey, July 1997

SECED Newsletter

The SECED Newsletter is published quarterly. Contributions are welcome and manuscripts should be sent on a PC compatible disk. Copy typed on one side of the paper only is also acceptable.

Diagrams should be sharply defined and prepared in a form suitable for direct reproduction. Photographs should be high quality (black and white prints are preferred). Diagrams and photographs are only returned to the authors on request.

Articles should be sent to:

Adam Crewe,
Editor SECED Newsletter,
University of Bristol,
Department of Civil Engineering,
Queen's Building,
University Walk,
Bristol BS8 1TR,
UK.

Email: A.J.Crewe@bristol.ac.uk

Forthcoming Events

29 October 1997
Recent Developments in Shaking Table Control and Testing
Bristol University 2.15pm

26 November 1997
Seismic assessment of existing structures *ICE 5.30pm*

11 February 1998
Seismic analysis and design of Marine structures for nuclear safety
Plymouth University

25 February 1998
WHESSOE - DEPA LNG Terminal
ICE

26 to 27 March 1998
The Next SECED Conference:
Seismic design practice into the next century - research and application.
Oxford

29 April 1998
Effect of vertical acceleration on structures. ICE *(proceeded by AGM at 5pm)*

27 May 1998
Blast Loading / Industrial Safety *ICE*

Contents

Selected extracts from previous SECED Newsletters can now be found on the World Wide Web at the Institution of Civil Engineers:

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Comments are welcomed and should be sent to: A.J.Crewe@bristol.ac.uk

SECED

SECED, The Society for Earthquake and Civil Engineering Dynamics, is the UK national section of the International and European Associations for Earthquake Engineering and is an affiliated society of the Institution of Civil Engineers.

It is also sponsored by the Institution of Mechanical Engineers, the Institution of Structural Engineers, and the Geophysical Society. The Society is also closely associated with the UK Earthquake Engineering Field Investigation Team. The objective of the Society is to promote co-operation in the advancement of knowledge in the fields of earthquake engineering and civil engineering dynamics including blast, impact and other vibration problems.

For further information about SECED contact:
The Secretary,
SECED,
Institution of Civil Engineers,
Great George Street,
London SW1P 3AA, UK.