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SECED NEWSLETTER

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A 12-Year Field Mission

Dr. Julian Bommer looks back to a field mission in El Salvador that was the starting point for some long term collaborations which continue to this day.

In earthquake engineering circles, and also within SECED, there is often debate regarding the usefulness of earthquake field missions. If the trip consists of little more than an unaccompanied visit to the affected area and a few slide shows upon return, then probably the usefulness is limited to the personal instruction of the person making the field mission. When the field studies are carried out in conjunction with local seismologists and earthquake engineers, and are followed up by interpretation of strong-motion data and back-analyses of geotechnical and structural failures, presented in clear and timely reports, then the usefulness of the visit is greatly enhanced. Occasionally, the field mission can actually turn out to be the starting point for long-term collaborations with engineers and researchers in the affected region.

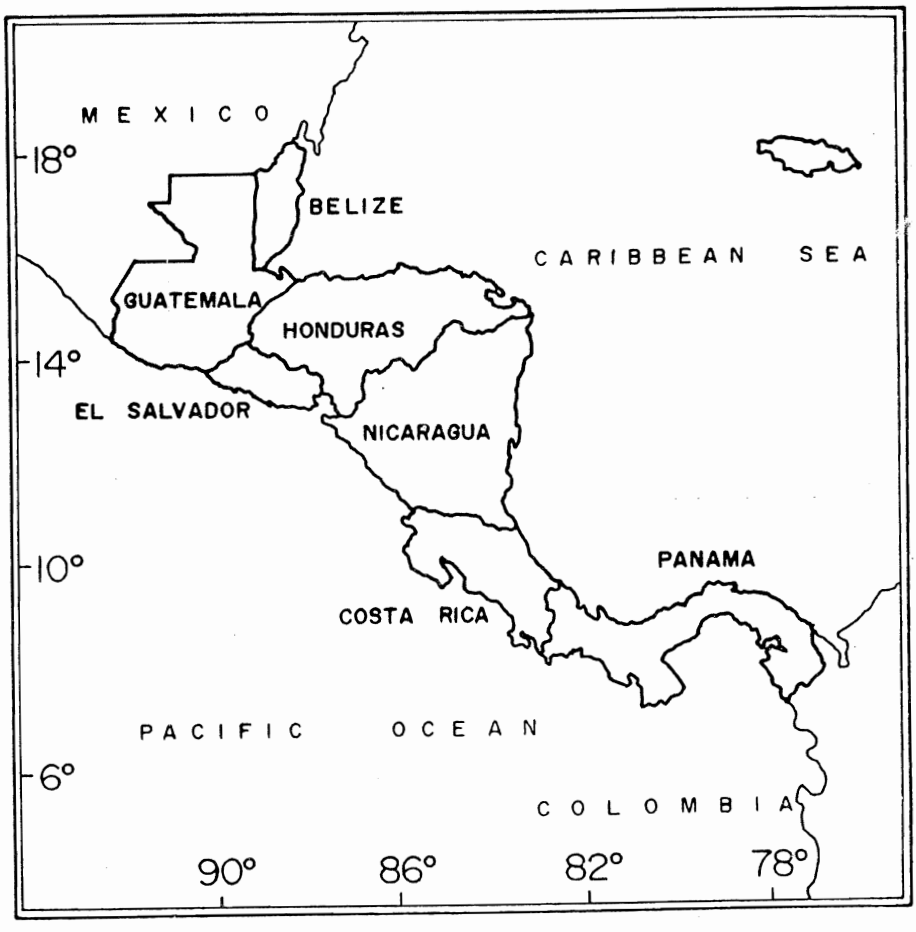

Figure 1 Central America.

In September 1986 I started work in the bridges department of Rendel Palmer & Tritton (RPT), having graduated with an M.Sc. in Soil Mechanics and Engineering Seismology from Imperial College. I was fortunate enough to be involved in seismic design aspects of the Jamuna Bridge at the time but, inspired by the lectures of Professor Ambraseys, I was also keen to undertake field studies of earthquakes. In the evening of Friday 10 October 1986, the first reports arrived of the earthquake that had struck the city of San Salvador, capital of the republic of El Salvador in Central America (Fig. 1). Despite the small size of the earthquake (M_s 5.4), as a result of its shallow depth and proximity to a dense and vulnerable city, the impact was very heavy, leaving 1,500 dead and destroying hundreds of buildings (Figs. 2-3). Myself and Dr. Stephen Ledbetter of Bath University left for El Salvador about two weeks later as an EEFIT team, RPT very generously providing my funding. We went without any contacts but on our rather contorted flight route I got talking to Ignacio Ellacuría s.j., the rector of the Central American University (UCA) and the next day, in San Salvador, he introduced us to Dr. Jon Cortina s.j., head of the Civil Engineering Department at the UCA. Dr. Cortina,

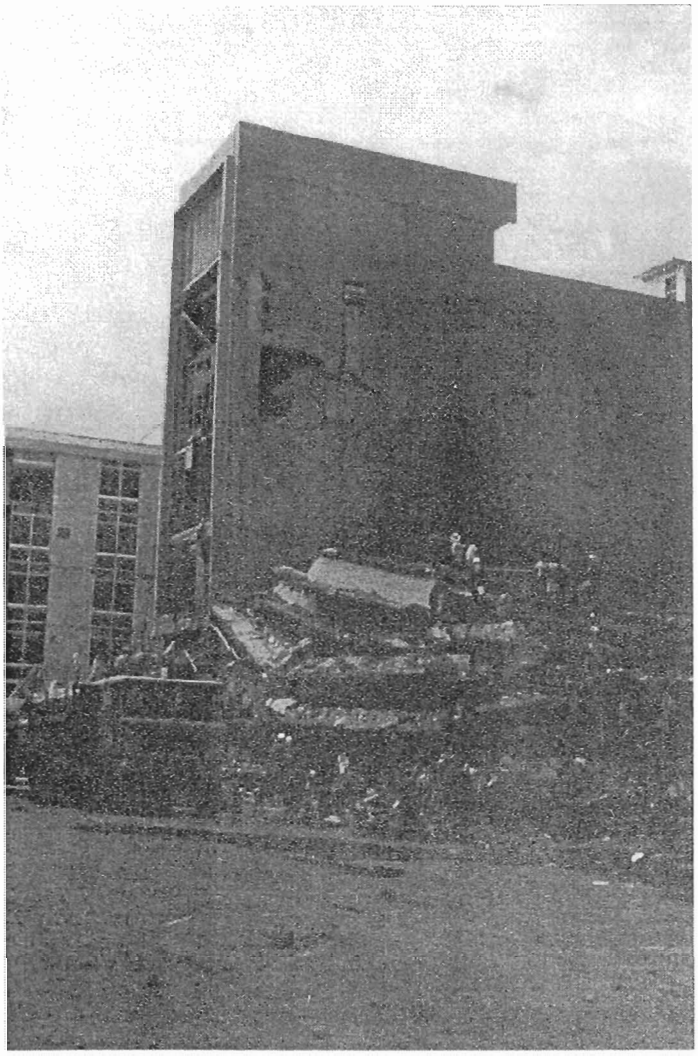

Figure 2 Collapse of the Rubén Dario Building in San Salvador, October 1986.

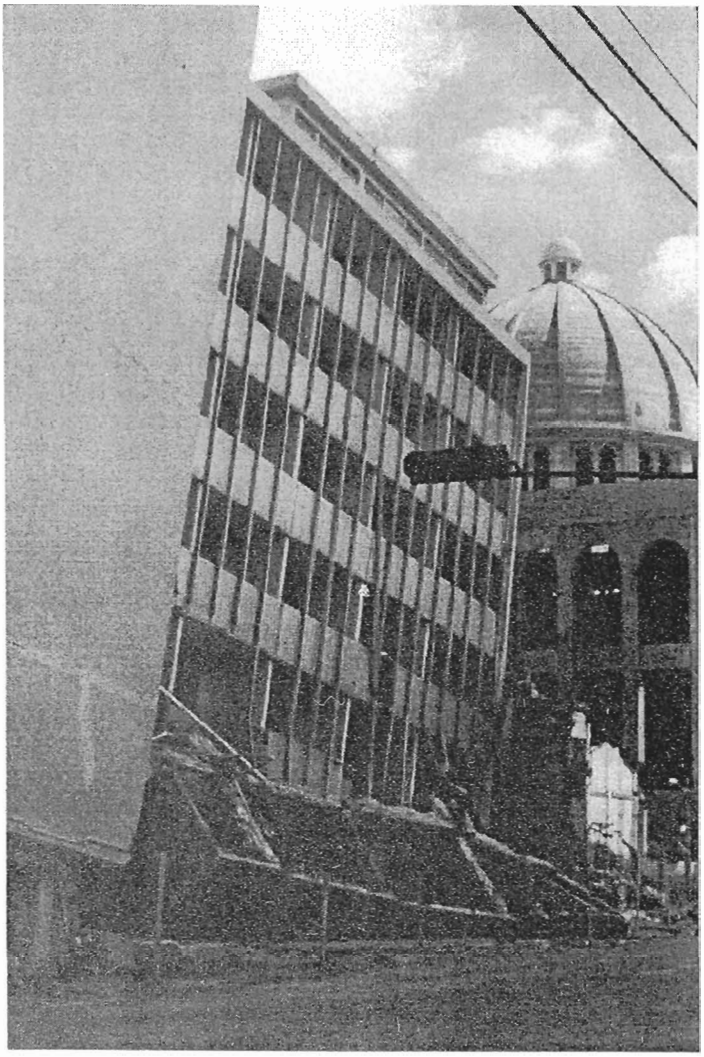

Figure 3 Collapse of the Hotel San Salvador, October 1986.

who had a strong interest in Earthquake Engineering, accompanied us throughout our two-week field mission and was an excellent guide. On returning to the UK, we produced our reports (Bommer & Ledbetter, 1987; Ledbetter & Bommer, 1987), made our presentations at SECED informal discussions and at that point may well have drawn the field mission for the San Salvador earthquake to a close.

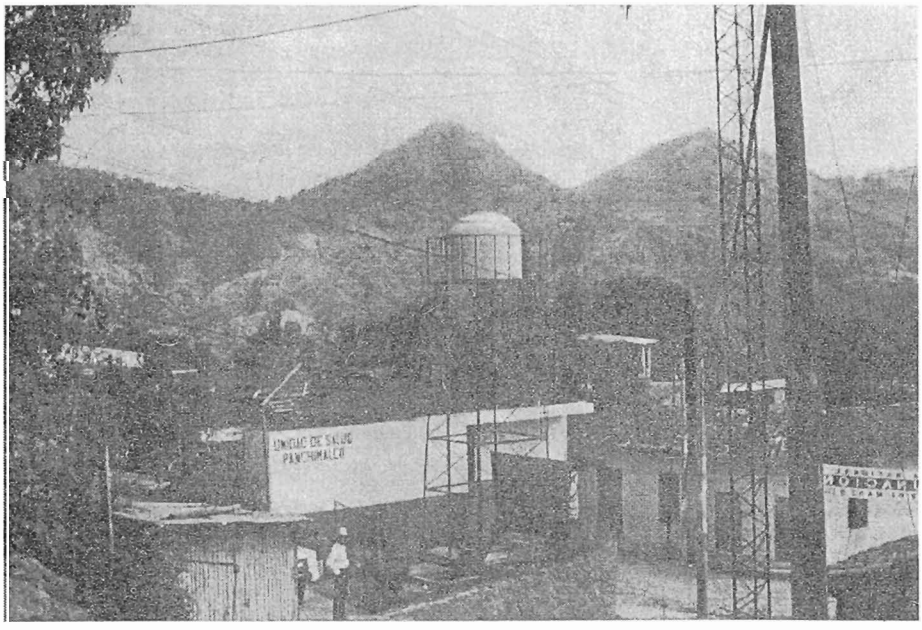

Figure 4 Health Centre in Panchimalco where one of the accelerographs was installed.

During the brief visit to El Salvador, I had been fascinated by the country, its dramatic volcanic scenery, the tropical climate and the incredibly friendly people. I had also had lengthy conversations with Dr. Cortina about his vision to set up research projects into seismicity and seismic hazard in El Salvador, and to bring Earthquake Engineering into the curriculum of the UCA. Dr. Cortina and I kept in touch through correspondence and on a couple of occasions he visited Imperial College. Throughout all of this we continued to discuss the ideas for joint research, although the possibilities for carrying out work in El Salvador were severely limited by the civil war that had begun around 1980.

In 1991, after completing my Ph.D. and needing a change of scenery, I started to look in more detail at ways to strengthen the links with the UCA. When the civil war came to end with the signing of the peace agreements in January 1992, I took the plunge and

offered my services to the UCA. I made an initial visit in August 1992, during which we discussed plans for the joint work, prepared a research proposal to be presented in Brussels and I also collected a number of previously unprocessed strong-motion records. At the end of January 1993 I arrived in El Salvador, with some help from the British Council, and became a full-time employee of the UCA. My tasks included lecturing on Engineering Seismology (producing a 400-page textbook for the course) and carrying out some background research. With a generous donation from CAFOD, I also set up a library in Earthquake Engineering, which is probably unrivalled in El Salvador. I stayed in El Salvador for 18 months until I was enticed back to Imperial College by the offer a lectureship. Before leaving El Salvador, with another grant from CAFOD as seed money, and then support from the British Embassy and the Inter-American Development Bank, it was possible to fund a young lecturer from the UCA to undertake an M.Sc. at Imperial College in Engineering Seismology.

Fortuitously, just about the same time as I returned to London, the European Community finally approved the research proposal for investigating seismic hazard, with the participation of five research centres in Europe and the UCA in El Salvador. This project has enabled me to return to El Salvador on a number of occasions and continue the work already started, and also to bring staff members from the UCA to London for training. A large part of the work has been directed towards hazard assessment, reviewing previous studies for the country (Bommer *et al.*, 1996) and exploring more appropriate methodologies for the particular characteristics of Central America (Bommer *et al.*, 1998). A major contribution of the project has been the installation of a network of digital accelerographs (Bommer *et al.*, 1997). A major concern we had in setting the network up was the question of security, but here we had a lucky break. During my stay in El Salvador I had given a couple of talks on earthquakes to the disaster response units of the Ministry of Health. Through contacts established then we managed to obtain permission from the Minister of Health to install our instruments in hospitals and health

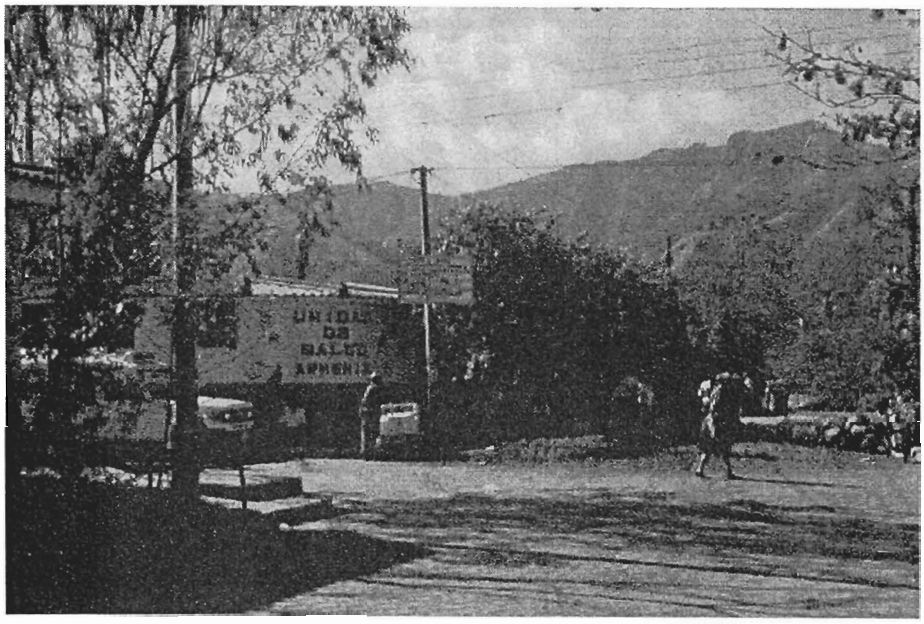

Figure 5 Health Centre in Armenia where one of the accelerographs was installed.

centres (Figures 4-6). The last of the accelerographs was installed on a Friday afternoon in March 1996, and on the Sunday, resting at the beach, I felt the shock of an earthquake off the coast of Nicaragua that produced our first records. A large number of earthquakes have since been recorded and a significant databank has been built up (Figure 7).

In parallel with the activities of the research project, I have also given courses at the National University (UES) and at the Salvadorian

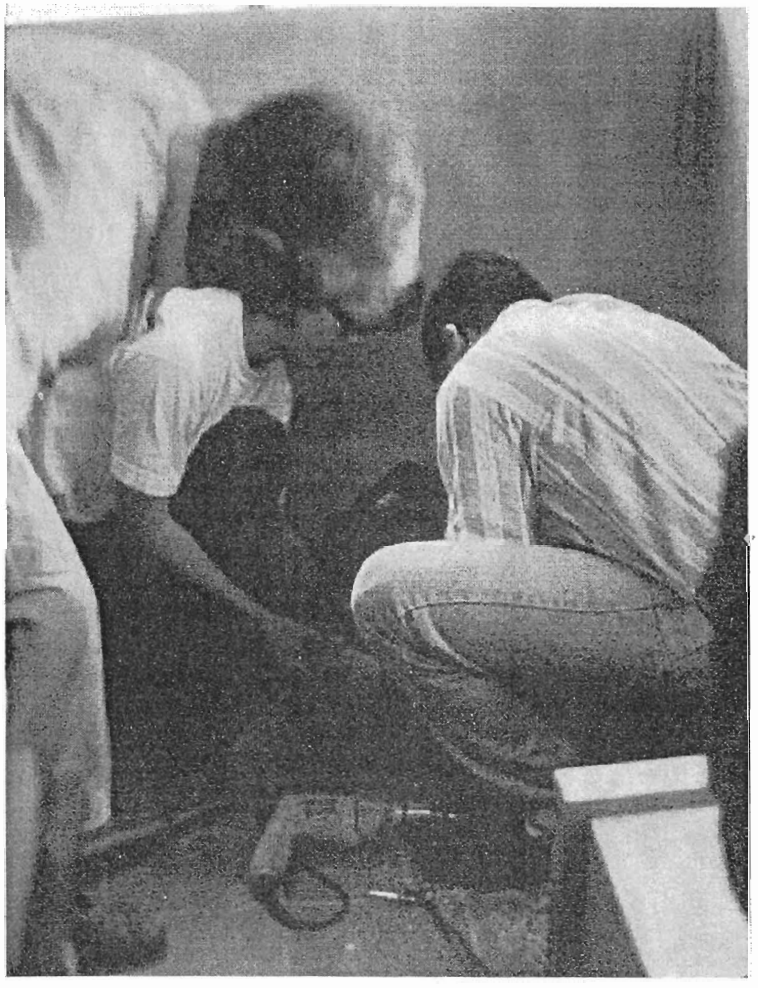

Figure 6 Dr. Cortina watches over as staff members from the UCA install one of the accelerographs.

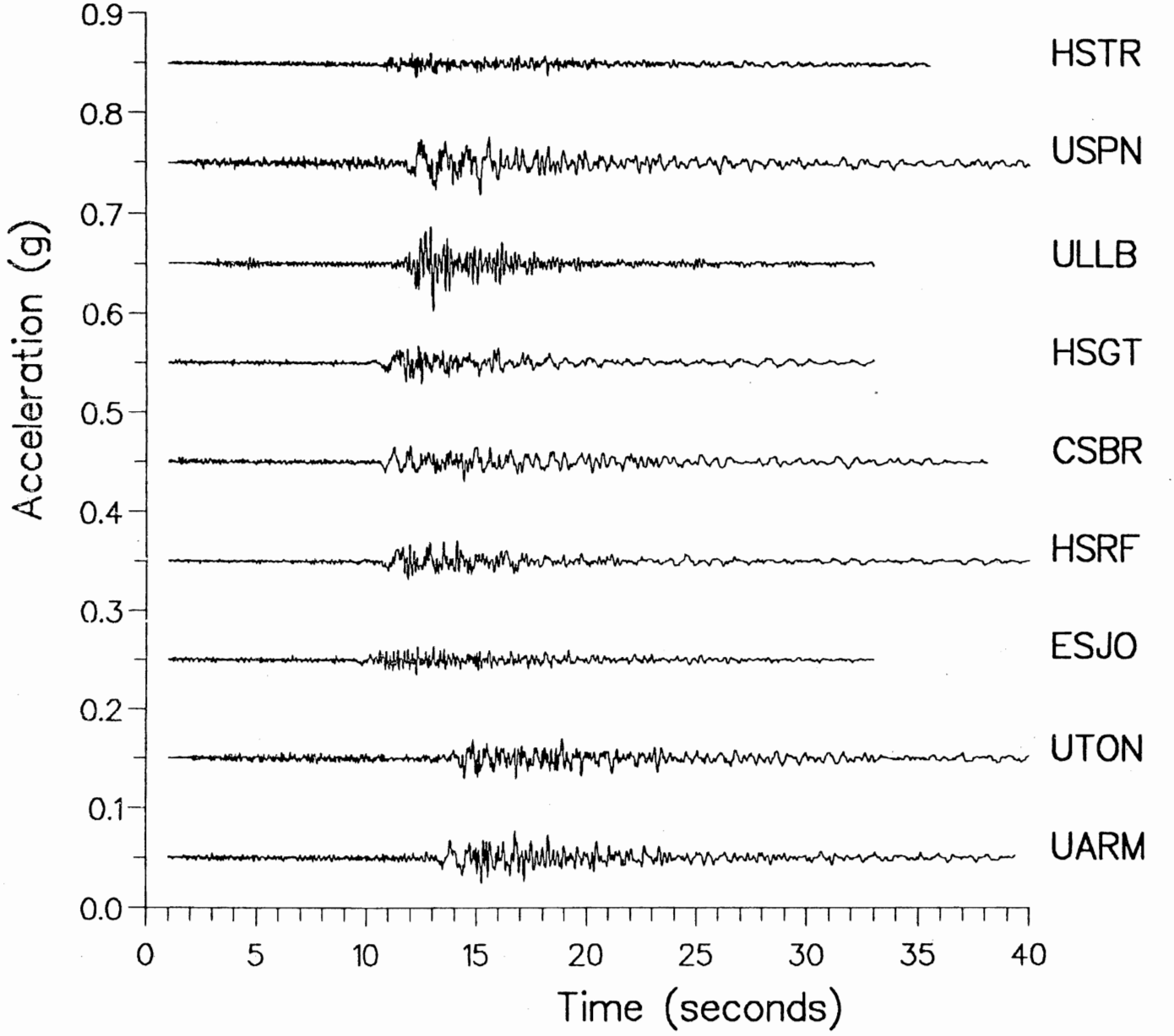

Figure 7 Strong-motion records obtained from digital accelerograph network on 22 July 1996.

Association of Engineers and Architects (ASIA), of which I have been made an honorary member. In September 1995, in conjunction with Dr. José Grases of the Latin American and Caribbean Network of Earthquake Engineering Centres (RELACIS), the Fifth Roving International Course on Earthquake Engineering was held under the auspices of ASIA and UES. This course, supported by UNESCO, had previously been held in Venezuela, Guatemala, Panama and Jamaica.

I was recently invited to be the technical representative for San Salvador, in conjunction with a political representative from the city planning organisation OPAMSS, in the United Nations RADIUS Project for the assessment of seismic risk throughout the world. Twelve years after the earthquake of October 1986, I am more involved in Earthquake Engineering in El Salvador than ever, and it seems likely to keep going for a while to come. As the International Decade for Natural Disaster Reduction draws to a close and I look back at what has come from my first visit to El Salvador, I am convinced that field missions can be enormously useful. However quickly data from an earthquake can be loaded on to the Internet, there is no substitute for being in the field. And whatever noble declarations are made at international conferences on technology transfer and disaster mitigation, there is no substitute for the potential that comes from human contact.

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Bommer, J.J., Hernández, D., Navarrete, J. & Salazar, W. (1996) Seismic hazard assessments for El Salvador. *Geofísica Internacional* **35**, 227-244.

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Bommer, J., McQueen, C., Salazar, W., Scott, S. & Woo, G. (1998) A case study of the spatial distribution of seismic hazard (El Salvador). *Natural Hazards* **18**, 2.

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Dr Julian Bommer

Meeting Report: 28 October 1998

Composite construction - Earthquake resistant design

Professor Bouwkamp is one of the most international figures in earthquake engineering. A Dutchman, he spent over 25 years at the Earthquake Engineering Research Center in Berkeley, California working with such great names as Popov, Clough, Bertero, Wilson, Powell and many others before crossing back over the Atlantic to take the chair of steel construction at Darmstadt University in Germany, where he has been since 1984. He is principally known as an experimentalist, but has also extensive experience in consulting on the seismic design of building, heavy industrial and offshore structures. He has been heavily involved in the development of the seismic Eurocode, EC8.

Professor Bouwkamp's presentation covered an equally extensive range. He started with an overview of the principles of seismic design for unbraced, concentrically braced and eccentrically braced steel frames, and noted the current deficiencies in EC8's provisions for composite construction. One particular aspect is the option in the current version of the code to design a composite frame by neglecting the contribution to strength of the concrete; Prof Bouwkamp showed that the concrete can increase shear strength by up to 50%, and that neglecting this contribution may lead not only to overdesign of yielding members, but also significant underdesign of members such as columns and diagonal braces intended not to yield. Other areas needing investigation include beam-column connection design and the detailing of slabs acting compositely with beams in the column head region. He described a series of tests, dating back over a number of years, which investigated single elements, one way frames and (most recently, at the European Commission's Joint Research Centre at Ispra, Italy) a full scale 3 dimensional composite three storey frame. These tests have clarified the issues and will assist the revision of the EC8 provisions on composite construction (currently relegated to the form of an 'informative annexe' - at the UK's insistence, as Prof Bouwkamp wryly recalled).

Many interesting details emerged, including the finding that composite frame members tend to grow in length under extreme cyclical loading, the influence of stud and stirrup detailing in steel shear links filled with concrete and the use of 'dogbones' (local reductions in flange width to induce plastic hinges to form away from joints). Dogbones were used in the Ispra tests to control yielding at the column bases, and some had fractured under extreme loading. Prof Bouwkamp said that this had been because the steep moment gradient at the dogbone had not been adequately accounted for in design, leading to a high concentration of plastic yield strains into a small region and consequent fracture.

An extensive discussion period ended with Prof Bouwkamp's upbeat assertion that the data is now in place to present well founded design provisions in Eurocode 8 when it is reissued as a full Euronorm early next century.

Edmund Booth

Meeting Report: 25 November 1998

The response of structures to dynamic crowd loads

An informal discussion on 'The response of structures to dynamic crowd loads' was held at the Institution of Civil Engineers in London on 25 November 1998. The meeting was chaired by Edmund Booth and the speakers were Brian Ellis of BRE and Tianjian Ji of UMIST. The meeting attracted an audience of 70 and generated a lively discussion.

Dr. Ellis started with a review of the background to current understanding and the development of design practice on structural response to dynamic crowd loads. The structures sensitive to dynamic crowd loads include cantilevered grandstands and floors used for pop concerts. A short video was shown in which significant vibrations of a large stand were generated by a small group of people jumping at the structural frequency, and this also showed the lack of co-ordination between individuals in the group even when there was a clear beat to follow. Dr Ellis then considered the dynamic loading requirements in BS 6399 Loading for Buildings (1996) which is concerned with rhythmic loading at pop concerts, and those in the Guide to Safety at Sports Grounds (the Green Guide, 1997) which introduces new requirements for non-rhythmic loading at all sports events. Mention was also made of the draft European standard prN 13200-1 "Spectator Facilities - Part 1: Layout Criteria for Spectator Viewing Area".

Dr. Ellis then described an experiment concerned with the measurement of dynamic loads for crowds jumping (pogoing) at specific frequencies. This form of loading requires both an active audience and a strong musical beat and thus relates to lively pop concerts. It is concerned with the type of dance activity, the frequency of the action, the density of the load and the dynamic crowd effect. This last item describes the attenuation of the load due to the imperfect co-ordination of individuals in a group and requires experimental investigation. He showed the experiments organised with UMIST at BRE's Cardington laboratory on a specially selected and calibrated area of floor on the steel framed building. Various groups of students, ranged in size from 2 through to 64, were jumping to a specific beat in response to music, and the vertical acceleration and displacement of the floor were monitored. The measurements indicated that the attenuation increased as the number of people increased and the attenuation was different for acceleration and displacement. He also mentioned tests on walking loads and human-

structure interaction effects, again looking at the different group sizes.

Dr. Ji's talk focused on how to stiffen structures using bracing members to resist dynamic crowd loading and other loads. Dr. Ji began by asking a question to the audience about the stiffness of two frames. The two frames have the same dimensions, material and cross-section for all members, but different bracing arrangements (see figure opposite). About half of the audience judged that the first one was stiffer while the other half selected the second. The answer to the question was given at the end his talk (The left one is stiffer). Dr. Ji examined the importance of appropriate bracing systems through known accidents and practical situations. Then he demonstrated two engineering concepts that can be used to design stiffer structures. They are:

- the shorter the force path between the loads and the structural supports, the stiffer the structure,
- the more uniform the inner force distribution, the stiffer the structure.

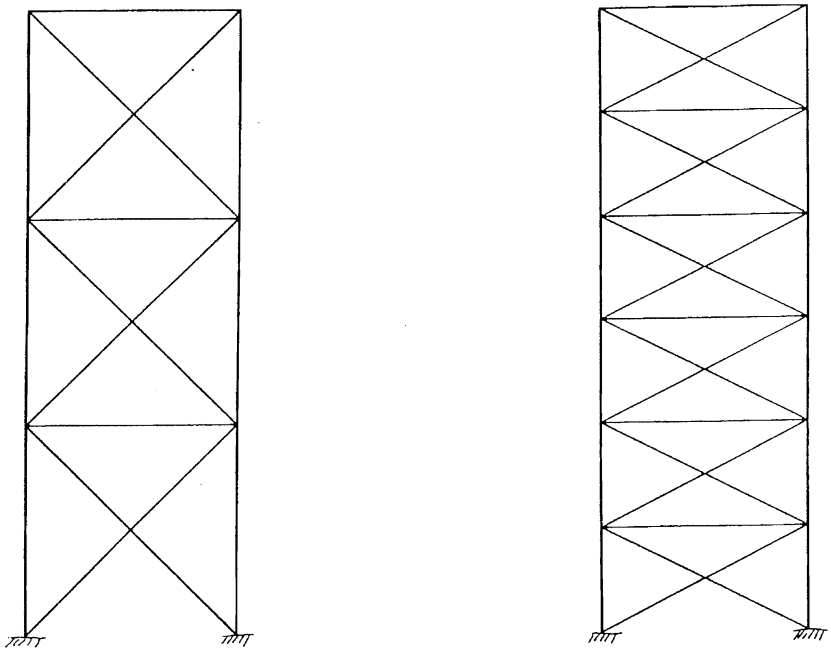
He gave five simple criteria, based on the two concepts, for arranging bracing members for temporary grandstands. Numerical examples and experiments were provided to demonstrate the efficiency of these criteria. Further applications of the criteria were shown relating to tall buildings, scaffolding structures and permanent grandstands. Two demonstration models were also displayed to allow attendees to feel the stiffness of the models which adopted different bracing criteria.

Further information is available in the following references for those who wish to read about the above topics.

1) B R Ellis and T Ji. "Human-structure interaction in vertical vibrations." Proc. Instn. Civ. Engrs. Structs & Bldgs. 122, pp 1-9, Feb.1997.
2) T Ji and B R Ellis. "Effective bracing systems for temporary grandstands". Structural Engineer, Vol. 75, No 6, pp 95-100, March 1997. Discussion, The Structural Engineer, Vol.75, No.22, pp.389-390, November 1997.
3) BRE Digest 426, "The response of structures to dynamic crowd loads". October 1997.

Tianjian Ji (UMIST)

Which One Is Stiffer?



Ninth International Conference on

SOIL DYNAMICS and EARTHQUAKE ENGINEERING

9-12 August 1999, Bergen, NORWAY

The Local Organizing Committee and the Norwegian Association for Earthquake Engineering, invite you to the 9th International Conference on "Soil Dynamics and Earthquake Engineering (SDEE '99)" to be held between 9-12 of August 1999 in Bergen, Norway. SDEE '99 represents the continuation in a series of successful conferences which aim to contribute to the international understanding of the problems and progress in Soil Dynamics and Earthquake Engineering and, as such, complements the objective and the role of the International Journal that bears the same name. The specific purpose of the Conference is to provide a forum for presentation and discussion of current activities and progress in soil dynamics and earthquake engineering with the hope of stimulating greater interest in this interdisciplinary field of Geotechnical Earthquake Engineering. The Conference is aimed at a better understanding of the earthquake response of groundstructure systems through exchanging the knowledge and the experience of the participants and to enhance the combined efforts of geophysics, geology, earthquake engineering and civil engineering for the reduction of earthquake risk to people and the physical environment. The Conference will encompass a Special Session on off-shore applications of the above mentioned problems which is especially relevant to the Oil Industry operating in the Norwegian Continental margin and off-shore areas elsewhere in the world.

The scientific sessions will be organized under the following topics:

- Seismicity, Ground Motion and Site Effects
- Seismic Hazard and Risk Assessment
- Geotechnical Engineering (foundations, liquefaction, slope stability, constitutive models)
- Laboratory and Field Tests of Soils and Foundations
- Analysis of Soil-Structure Systems
- Seismic Codes and Standards
- Special Structures and Systems (bridges, dams, underground structures)
- Soil Dynamics and Earthquake Engineering Related to Off-shore installations.
- Extended Structures and Systems (lifelines, urban systems)
- Experiences Derived from Recent Earthquakes

Authors wishing to present papers at the Conference are requested to submit abstracts to the SDEE '99, Local Organizing Committee latest on January 31, 1999, at the contact address given below. An abstracts volume will be ready for delivery at the Conference. Authors of selected papers will be invited to publish their full papers in the Proceedings Volume and the Special Issue of the International Journal "*Soil Dynamics and Earthquake Engineering*".

Contact Dr. Kuvvet Atakan, Conference Chair, SDEE '99, Institute of Solid Earth Physics, University of Bergen, Allegt.41, N-5007 Bergen, Norway. Tel: +47-55-583420, Fax: +47-55-589669, E-Mail: sdee99@ifjf.uib.no, http://www.ifif.uib.no/seismo/sdee99.html, for more information or to be included on the mailing list.

A New Member for the New Year !

SECED has enjoyed a number of major successes over the past few years such as the Conferences in Chester and Oxford, the Short Course on Practical Seismic Design and a number of excellent technical meetings. The Society faces a major challenge over the next few years as we prepare to host the Twelfth European Conference on Earthquake Engineering in September 2002. The Conference will strengthen the standing of the UK in Earthquake Engineering and provides a great opportunity to expand and strengthen SECED. The success of the Society depends completely on the voluntary contributions and the enthusiasm of its members and the larger our membership base, the more opportunities there will be to develop interesting and useful activities. It is clear that there are still many individuals and organisations in the UK with a strong interest in Earthquake Engineering who are not involved with SECED. The Society is calling on all each of its members to find at least one new member for SECED during 1999 (an application form is being sent out with this Newsletter for this purpose). Whether it be a friend or a colleague or a client, each of us must be able to find at least one person who would benefit from membership of SECED. Why not persuade your organisation to take out Corporate Membership?

ERRATUM

The October Newsletter stated (page 5) that the next Mallet-Milne lecture would be held on 27 May 1997 - this should, of course, have read 27 May 1999.

IStructE Short Course :

Structures and blast loading

Wednesday 17th February 1999, London

As a follow up to the Institution's guide 'The structural engineer's response to explosion damage' published in 1995 and the successful course held in 1998, this course is intended to show how significant improvements in blast resilience and resistance are possible with careful design, planning and detailing. The question of blast and structures is one of management as well as design. The course is intended for engineers, architects, property owners, managers and clients who have an interest in blast-resistant design of commercial buildings. For further details, contact the Conference office at the Institution of Structural Engineers (Tel. 0171 235 4535).

Short Course - 22 to 24 September 1999

Practical Seismic Design for New and Existing Structures

As announced in the last Newsletter, a three-day short course on *"Practical Seismic Design for New and Existing Structures"* will be run jointly by SECED and Imperial College from 22-24 September 1998. The course will be held at Imperial College in London and will cover the basic elements of seismic design, with particular emphasis on the provisions of UBC and Eurocode 8. The course covers the definition of earthquake loading for design, the seismic behaviour of soils and foundations, and the design of reinforced concrete and steel structures to resist earthquake effects. The course also covers the assessment and seismic retrofit of existing structures. The course will be presented by speakers from Imperial College and from a number of leading engineering companies, including Ove Arup & Partners, EQE International, GIBB Ltd., BNFL, and RT James & Partners Ltd.

The course has been jointly organised by the Engineering Seismology and Earthquake Engineering Section of Imperial College and the Research & Education Sub-Committee of SECED. The first day of the course, co-ordinated by Julian Bommer, includes an overview of seismic design, seismic hazard assessment and geotechnical earthquake engineering. The second day, co-ordinated by Edmund Booth, covers practical tools for the seismic analysis of structures, and the seismic design of reinforced concrete. The third day, co-ordinated by Ahmed Elghazouli, covers seismic design of steel structures and the assessment and upgrading of existing structures. Enquiries about the technical content of the course can be directed to the Course Chairman Dr. Julian Bommer, Department of Civil and Environmental Engineering, Imperial College, London SW7 2BU, Tel: 0171-594 5984, Fax: 0171-225 2716, Email: j.bommer@ic.ac.uk.

The cost of the course to SECED members is only £400, provided the booking is made before 20 August 1999. The course fee includes a comprehensive set of lecture notes, lunches and light refreshments. The course will be recognised for CET/CPD days and is aimed mainly at practising civil engineers, although a limited number of student spaces will be available. The course is supported by the European Association for Earthquake Engineering and SECED is sponsoring up to 20 places on the course for candidates nominated by national associations affiliated to the EAEE.

Copies of the full course brochure and booking form may be obtained from Sally Verkaik at the Centre for Continuing Education at Imperial College on Tel: 0171-594 6882, Fax: 0171-594 6883, Email: cpd@ic.ac.uk.

Second International Symposium on

Earthquake Resistant Engineering Structures

June 15-17, 1999 - Catania, Italy.

The objective of this symposium is to provide a forum for discussion of both basic and applied research in the various fields of engineering relevant to earthquake resistant analysis and design of structural systems. The symposium will create an atmosphere that is conducive to fruitful interaction and exchange of ideas as well as state-of-the-art information between scientists and engineers from both academia and industry.

Papers are invited on the topics outlined below and other topics of interest which fall within the general scope of the symposium. Abstracts of no more than 300 words, clearly stating the purpose, results and conclusions of the work to be described in the final paper should be submitted to the Secretariat as soon as possible. The final acceptance will depend upon the review of the full-length paper which is required by 2 February 1999.

More information on this symposium can be obtained from:

Sally Walsh, Symposium Secretariat, ERES 99
Wessex Institute of Technology
Ashurst Lodge, Ashurst, Southampton, S040 7AA, UK
Tel: 44 (0)1703 293223 Fax: 44 (0)1703 292853
E-Mail: Slwalsh@wessex.ac.uk
http://www.wessex.ac.uk

THE 1998 & 1999 SHAMSHER PRAKASH RESEARCH AWARDS

1998 SP RESEARCH AWARD

The 1998 Research Award for Excellence in Geotechnical Earthquake Engineering has been won by Dr. Ikuo Towhata. His original contributions at the University of Tokyo on permanent displacement caused by liquefaction, dynamic analysis, thermal effects on clays, and microscopic observation of sand during shear. He has travelled internationally and contributed regularly to the Geotechnical Earthquake Conferences hosted by the University of Missouri-Rolla. He got a doctoral degree from University of Tokyo in 1982. Two awards from the Japanese Geotechnical Society were won by him on previous occasions.

1999 SP RESEARCH AWARD

Nominations/Applications for the 1999 SP RESEARCH AWARD are solicited from young professionals (40 years or younger on May 31, 1999). For complete package, contact Sally Prakash, Honorary Secretary, Shamsher Prakash Foundation, "Anand Kutir," 1111 Duane Avenue, Rolla. MO 65401, USA, FAX (573) 364-5572(*51), E-Mail: prakash@novell.civil.umr.edu.

NOTABLE EARTHQUAKES OCTOBER - DECEMBER 1998

Reported by British Geological Survey

YEAR	DAY	MON	TIME UTC	LAT	LON	DEP KM	MAGNITUDES ML	MB	MS	LOCATION
1998	07	OCT	18:39	53.60N	0.29W	31	2.8			GRIMSBY, HUMBERSIDE
1998	08	OCT	04:51	15.96S	71.47W	136		6.1		SOUTHERN PERU
1998	16	OCT	13:04	53.18N	4.23W	12	2.7			PORT DINORWIC, GWYNEDD
				Felt throughout Gwynedd with intensities of at least 3 EMS.						
1998	28	OCT	16:25	0.80N	125.93E	33		6.2		NORTHERN MOLUCCA SEA
1998	09	NOV	05:30	7.01S	128.98N	33		6.1		BANDA SEA
1998	09	NOV	05:38	6.89S	128.98E	33		6.4	7.0	BANDA SEA
1998	13	NOV	13:01	27.77N	53.61E	33		5.3	5.1	SOUTHERN IRAN
				At least five people were killed, 105 people injured and approximately 850 houses were damaged throughout the epicentral region.						
1998	19	NOV	11:38	27.27N	100.97E	33		5.2	5.6	YUNNAN, CHINA
				Three people were killed, at least 1500 people were injured and extensive damage occurred throughout the epicentral region.						
1998	29	NOV	14:10	2.05S	124.93	33		6.5	7.7	CERAM SEA
				At least 34 people were killed on Mangole and approximately 150 people were injured on Mangole and Taliabu.						
1998	01	DEC	07:37	26.44N	104.03E	10		4.5		SE CHINA
				At least 84 people were injured and approximately 21,000 houses were damaged throughout Xuanwei.						
1998	06	DEC	00:47	1.30N	126.25E	33		6.3	6.2	NORTHERN MOLUCCA SEA
1998	16	DEC	17:45	1.18N	126.16E	33		6.1	5.8	NORTHERN MOLUCCA SEA
1998	27	DEC	00:38	21.50S	176.41W	144		6.1		FIJI ISLANDS REGION

Issued by Bennett Simpson, British Geological Survey, January 1999

Forthcoming Events

3 February 1999
Dynamic Loading in Offshore Engineering. (Joint meeting with The Offshore Engineering Society)
ICE 5.30 pm

24 February 1999
Structural Restoration of Historical Buildings in Seismic Areas. *Room 207, Civil and Environmental Engineering Department, Imperial College Road, London 2.30 pm*

31 March 1999
Remote sensing.

28 April 1999
AGM followed by "Strong motion parameters for seismic design"

27 May 1999
The 7th Mallet Milne Lecture

29 September 1999
Crash/Impact/Blast

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

http://www.ice.org.uk/public/seced.html

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

Contents

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

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.

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