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AEES is a Technical Society of IEAust
The Institution of Engineers Australia

1/97

AEES Newsletter

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Your Society - AEES

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Kevin McCue (ACT)

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SAA Masonry Code, AS3700
(from The Australian Standard September 1996)

Revision of the masonry code by committee BD/4 chaired by Dr Steve Lawrence is underway. It is proposed to use performance rather than prescription type specifications and the code will use ultimate limit state in line with AS3600.

'The design and construction of prestressed masonry and *an elaboration of additional requirements for structures subject to earthquake actions* are also to be expected.

Further, the inclusion of the energy line method for design of unreinforced masonry subject to wind or earthquake loads addresses window and door openings of wall panels and also cover panels not fixed at one end.'

The draft report should be available now for public comment.

AEES 1997 BRISBANE QUEENSLAND

Date: 2 & 3 October 1997
Place: University of Queensland

Theme - "Earthquakes in Australian cities - Can we ignore the risks?"

The lack of awareness of the earthquake loading standard amongst practicing engineers was bemoaned by the Society's Treasurer John Wilson, in a recent article in Engineering Times. This conference seeks to publicise the fact that Australian cities are exposed to earthquake risk and that engineers, local government planners, insurance companies and emergency services personnel, should be more aware of this fact. The question of how to deal with the risk must also be addressed.

The Annual General Meeting of the Society is to be held following the proceedings on the first day and prior to the Conference Dinner. Abstracts of proposed presentations must reach Barbara Butler no later than 6 June 1997 (by mail at PO Box 829, Parkville, Victoria 3052, by Fax on 03-9348 1524 or email on Barbara_Butler@muwayf.unimelb.edu.au).

For those with Internet access, a web page has been set up to provide the latest details from the Organising Committee:
(http://QUAKES.earthsciences.uq.edu.au/AEES.html)

NUGGETS FROM THE NEWSGROUP A REGULAR FEATURE BY CHARLES BUBB

The Professor of Geophysics at the University of California LA David Jackson recently said, despite extensive research in Japan and China there was no telling when an earthquake will strike (CT 15/3/97).

Nevertheless (or perhaps because of this) much of the space on the newsgroup sci.geo.earthquakes is devoted to argument on predicting earthquakes. Most of this is rubbish but two recent items refer to some published work in the literature. John Taber writes:
Tuesday, 4 March 1997 12:13:33 PM
Subject: Earthquakes: Thinking about the un-predictable
To: sci.geo.earthquakes

One pair who have been using a weighting scheme for years to test their predictions is Frank Evison and David Rhodes.

They have conducted a series of prediction tests over the past 10 years, based on earthquake swarms. They specify a scoring function (in time, space and magnitude) that has its highest value at the specified prediction and tails off away from the prediction. Scoring is also assigned for failures and false alarms. They were unable to beat the Poisson model (the simplest existing model) in their first 2 trials but they are hoping to do better in their current test. Since they are still testing a hypothesis (ie they haven't yet proved that their technique works) they don't release the active predictions in their current test.

Their predictions are long-term (3 years in advance of a magnitude 6, 12 years in advance of a magnitude 7), but the methodology could be applied just as easily to short term precursors.
(For more information, see Evison, F. F.; Rhodes, D. A., 1993, The precursory earthquake swarm in New Zealand: hypothesis tests, New Zealand Journal of Geology & Geophysics, v36 n1, pp 51-60.)

John.Taber@vuw.ac.nz
Institute of Geophysics, Victoria University
P.O. Box, 600, Wellington, New Zealand

and Gerard Fryer writes from the School of Ocean and Earth Science, Hawaii:

Thursday, 16 January 1997 7:55:18 AM
To: sci.geo.earthquakes

When it comes to earthquake prediction, it is the nature of the prediction that most influences people's interest. Successfully predict a bunch of magnitude 4 - 5 earthquakes in a larger collection of similar-sized earthquakes which you do not predict, and the reaction is likely to be a big yawn, or at least the demand that you, as proponent of the hypothesis, must collect the data to back it up. But successfully predict a big earthquake, like the June 10 Delarof Islands (Alaska) earthquake of last year, and people really sit up and take notice. I think Charles Bufe and Stuart Nishenko are still riding high. If there is a big Shumagin or Unimak earthquake before the end of 1998, then we'll all be talking about accelerated energy release.
Personal views only

Gerard Fryer gerard@hawaii.edu
http://www.soest.hawaii.edu/~gerard/

key words are accelerated energy release - a new technique for prediction? Now some words from the UK in answer to a question about the Japanese Intensity scale and why we need to keep recording both intensity and magnitude.

Monday, 10 March 1997 8:21:47 AM
Subject: Re: Magnitude scale
To: sci.geo.earthquakes

Martyn Williams wrote: the "Shindo" scale, from 0 to 7. This, I presume, combines the magnitude and depth because it gives you an idea how it felt at the surface.
Q1, despite this being called a "Japanese" scale here, does it have a proper name and is it used elsewhere?
Q2, Why do people continue to focus on the magnitude of an earthquake, especially in news reports, because it seems to me that the magnitude means little, unless you are studying earthquakes.

The shindo scale is an intensity scale (not a magnitude scale) which, like other intensity scales, describes the effects ground motion has on people, objects and buildings in a particular location.

A1 The scale is the Omori scale, (1900) also known as the JMA scale, (Japanese Meteorological Agency scale). shindo is not its real name. Shindo in Japanese just means 'degree of shaking', shin=shake, do=degree. It is not used outside Japan.

A2 Magnitude values are an efficient way of obtaining relative comparisons between earthquakes, as intensity values are not always reliable. A good way to understand the difference between magnitude and intenity is to compare them to a light bulb.

In a light bulb the wattage of the bulb would be the magnitude, whereas the brightness of the bulb would be the intensity. Your perception of the latter, (intensity) would depend on the lamp shade you choose to cover the bulb with, and how far away you stood from it. Earthquakes are just the same. Imagine your town in Japan were affected by an earthquake which the press reported to be intensity JMA3, this could result from a local shallow earthquake of say Mb 3,6 or a medium depth Mb5,3 80km away. So if this event was not qualified by a magnitude value, we would all be at a loss.

On the other hand, and for exactly the same reasons, magnitude values should always be qualified by an intensity value when possible. In California, where all earthquakes are shallow, (d <20 km) most earthquakes give consistant and predictable intensity values. However, this is not the normal case for other seismogenic areas, particularly in island arcs and subduction trenches, where earthquakes happen at all depths. Obviously an Mb 5,0 quake happening at d=5 km and another happening at d=268 km give different intensity values on the surface.

This is why intensity values are in a lot more common use outside the US.

If you are interested in intensity scales, look up the EMS 92 (European Macroseismic Scale), an updated version of the MSK scale, (practically equivalent to the now rather dated Mercalli scale), and is probably the most efficient and unambiguous scale currently used.

ESC working group:
http://www.gsrg.nmh.ac.uk/~phoh/escmac1.htm

Patrick Murphy is an architect specialising in seismic resistant design.

And finally some interesting remarks from Phillip L Fradkin who is writing a book about earthquakes:

Tuesday, 18 March 1997 8:49:27 AM
Subject: Some miscellaneous items
To: sci.geo.earthquakes

... since I picked up the idea from something Harold Asmis wrote on this newsgroup, I should report briefly on my trip underground through the Hollywood Fault. It took some arranging, but since I am writing a book on earthquakes, I eventually got the Metropolitan Transit Authority to take me into the subway tunnel they are building from Hollywood Blvd. and La Brea Avenue to Universal City. This was a few weeks ago. After sloshing through the alluvium, brown mud and water, for about one mile we got to where they had stopped digging which was half way through the fault in one tunnel and all the way in the other. Since the fault gouge is quite gritty and not stable at all, they shore up the tunnel immediately with a thin layer of shotcrete, sort of a stucco-like material. But the layer was so thin that you could dig out a piece and get a look at the dark gray gouge.

The fault is about one hundred and twenty feet wide, and consists of multiple strands. The subway had more reinforcing in the special seismic zone, which is wider to facilitate repairs. What should be of special interest to seismologists et al., I would think, is a four hundred foot long horizontal boring through the fault. Is there any better example of what a fault might actually look like?

I went through a number of briefings where various engineers assured me that it was going to be quite safe. The fault has a recurrence rate in thousands of years. I then traced the fault on the surface, using an unpublished paper of Jim Dolan's. From the street that leads from the HOLLYWOOD sign to Beverly Hills, and crosses the underground subway near the Ozzie and Harriet residence, the fault is a study in monetary and social extremes. Nathaniel West lived in a rooming house on the fault when he wrote <Day of the Locust.> Remember his apocalyptic painting? I stopped at the Hollywood Visitor's Center and asked where the fault was. I was told that they did not know since it wasn't an <attraction.> (Hint: Next time you travel the Sunset Strip, think fault.)
Philip L. Fradkin
filfrad@nbn.com

I am sure we are all looking forward to reading the book when it appears

Charles

The AEES subscription year is from 1 Dec to 30 November. It is difficult and expensive to send each of ~ 400 members an individual reminder that fees are due so please help us by sending your subscription for 1996/97 to AEES now (att: John Wilson, Civil and Environmental Engineering Dept, Melbourne University Parkville Vic 3052) or renew through IEAust's annual subscription system by marking AEES your preferred Society. If you change address or if you know a member who is not receiving the newsletter please advise the Secretary, many newsletters are returned.

Earthquake in South Australia - 5 March 1997

Adelaide was gently shaken at 4:45 pm on Wednesday 5 March by a moderate magnitude ML 5.2 earthquake centred about 130 km north of Adelaide near the towns of Clair and Burra. No damage was done but at Robertstown, pictures were displaced on walls and articles were knocked off shelves. The natural gas pipeline supplying Adelaide from the Cooper Basin was 100 km from the epicentre and suffered no damage.

Seismologists Cvetan Sinadinovski and David Love from AGSO and Mines and Energy South Australia installed four seismographs and an accelerograph in the epicentral area on Friday and recorded several of the later aftershocks. The largest aftershock occurred just minutes after the mainshock.

The 4 accelerographs deployed under the joint AGSO/MESA urban monitoring project recorded the ground motion near Port Pirie and at Adelaide at distances greater than 80 km. This was the third earthquake of a similar size since September 1996 and all three have provided accelerograms over the distance range 0 to 200 km which is great for attenuation studies.

MESA have distributed questionnaires to compile an isoseismal map for the earthquake which will be compared with a slightly smaller earthquake in the same region last century, on 12 February 1889 (AGSO Isoseismal Atlas Part 3).

WCEE 2000 AUCKLAND NEW ZEALAND

The New Zealand National Society for Earthquake Engineering were successful in their bid at the WCEE in Acapulco to hold the next World Conference on Earthquake Engineering! The venue will be Auckland.

Conference Proceedings

AEES The main function of our Society is the Annual Seminar. You can keep informed about the latest developments in Earthquake Engineering and Engineering Seismology in Australia by purchasing the Proceedings of these seminars.
1996 Proceedings now available.$30.00.
1992, 1993 and 1994 Proceedings $25 each, $45 for two, $60.00 for three.. Postage within Australia is an additional $5.

PCEE

•1995 Melbourne Proceedings $185 from Mrs Barbara Butler, Melbourne Uni phone 03 9344 6712 / fax 03 9348 1524
•1987 & 1991 Proceedings NZ$50 plus P&P from Admin Sec Michael Brice, NZNSEE, PO Box 312 Waikanae New Zealand

Current Research: Earthquake Engineering and Engineering Seismology in Australia

(We plan to print one article per Newsletter to let you know what is happening in relevant Research Institutions around Australia - Ed.)

Adelaide University (Mike Griffith) Research in the Department of Civil & Environmental Engineering at Adelaide University is in progress on the following topics:

1. Seismic behaviour of reinforced concrete frames with brick masonry infill.

This project is looking at the interaction which occurs betweent the brick infill wall panels and the surrounding concrete frame for differing size gaps between the columns and the wall panels. This laboratory-based project consists of applying quasi-static cyclic loads to a 1.8m tall by 5m long concrete frame designed to the seismic detailing requirements in Appendix A of AS3600. Testing has been completed with a report due out in June.

The project was supported over 2 years by the SRIA through an APA(Industry) grant with Steve Freeman acting as the industry supervisor and myself acting as the academic supervisor for the project.

2. Seismic integrity of walls and connections in unreinforced masonry buildings.

This work is being conducted jointly between the Universities of Adelaide (myself) and Melbourne (John Wilson). The force transfer mechanisms of connection details typical of current Australian practice are being investigated over the course of this 3-year, large ARC funded project. The project has just begun but will involve extensive experimental testing of URM wall panels, supported with typical connections, to establish their seismic capacity. Modifications, where necessary, to typical details will be recommended to comply with the seismic detailing requirements given in AS1170.4.

3. Seismic Design of Connections in URM Buildings.

This project is being conducted jointly between myself and A.Page at Newcastle University. The aim is to test a wide range of damp proof course joint and slip joint details in order to establish their suitability under seismic loading. In-plane and out-of-plane load transfer will be studied. Static loading will be used at Newcastle, dynamic loading will be used at Adelaide. The effect of vertical precompression will be considered as well. The project is funded by a 3-year APA (Industry) grant with the student working out of Newcastle.

4. Nonlinear analysis and design of reinforced concrete buildings under severe earthquake loading.

This project is supported by a 3-year large ARC grant, beginning in Jan 1997, and is under the joint supervision of Professor R Warner and myself. A key feature of the project is the collaboration with Professor A Kawano from Kyushu University in Japan who has been responsible for development of the analytical techniques. Work will focus on developing computer modelling procedures capable of simulating the highly nonlinear response of a frame building under severe earthquake loading. The modelling procedures will be verified against experimental test results before turning our attention to the design process. In order to safely undertake nonlinear design, global safety coefficients are required. This work will take the first steps towards the development of these coefficients.

Earthquake At Ston, Dalmatia by David Potter M AEES

The town of Ston, on the Adriatic coast of Croatia, was founded in 1333. On 5 September 1996 it suffered a Richter 6 earthquake, the effects of which are the subject of this report. The epicentre was in the area of Ston/Slano, see map.

Ston is a small town, 37 km north of Dubrovnik. Most of its buildings date from the late 17th century having been rebuilt after the earthquake that 'destroyed' Dubrovnik in 1667. The buildings of the town are constructed in karst limestone masonry, either coursed or rubble, presumably with weak lime mortar. Houses are two to three storeys with some larger religious and civic buildings. The Croatian Institute for Cultural Heritage classifies Ston as having a value 'right after Dubrovnik'.

The earthquake was strong enough to wake people 65 km away in Mostar, where the motion was observed to be slow but drawnout in time and amplitude. After shocks were frequently noticed in Mostar up to a week later. Damage in Ston was extensive; probably no buildings escaped. Many buildings were left in a very dangerous state; the town was evacuated and entry prevented. There were no reported injuries. The residents are now living in caravans in a nearby park. As yet plans for restoration have not been devised, nor are national funds available with the nation fully committed to repairing war damage.

I was able to go to the site about a week later. Primary damage was confined to masonry work, with collateral damage to tile roofs. This was thought to be a consequence of construction comprising massive masonry walls supporting robust timber floor and roof framing. Some walls show a pattern of shear

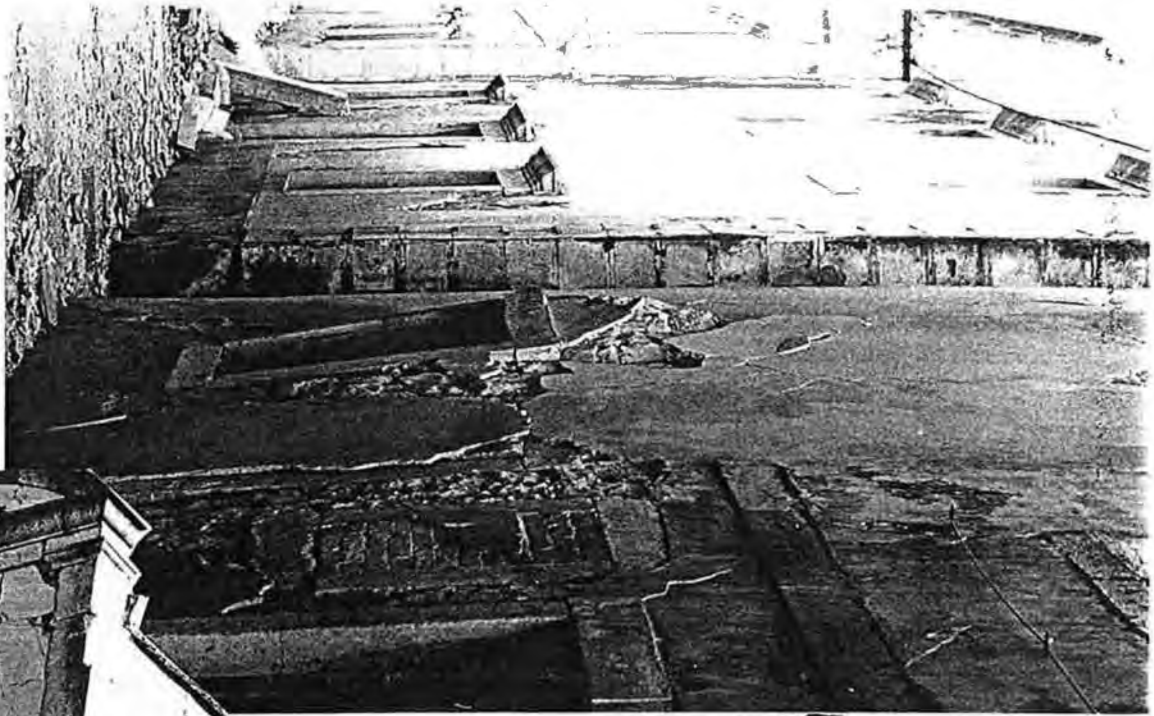

Photo 2

Photo 1

Photo 3
Dalmatian limestone

Photo 4
Bell Tower tied and banded

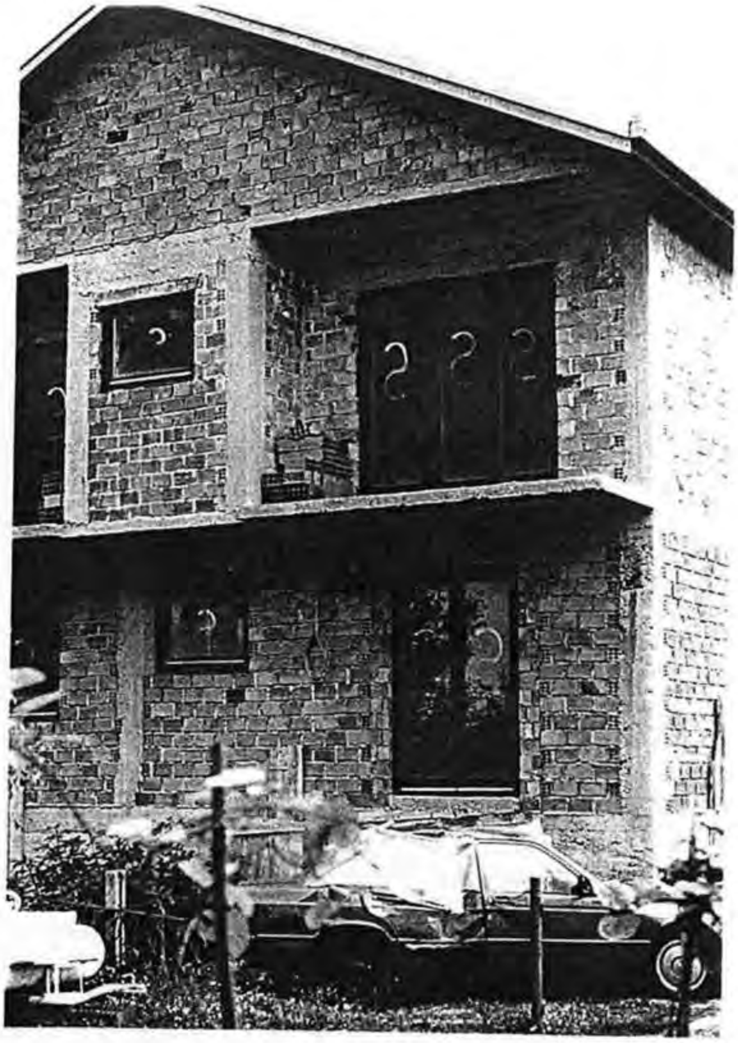

Photo 5

Photo 6

cracks (Photo 1), suggesting that they were aligned in the direction of wave propagation. These walls were parallel to one another. Walls at right angles to these appeared to have failed from out-of-plane displacement (Photos 2 and 3). Remedial work will require a combination of shoring, bracing and propping with the minimum of demolition. It is presumed that reconstruction will be as close to the original as possible.

Little could be learned from the above part of the inspection however observation of the monastery bell tower (Photo 4) was more instructive, though close inspection was not possible. It can be seen that the bell tower has been braced, presumably after the 1667 earthquake and has suffered no damage. There is a band around the perimeter just below the eaves and pairs of ties through the structure, in both directions at the intermediate floor levels. It is unlikely that there is also vertical bracing as the fitting would have required major alterations to the vaulted stone floors of the bell tower. It is notable how much the structural performance of the tower has been enhanced by the simple addition of these ties which are necessarily positioned at the levels in the structure where the mass is concentrated.

Earthquake damage was remarkably localised, similar structures in nearby villages reported very little or no damage.

There were also failures in the highway nearby. The road cuttings are excavated in highly fractured rock to an irregular face with little or no batter so that rock falls are common with or without earthquakes. On the embankments (Photos 7 and 8), slip circle failures occurred at the road's edge and wedge failures occurred along the cut-fill interface.

Contemporary construction practice has learned from earthquake experience and now requires a moment-resisting frame (Photo 5), even for domestic dwellings. However, if the infill brickwork of the lower storey happens to be shot out, we are left with a classic soft storey, with the usual consequences (Photo 6).

Earthquake data courtesy Geophysical Observatory, Zagreb.

David Potter, Mostar

FORTHCOMING CONFERENCES

(Flyers for some conferences are available from Ed)

16/4/97

• **1997, 14-16 March NZNSEE Technical Conference and Annual Meeting**. A decade of progress since the Edgecumbe earthquake. Abstracts by 30 September to The Admin Sec. NZNSEE, PO Box 312, Waikanae New Zealand.

• **1997, 20-24 July; Istanbul, Turkey 8th International Conference On Soil Dynamics And Earthquake Engineering (SDEE '97)**

• **1997, 18-29 August; Thessaloniki, Greece 29th General Assembly of the International Association of Seismology and Physics of the Earth's Interior**
contact: Prof Papazachos iaspei@olymp.ccf.auth.gr

• **1997, 2-3 October 1997 AEES Annual Seminar and AGM**, University of Queensland, Brisbane

• **1998, 6-11 September; Paris La Défense France, 11th European Conference on Earthquake Engineering.** Organised by EAEE, information at http://dfc2.enpc.fr/ecee11 (flyer available - Ed)

• **1997, 20 - 24 July; Istanbul, Turkey 8th INTERNATIONAL CONFERENCE ON SOIL DYNAMICS AND EARTHQUAKE ENGINEERING (SDEE '97)**

16/4/97

The deadline for abstracts has been extended from January 30, 1997 to March 31, 1997 so that if you were busy on vacation, conclusion of classes and grades, you may submit your abstract now.

CONFERENCE THEMES
1. Seismicity, Ground Motion and Site Effects
2. Seismic Hazard and Risk Assessment
3. Laboratory and Field Tests of Soils and Foundations
4. Analysis of Soil-Structure Systems and System Identification
5. Special Structures and Systems (Bridges, Dams, Earth Structures, Offshore Structures, Underground Structures)
6. Extended Structures and Systems (Lifelines, Urban Systems)
7. Seismic Evaluation and Rehabilitation of Structure-Soil Systems
8. Seismic Codes and Standards
9. Earthquake Insurance and Other Socio-Economic Issues
10. Experiences Derived from Recent Earthquakes
11. Historical Structures and Monuments

ABSTRACTS
One page abstracts, stating the purpose, methodology, results and the conclusions should be forwarded (mail, fax, e-mail) to the either of the Chairs of the Organizing Committee. The name, title, affiliation, postal and e-mail addresses, and the telephone and fax numbers should be provided on the abstract page. The abstracts will be reviewed by the Advisory Committee for inclusion in the conference program.

IMPORTANT DATES received 16/4/97
Submit Abstract: As soon as possible but no later than February 28, 1997
Notification for accepted papers by April 15, 1997
Submit Camera-Ready Extended Abstract: Before May 30, 1997

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SDEE'97 WWW HOME PAGE
Detailed information and the registration form can be obtained directly from the following home pages. We will start posting the submitted abstracts on the web.

http://www.ceor.princeton.edu/sdee.html
http://www.boun.edu.tr/sdee.html

• **2000 - WCEE/PCEE Auckland New Zealand** - Watch this space.

NEW BOOKS

Report on the January 17, 1995 Great Hyogo-Ken Nambu (Kobe) Earthquake. Lam Pham & M Griffith. CSIRO DBCE 95/175(M)

Earthquake Engineering *Proceedings of the 10th European Conference*, Vienna Austria 28 Aug - 2 September 1994, Balkema, Ed G Duma, price $593.00

Tsunami - Progress in Prediction, Disaster Prevention and Warning in *Advances in Natural and Technological Hazards* Eds Yoshito Tsuchiya & Nobuo Shuto. Kluwer Academic price $240

Isoseismal Atlas of Australian Earthquakes - Part 3 AGSO Record 1995/44, $50 + pp. AGSO Sales Centre phone: 06 249 9519, fax: 06 249 9982

Australian Seismological Report - 1994 AGSO Sales Centre ph: 06 249 99519, fax: 06 249 9982

Fundamentals of Earthquake Prediction by Cinna Lomnitz: John Wiley & Sons.

The Geology of Earthquakes by R.S. Yeats, K.E. Sieh, and C.R. Allen: Oxford University Press, 576 p., price $65.00.

Paleoseismology, edited by James P. McCalpin. Academic Press, 576 p., price $89.95.


Photo 7
Collapse of road embankment


Photo 8
Cracking in road pavement, the Adriatic coast