The Editor AEES Newsletter
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AEES is a Technical Society of IEAust
The Institution of Engineers Australia
and is affiliated with IAEE

1/98

AEES Newsletter

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The Society

Vaughan Wesson

It is that time of year again - the membership fee is due! Please send $25 to Barbara Butler (PO Box 829, Parkville, Vic 3052) unless you are paying through the IEAust with AEES your preferred Society. If you have a RED MARK on the envelope containing this Newsletter then you have not paid 1998 dues and no further Newsletters will be sent.

The Society is planning on setting up an email list for members. This could be used for discussions and questions relating to all aspects of earthquake engineering. It may also be used for administrative matters and reminders for conferences etc. If you would like to be placed on this list, please either fax the section below to the Hon Secretary Vaughan Wesson at 03 9467 6184 or email him with the required information at vaughanw@rmit.edu.au.

Name and AEES membership number (if known)

_____

e-mail address

_____

Selection of National Delegate and Deputy Delegate Mr John Wilson (not Prof Hutchinson as reported in the last Newsletter) was elected National Delegate to the IAEE at our last meeting. Gary Gibson was elected deputy Delegate and they will represent AEES at the International Association for Earthquake Engineering meeting in New Zealand at the year 2000 WCEE (see box elsewhere in the Newsletter for details of the WCEE).

Your Society - AEES

Executive:

President: Prof Graham Hutchinson[1]
Secretary: Vaughan Wesson[2]
Treasurer: John Wilson[1]
Immediate Past President: Charles Bubb
Secretariat: Barbara Butler[1]

Committee:

Russell Cuthbertson (Qld)
Peter Gregson (WA)
Vagn Jensen (Tas)
Michael Neville (NSW)
Mike Griffith (SA) and
Kevin McCue (ACT)

[1] Civil & Environmental Engineering Department, Melbourne University, Parkville, Vic 3052
[2] Seismology Research Centre, RMIT Bundoora, 3083

The President/Treasurer's Column

Prof Graham Hutchinson & John Wilson

Your Society has an income of approximately $5,000 per annum from subscriptions and there is also usually a modest surplus from the Annual General Meeting. Expenditure averages about $5,000 per year. The 1996 Pacific Conference on Earthquake Engineering which was held in Melbourne and co-hosted by the New Zealand Earthquake Engineering Society yielded a welcome surplus to our Society of approximately $13,000. This combined with prudent fiscal management by the Committee over the past decade has resulted in a modest reserve being established.

The Annual General Meeting (held in Brisbane in October) supported a Committee recommendation that a portion of the reserve be invested in the Membership.

1. Funding of recovery and reconnaissance missions.

   It is proposed that a register of interested persons be established and the decision as to who is funded will be made by the Committee. This funding is modest and limited to a maximum of $3,000 over any three year period.

2. As an investment in the future it was agreed to put aside $1500 per annum to support post-graduate students to attend the Annual General Meeting. A

maximum contribution of $500 per student for travel was agreed, provided that the student presents a paper.

A number of our members are involved in the harmonisation of the Loading Standards of Australia and New Zealand. Of particular interest to us is the joint Earthquake Loading Standard. The Committee considering this matter is chaired by Andrew King from BRANZ. Twelve working groups have been established to examine all aspects of the Standard extending from seismicity to the new displacement based design approach. The next joint meeting will be held later this month coinciding with the New Zealand Earthquake Engineering Society Conference.

At a local level the University of Melbourne invited Professor Nigel Priestley to Melbourne for three days late in February. He spent the time reviewing all the earthquake engineering research projects currently under way at Melbourne. One of the highlights of the visit was a presentation to over 120 structural engineers on the displacement based design approach.

THE 1998 AEES SEMINAR AND AGM - PERTH WA

The organising Committee comprises:

Peter Gregson	AGSO Mundaring
Rupert Grayson	Aust Institute of Steel Construction
Peter Gow	Contract and Management Services
Julian Yates	State Emergency Services
Mike Dentith	University of WA

The committee held its first meeting on Tuesday 3 February and decided:

Location: Perth, WA
Date & Time: 4 & 5 November 1998
Theme: *Meckering, 30 Years On - How Would We Cope Today*

Topics:

- Engineering aspects including - retrofitting and upgrade
- Unreinforced masonry - risks; design practise
- Seismology hazard related topics
- Disaster management - responding to an earthquake
- Offshore earthquake hazards (Tsunamis)
- Update on the Australian/NZ code

Excursion: An optional full day excursion is proposed on 6 November to Meckering, Northam and York, to inspect the earthquake fault scarp, affected buildings and a tour of Mundaring Observatory.

We will need to know how many are interested in joining the excursion.

It is 30 years since a magnitude 6.9 earthquake, the largest recorded on the Australian continent, occurred at Meckering (WA), 130 km east of Perth. Most buildings in the township were destroyed or damaged. The Eastern Goldfields water supply, transcontinental railway, roads and phone lines were all disrupted at the fault scarp. The largest scarp was 37 km long with maximum displacement of 2m (vertical) and 2.4m (horizontal). The earthquake was felt over 700km radius and caused damage in many towns and also in Perth. Fortunately the earthquake occurred on a public holiday and there were no deaths and only 20 people injured. The damage bill was in excess of $4m. Quote from a Meckering resident, "It is amazing how in a few seconds, everyone's lives can be changed. We do not know what to do about houses. Nobody is allowed to build in Meckering until given the okay by the authorities who are making tests everywhere".

How would we cope today?

PAPERS
Abstracts by: 6 June 1998
Final paper by: 1 September 1998

Ed. This 14 October is not only the 30th anniversary of the Meckering earthquake but a most important event for earthquake engineering in Australia because it led to the introduction of the first Australian Earthquake Building Code AS2121-1979. To remind you of the impact on the small wheat belt town of Meckering, 100 km east of Perth the pictures on the next page are from the Souvenir Booklet published by the Meckering Agricultural Society (Inc) to commemorate the 20th anniversary of the earthquake.

NUGGETS FROM THE NEWSGROUP - A REGULAR FEATURE BY CHARLES BUBB

I happened to see a post last week where the sender was a bit out of sorts (a polite term) because the media was taking the magnitude of the Kobe quake and confusing it with a Richter scale measurement. I've seen 3 (and maybe there are 1-2 more) different ways recently that the Kobe quake was measured: Magnitude, x.y Richter, and one other one.

For those of us who aren't seismologists or geologists etc, could someone explain (in layman's terms) what the differences are? I've puttered around a few places that list daily/weekly quakes and have seen things like "Mag 4.5" and always assumed it was 4.5 on the Richter scale. Now I see that this is probably a very wrong assumption. So, please, what ARE the differences, and why are quakes given different measurements?

> Thanks!
> Michele

This qualifies as the most often asked question on this newsgroup and sci.geo.geology; there should be a permanent post on what magnitudes mean, how they are defined, etc. The reason this question usually goes unanswered in these newsgroups is that all of us who have answered it a few times are just getting worn out.

So let's go ahead and see what's there....

First, there are two fundamental ways of describing the "size" of an earthquake that often make it to newspapers and the public: magnitude and intensity. We'll cover magnitude in a minute, but it is equivalent to the wattage on a light bulb--it to some degree should be proportional to the total energy

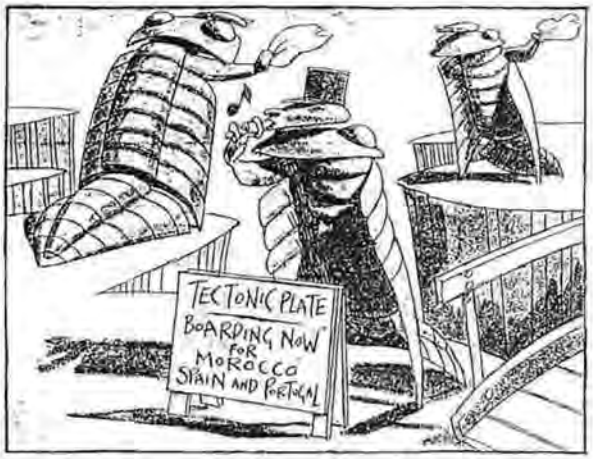
output of the earthquake regardless of where the earthquake is.

Intensity is how strongly the earthquake is felt at a particular spot, which depends on distance from the earthquake, local geology, the presence of observers (often), etc. It is equivalent to how bright the light from a bulb is at different places in a room. Intensity in the U.S. is generally reported as Modified Mercalli Intensity and is usually assigned a roman numeral (in part to distinguish it from magnitude, in part tradition, and in part because these observations are no more precise than an integral value); when reported in the media, usually the peak value is reported. This occasionally is confused with magnitude. In some countries other intensity scales are used.

OK, so now magnitude. The fundamental to all magnitude measures is that for a 1 point increase in any magnitude for fixed location of earthquake and seismometer, the amount of ground motion measured for that magnitude scale will increase by a factor of 10. It happens that this works out to mean that an increase of 1 in magnitude will also represent an increase in the total energy of an earthquake of a factor of about 28. To calculate the magnitude, corrections are made for the distance from the epicenter, depth of the earthquake, model of seismometer, and Earth structure; thus the magnitude of an earthquake should be identical regardless of where it is measured if using a common scale (discussed below). In reality, the corrections for Earth structure are complex and are affected as well by the radiation pattern of seismic waves from an earthquake. As a result, individual measurements on an earthquake will vary quite a bit. Most of the regional seismic networks in the U.S. will average readings from several stations to make their magnitude estimate. Again, because of some difficulties in correction and the way seismic energy might radiate from an earthquake somewhat differently to two different networks, the estimates of magnitude might vary by a few fractions of a magnitude.

Although this occasionally seems like incompetence, it just reflects the uncertainty of the whole procedure. If you return to the light bulb analogy, if two observers tried to estimate the wattage of the light bulb at two spots, they would in fact measure the intensity and then try and correct for the distance to the bulb. But if observer A had, say, a moth between her and the bulb, her wattage (magnitude) might be a little low, and observer B lacked the moth but caught a reflection from a window as well, his estimate might be a little too high.

Why different magnitudes? It boils down to the way the Earth transmits seismic energy. First, there are body waves and surface waves. Surface waves only travel (create motion) within the upper few kilometers to a few hundred km of the Earth; body waves can travel within the entire Earth. An analogy in water are ocean waves and sound. Scuba divers are probably familiar with the rapid decrease of motion from ocean swells (waves) with depth--a ship can bob about a lot at the surface while a diver 100 feet down might not move much at all. That is a surface wave. Sound, however, travels equally well throughout the ocean, as SONAR demonstrates (we'll omit all the peculiarities of SOFAR channels and the like, thank you very much ex-submariners)--it is a body wave. Second, the Earth has different flavors of seismic waves. For instance, body waves come in P and S waves. P waves are compressional waves and S waves are shear waves; P waves travel faster than S waves. If you want to see P and S waves, get a Slinky, lay it on a nice, slick table, stretch it out some, and then push and pull one end towards the other end quickly--you will see a wave travel down the Slinky of coils close together and further apart than the Slinky at rest--this is a P wave. Now rapidly move one end of the Slinky at right angles to the length of the Slinky--you'll see a wave move down where the Slinky slides over to one side and then back again. This is an S wave (more or less). Surface waves also have different flavors, but for the most part this isn't exploited in magnitude determinations.



OK, so what magnitude scales exist? There are more than I will go over, but these are the most common: duration magnitude (Md), local (Richter) magnitude (ML), body wave magnitude (Mb), surface wave magnitude (Ms), moment magnitude (Mw). The reason for using the different scales is that each type of seismic wave is easily observed only over certain magnitude or distance ranges.

Duration magnitude is used for small earthquakes or in areas with generally poorly calibrated seismometers. It relies on the observation that the time it takes for the motion from an earthquake to fall into the background noise is proportional to other, more physically defensible measures of magnitude.

Local (Richter) magnitudes are measured for most earthquakes up to somewhere around M 7; beyond that the measurement fails to increase with earthquake size. This is basically Richter's technique--you measure the maximum amplitude of ground motion (often restricted to a certain part of the seismogram but not always), take that and the distance from the earthquake and you can get the Richter magnitude. While the original definition was based on a specific instrument at a specific distance, corrections for

distance and other seismometers have been worked out over the years. Large earthquakes generally swamp the instruments used to make these measurements and the Earth does an increasingly inefficient job of transmitting these particular waves for very large events.

Body wave magnitude is a very similar measure to local magnitude except it can be applied to the body waves from distant earthquakes and it has quite a number of corrections for which body wave (P or S, for instance), the Earth's structure, and the period of the wave being examined. It is proportional to the log of the amplitude of ground motion divided by the period of the wave being measured (A/T).

Surface wave magnitudes also use the log of the amplitude divided by period, but surface waves are only generated by relatively shallow earthquakes. Again corrections exist for distance, depth, and seismometer type. Surface waves tend to saturate in the M 8+ range.

Moment magnitude has confused many people because it isn't really a direct magnitude measure (log of an amplitude of a seismic wave) as are the others. Instead it is derived from seismic moment, which is simply the product of the shear modulus (a property of the rock), the fault area, and the slip on the fault. Seismic moment is usually derived from fits made to entire seismograms or large parts of seismograms using certain physical models; this has been automated for several years by a group at Harvard and has been applied in near-real time by several other groups including the USGS.

Unlike other magnitude estimates, you can also derive an estimate of seismic moment from geodetic observations (how far points have moved on the surface of the Earth due to an earthquake) or from geologic observations because you only need fault area and displacement and some estimate of shear modulus.

In practice you will not see such estimates in the public media because they take time to measure and are not necessarily measuring the same exact phenomena (for instance, if sizable slip occurs without generating seismic energy, a geodetic or geologic moment will exceed a seismic moment). The measure "moment magnitude" is somewhat like the duration magnitude in that it has been made to correlate with the other scales, though there are good physical arguments for this relation. In practice, moment magnitudes are the best measure because they can include all the observations that go into the other magnitudes plus the duration of the arrivals plus additional very-long period oscillations of the Earth.

In general these magnitudes have all adjusted been to agree where they overlap (the worst case is usually Mb and Ms, which often disagree a fair bit--mostly due to the way surface waves are generated). Because of this, you could say that the ground motion would be 100,000 times greater in a magnitude 7 than a magnitude 2 earthquake at a given spot despite the different measures probably used (though the reality is that the ground motion would have probably saturated). A statement less affected by the way the Earth transmits energy would be that a magnitude 7 earthquake generates about 16,000,000 times more energy that a magnitude 2 earthquake.

Hopefully this goes some distance in explaining magnitudes.

Craig Jones
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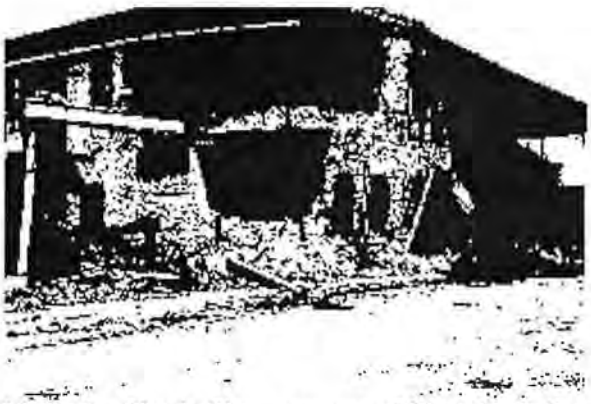
Charles

The AEES subscription year is from 1 Dec to 30 November. It is difficult and expensive to send each member an individual reminder that fees are due so please help us by sending your subscription for 1997/98 to AEES (attn: 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.



Meckering Hotel. Photo courtesy of West Australian Newspapers

1997 AEES Brisbane Conference Proceedings

The cover of the Proceedings reflects the theme of the Conference: Earthquake Risks in Australian Cities. The volume is available now and at a very reasonable price. To both learn about earthquake engineering

issues and support the Society place your orders now with Barbara Butler ($30 + pp).

1997 EARTHQUAKES IN AUSTRALIA

The table below completes the listing of Australian earthquakes of magnitude 3 or more in 1997, which we commenced in the last Newsletter.

The largest Australian earthquake of the year struck an isolated area of Western Australia at 5:20pm WST on 10 August. Its magnitude was Mw 6.3 and minor damage was reported (see AEES Newsletter 97/3 for a detailed description). An isoseismal map was compiled and the mechanism determined to be strike-slip rather than the more usual thrust type.

The occurrence of the once-in-ten-year Australian earthquake ensured that the seismicity for 1997 was above average in terms of energy release though the number of moderate and small earthquakes in the rest of the continent was below average.

Many of those smaller earthquakes, eg those at Meckering WA in November, were felt but caused no damage or panic and most of them were in recognised seismic zones. The Christmas day earthquake (local time) in the Tasman Sea was the largest in the eastern Australian region since August 1997 but it was not felt.

1997 Earthquakes in Australia (cont.)

DD	UTC	Lat	Long	ML	Place
Sep					
01	094837	18.12	123.14	4.5	Broome WA
03	051254	31.45	117.67	4.2	Kellerberrin WA
11	161938	30.97	126.27	3.0	Rawlinna WA
11	164136	31.44	117.70	3.0	Kellerberrin WA
11	164150	31.44	117.68	3.3	Kellerberrin WA
12	000820	31.45	117.67	3.7	Onslow WA
Oct					
02	093316	23.05	114.93	3.0	Nanutarra WA
10	171734	19.38	116.79	3.2	Dampier WA
12	145059	31.97	149.49	3.2	Dunedoo NSW
Nov					
11	122620	16.50	128.17	3.5	Kununurra WA
19	142649	22.58	112.49	3.7	Exmouth WA
20	014417	18.39	118.86	3.3	Pt Hedland WA
24	113927	31.70	117.05	3.0	Meckering WA
24	114038	31.71	117.04	3.2	Meckering WA
Dec					
07	175009	30.99	116.49	3.0	Calingiri WA
14	183608	23.94	112.98	3.3	C Cuvier WA
23	101102	21.88	115.06	3.4	Onslow WA
24	144304	40.31	155.22	3.5	Tasman Sea
26	80355	33.76	138.32	3.2	Clare SA
28	155652	32.62	122.31	3.0	Norseman WA

The Next Moderate Australian Earthquake

Australian seismologists recently had a winner in a lotto-type competition for seismologists to predict the location of the next earthquake of magnitude 5.5 or greater. The return period for such an event is about 18 months but we had to wait nearly 7 years after the January 1990 Meckering earthquake for another of at least that size. William Greenwood an AGSO Senior Technical Officer who has been with AGSO's Earthquake Monitoring group for more than 25 years narrowly won from Vic Dent, then an AGSO Mundaring seismologist by placing his mark near Collier Bay WA (see the last Newsletter).

The previous ML 5.5 earthquake was the disastrous event at Newcastle NSW on the other side of the continent, less than 3 weeks earlier.
The challenge appealed so much to our Hon Treasurer John Wilson that he has suggested we rerun the competition for AEES members - so here are the rules:

- Each member may have a single entry only
- You may plot your estimate on the map of the epicentre of the next ML 5.5 or greater earthquake but
- You must also provide the latitude and longitude
- AGSO seismologists will compute the epicentre
- The committee will judge the winning entry on the written lats and longs provided and award a suitable prize.
- Mark up the map provided with a cross plus coordinates and send your entry to Barbara Butler, Civil and Environmental Engineering, Melbourne University, Parkville Vic, 3052.

Thanks John

SPECIAL OFFER ON CONFERENCE PROCEEDINGS

We are having a clearance sale which you will find irresistible. Simply complete the form below and send to Barbara Butler: fax: 03 9348 1524

Please send to me the following publications at the special price listed, plus postage.

- Proceedings of the 1992, 1993 and 1994 Conferences $20.00 / pack of three
- Proceedings of the 1995 Pacific Conference on Earthquake Engineering 3-Volume set $90.00 per set
- Proceedings of the 1996 Adelaide Conference $12.00 each

Invoice and publications to be sent to:

Name.....

Address.....

.....

City.....State.....

Postcode.....

There are many Journals and Newsletters that we suspect you our members probably never have time to scan which contain articles of relevance to our topic of mutual interest.

We have sampled and slightly modified a couple of articles from: *Earthquake Spectra*, Volume 12, No. 3, August 1996 to entice you to purchase the original.

Seismic Upgrading of Old Brick-Masonry Urban Houses: Tying of Walls with Steel Ties Miha Tomazevic, M.EERI, Marjana Lutman, and Polona Weiss

ABSTRACT

The influence of tying the walls with steel ties on the seismic behaviour of existing brick-masonry houses has been investigated. Three models of simple two story brick masonry houses with wooden floors, with or without wall ties, have been tested on a simple earthquake simulator. In addition, a model with identical structural configuration, but with r.c. slabs instead of wooden floors, has been tested for comparison. Whereas wooden floors with joists not anchored to the walls did not prevent separation and disintegration of the walls, rigid slabs and steel ties significantly improved seismic behaviour. On the basis of test results, a simple method for designing the ties has been proposed.

INTRODUCTION

In many cities located in earthquake-prone areas of Central Europe and the Mediterranean region, old stone and brick-masonry buildings represent an important part of the existing building stock. On account of their historic importance, residential and public buildings are preserved and renewed in order to meet modern living and functional standards. Due to their seismic vulnerability, however, necessary measures should be taken during renewal in order to improve their poor expected seismic behaviour.

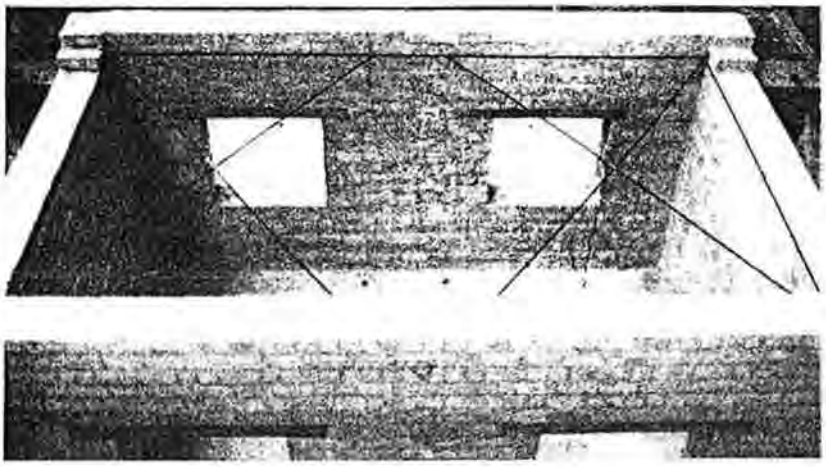


Figure 3 Placing of inner diagonal ties in case of Model D

Analysis of damage to historic buildings due to earthquakes indicates that besides the quality of masonry materials and the distribution of structural walls in the plan, the connection between the walls and floors significantly influences the seismic resistance. Where timber joists are not anchored and the walls are not tied, vertical cracks develop along the joints between walls, and transverse walls collapse due to out-of-plane forces. In order to ensure integrity of masonry structures during earthquakes, wooden floors are often replaced by r.c. slabs, anchored to supporting walls, or the walls are tied with steel ties and wooden floors anchored to the walls and/or braced with diagonal ties.

TIES DESIGN RECOMMENDATIONS

Test results were used in order to propose the ties design recommendations which should be taken into account in the case where brick-masonry wails of historic houses with wooden floors are additionally tied with steel ties. In this regard, the following observations in the behaviour of wall ties could be considered:

The ties of the walls, orthogonal to seismic motion (transverse ties) behaved similarly as reinforcing steel of a r.c. bond-beam made along the wall at floor level. Consequently, wall ties should be basically designed for bending moments developed in the equivalent bond-beam, formed by a strip of wall between the ties, due to out-of-plane vibration of the wall.

On the other hand, steel ties should also be verified for forces which might develop in the direction of seismic motion, ie. longitudinally. Globally, a kind of truss mechanism developed in the masonry structure in the direction of seismic loads, where the shear induced in the walls had been carried over from story to story by means of tension developed in longitudinal ties. Namely, in the case of the models with tied walls, diagonally oriented cracks, which developed in the walls, did not pass from story to story . In the case of the model without wall ties, however, one single crack developed, passing from the bottom to the top of the model. As indicated by the measurements, forces developed in longitudinal ties at ultimate state were of the same order of magnitude as seismic shear induced in the models.

Since the tested models represented only part (a segment) of a prototype building, it can be assumed that, in the longitudinal direction, the minimum dimension and number of ties depends on the magnitude of the ultimate seismic shear, or lateral resistance capacity of the critical segment of the real building in this direction. In this assumption, critical segment is composed of structural walls, which limit typical floor area of a part of a building, and are connected with the rest of the structure with ties or otherwise in order to make it a resisting part of the whole structure.

(MT, ML, PW) National Building and Civil Engineering Institute, Dimiceva 12, SI- 1001 Ljubljana, Slovenia

Reference: Earthquake Spectra, Volume 12, No. 3, August 1996

The second paper we have abstracted is of interest to both the writers of our nascent joint loading code and its subsequent users - the engineering practitioner. We commend you to the full paper referenced below.

Site Response Studies for Purpose of Revising NEHRP Seismic Provisions
C. B. Crouse, M.EERI, and J.W. McGuire, M.EERI

ABSTRACT

A strong motion database was compiled for California earthquakes of surface wave magnitudes, Ms > 6, occurring from 1933 through 1992. The database consisted of horizontal peak ground acceleration and 5% damped response spectra of accelerograms recorded on four different local geologies: rock (class A), soft rock or stiff soil (class B), medium stiff soil (class C), and soft soil (class D). The results of analyses of the database within each of these site classes were used to derive a set of site-dependent spectral amplification factors for oscillator periods between 0.1 and 4.0 sec and ground acceleration levels between 0.1 and 0.4 g. The amplification factors at 0.3 and 1.0 sec periods (designated as Fa and Fv, respectively) are generally within 20 percent of those recommended during the 1992 Site Response Workshop conducted by the National Center for Earthquake Engineering Research (NCEER). The Fa, and Fv, values recommended from our study and those from the NCEER workshop are intended for use by code committees making future revisions to the National Earthquake Hazard Reduction Program (NEHRP) seismic provisions and the Uniform Building Code.

(CBC, JWM) Dames & Moore, 2025 First Avenue, Suite 500, Seattle, WA 98121
Reference: Earthquake Spectra, Volume 12, No. 3, August 1996

WCEE 2000
AUCKLAND NEW ZEALAND

Please Note: The New Zealand National Society for Earthquake Engineering will host the next World Conference on Earthquake Engineering in Auckland
30 January - 4 February 2000.

CURRENT RESEARCH: EARTHQUAKE ENGINEERING and ENGINEERING SEISMOLOGY IN AUSTRALIA

The next Newsletter will focus on the program and activites at the **AGSO Seismological Centre** in the Australian Geological Survey Organisation, Canberra.

RECENT WORLD EARTHQUAKES

In January 1998 there were 14 earthquakes of magnitude 6 or more worldwide, the largest of which was a magnitude 7.4 earthquake in the Loyalty islands region on 4 January which caused no injuries or damage. The most damaging earthquake was the moderate magnitude Mw 5.8 earthquake in China on 10 January which killed at least 50 people but left many injured and homeless. The largest and/or damaging events are listed below.

UTC TIME LAT LONG DEP GS MAGS
SD STA REGION AND COMMENTS

JAN 04
061159.3 22.223S 170.877E 100D 6.5 6.9 0.9 137
LOYALTY ISLANDS REGION. Mw 7.4

JAN 10
035037.8 41.130N 114.494E 6G 5.9 5.7 0.9 224
NORTHEASTERN CHINA. Mw 5.8 (GS). At least 50 people killed, 11,500 injured, extensive damage, and more than 44,000 left homeless in the Zhangbei-Shangyi area. Also felt in Beijing and Zhangjiakou.

JAN 10
082005.2 14.225N 91.589W 33N 6.3 6.2 1.2 142
GUATEMALA. Mw 6.6 (GS). Sixteen people injured in Quazaltenango city and three people injured in San Marcos department. Damage in Quazaltenango, San Marcos and Solola departments. Landslides and power outages occurred at Quazaltenango. Felt in El Salvador, much of southern and western Guatemala and coastal areas of southeastern Mexico.

JAN 12
101407.6 30.941S 71.372W 33N 5.8 6.2 0.9 137
NEAR COAST OF CENTRAL CHILE. Mw 6.6 (GS). Felt (VI) at Combarbala and Ovalle; (V) at Coquimbo, Illapel, La Serena, Los Andes and Los Vilos;

JAN 30
121607.8 24.118S 70.455W 44D 6.3 6.5 1.4 125
NEAR COAST OF NORTHERN CHILE. Mw 7.0 (GS), 7.0 (HRV). Me 6.7 (GS). Minor damage (VII) in the Antofogasta area. Felt (VII) at Collahaus; (VI) at Calama, Maria Elena, Taltal, and Tocopilla; (V) at Chanaral, Copapipo, and San Pedro de Atacama

FEB 04
143321.8 37.10N 70.2E 33 AFGHANISTAN - TAJIKISTAN border. As many as 4000 people may have died, crushed under collapsed mud and brick homes and buried by landslides in villages 240 km north of Kabul near the border with Tadjakistan.

Forthcoming Conferences

(Flyers for some conferences are available from Ed)

• **1998, 27 - 29 March Wairakei Resort New Zealand** NZNSEE Annual Conference 'Reducing Earthquake Risk and Encouraging Preparedness - Who is responsible? Admin Sec PO Box 312 Waikanae NZ ph/fax 64 4 293 3059

• **1998, 27 - 30 April Santiago CHILE.** International Conference on 'Modern Preparation and Response Systems for Earthquake, Tsunami and Volcanic Hazards' IUGG Chile National Committee email: seisvolc@conf.dgf.uchile.cl

• **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)

• **1998, 29 Sep - 2 October, Auckland, New Zealand.** The Australasian Structural Engineering Conference 1998 Contact ph: + 64 9 360 1980 fax: 64 9 376 1980 e-mail: asec@conventionmgmt.co.nz

• **1998, 4 - 5 November, Perth WA.** The AEES Seminar and AGM. See article page 1.

• **1998, 8 -12 November Hobart Tasmania.** ASEG 13th Int Conference and Exhibition. e-mail: wsm@latrobe.edu.au

• **1999, 04 - 09 July Sydney NSW.** XIX Pacific Science Congress, University of New South Wales. e-mail reply@icmsaust.com.au

• **1999, 19 - 30 July, Birmingham, England, UK.** The Tsunami Symposium will be held in conjunction with IUGG99. The 22nd General Assembly of the International Union of Geodesy and Geophysics (IUGG will be held at the University of Birmingham. Register your name and address at: http://www.bham.ac.uk/IUGG99

• **2000, 30 Jan - 4 Feb, Auckland New Zealand.** 12th WCEE/PCEE. Call for abstracts in May 1998.

NEW BOOKS / REPORTS

Acceptable Risks for Major Infrastructure. Eds P Heinrichs and R Fell, Balkema 1995. Proceedings of the Seminar on Acceptable Risks for Extreme Events in the Planning and Design of Major Infrastructure. Sydney NSW Australia, 26 - 27 April 1994.

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

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.

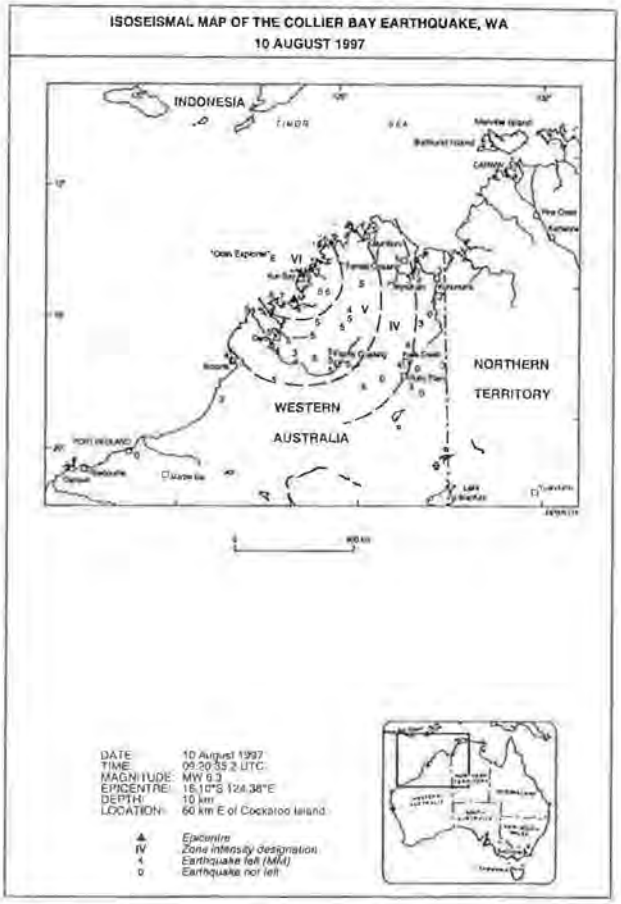
The Geology of Earthquakes by R.S. Yeats, K.E. Sieh, and C.R. Allen: Oxford University Press, 576 p., price $65.00.

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

Earthquakes and Geological Discovery by Bruce Bolt. W H Freeman and Co., 1993.

AGSO Clearance Catalogue

Selected AGSO publications are being offered for 50% off - until February but I am sure this can be extended. If you always wanted a copy of the Isoseismal Atlases Vol 1 & 2 then now is the time. They cost $10 each plus $5 postage. Sales and the catalogue can be obtained from the Sales Centre at Fax 02 6249 9982.



Preliminary Isoseismal Map of the Collier Bay earthquake compiled by AGSO and SRC seismologists (see AEES Newsletter 3/97 for report)