Australian
Earthquake
Engineering
Society

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AEES Newsletter

No 3/93

1993 ELECTION & AGM

At the AEES annual meeting in Melbourne on 25 October we will hold an election of office bearers. The present executive are willing to stand one further time. Any other nominations and agenda items should be sent in writing to the Hon Sec before Friday 15 October (fax: 06 249 9969).

John Wilson and Gary Gibson have organised an exciting Workshop and AGM - see the flyer attached. We hope to see you all there.

The Society -David Rossiter (Treasurer)

Please help your executive by checking whether you are financial or not. If you have not yet renewed your subscription for this year, please send your subscription to AEES. If you are a member of the Institution of Engineers, you can renew through your annual Institution subscription system and, in addition sending AEES the $10 balance. Please note the subscription year is from 1 December 1992 to 30 November 1993. Latest member: Earthquake Engineering Research Centre, Univ. California.

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President's column - Charles Bubb

Barring a damaging Earthquake, the most significant event for any Earthquake Engineering community is the issue of a new Earthquake Design Code. The previous Code AS 2121 was published in 1919 and in September 1993 we will see AS 1170 Part 4 published by Standards Australia. Although dissimilar in many respects there are also strong similarities - not surprising because they come from the same (American) stable. This newsletter naturally covers this important event with a centre page spread from the Code Committee Chairman John Woodside and it also gets considerable coverage in our Melbourne seminar on 25 October 1993. Probably the most striking difference between the two documents is in the assessment of earthquake risk - the new Code assigning a significant earthquake risk to all parts of Australia without exception. That is no doubt more practical in 1993 and post Newcastle than it would have been in 1979. You will recall that, even without this universal requirements for earthquake-resistant design, AS 1170 - 1979 was not adopted by all State Governments - not by NSW for example.

It will be interesting to see the reaction when the wider community becomes aware of all the requirements of AS 1170 - Part 4 - 1993.

I look forward to seeing and meeting as many members as possible in Melbourne. Our first Seminar in 1992 in Sydney was a success I am sure that our Melbourne one will at least equal it in both quality and numbers. See you there.

New Intensity scale- Kevin McCue

The executive proposes to form a national committee to write an appropriate intensity scale for Australia, and to provide a national representative on the US committee charged with revising the US MM scale (currently the 1931 version).

A number of members familiar with the scale have already volunteered to participate, others are welcome. Please ring or fax me (Ed.) (ph: 06 249 9675, fax: 06 249 9969).

Coping with 'qua

by John Woodside,
Chairman of technical subcommittee BD/6/4 *

An earthquake—perhaps more than any other natural phenomenon—has the ability to wreak widespread destruction and cause maximum disruption over a large area. Although most earthquakes in Australia occur in isolated and sparsely populated areas, it only takes one, like the Newcastle earthquake of 1989, to bring home the havoc that can be caused in towns and cities.

Standards Australia has just published the newly revised edition of the earthquake code. This important document will go a long way to ensuring that buildings are able to cope with the most severe earthquakes Australia is likely to experience, and will not only affect structural engineers but also architects, designers, building services engineers and others when designing buildings and associated elements. The new edition is similar in approach to the former document but the layout and details have undergone significant change.

Impetus

Australia's first earthquake standard was published in 1979 as AS 2121. It was principally a result of the earthquake in Western Australia of 14 October 1968, and was based on the 1977 version of a document prepared by the Seismology Committee Structural Engineers Association of California (SEAOC). It was both a loading and material design document in working stress.

The new earthquake standard is a loading standard only, and is now part of the AS 1170 series of standards. It is titled *Minimum design loads on structures, Part 4: Earthquake loads* (AS 1170.4), with the design requirements specified in the various materials standards such as the concrete and steel standards. The earthquake standard is largely based on the 'Tentative Provisions for the Development of Seismic Regulations for Buildings', ATC-3.06 and the NERHP documents, but is modified to suit Australian conditions.

The earthquake hazard map

No part of Australia is free from the possibility of an earthquake, as large, potentially destructive earthquakes have occurred this century in eastern, central and western Australia. The 1989 Newcastle earthquake has reinforced the lessons learnt from both overseas and Australian earthquakes: *that such earthquakes will continue to occur in the future with possible significant property damage and loss of life.*

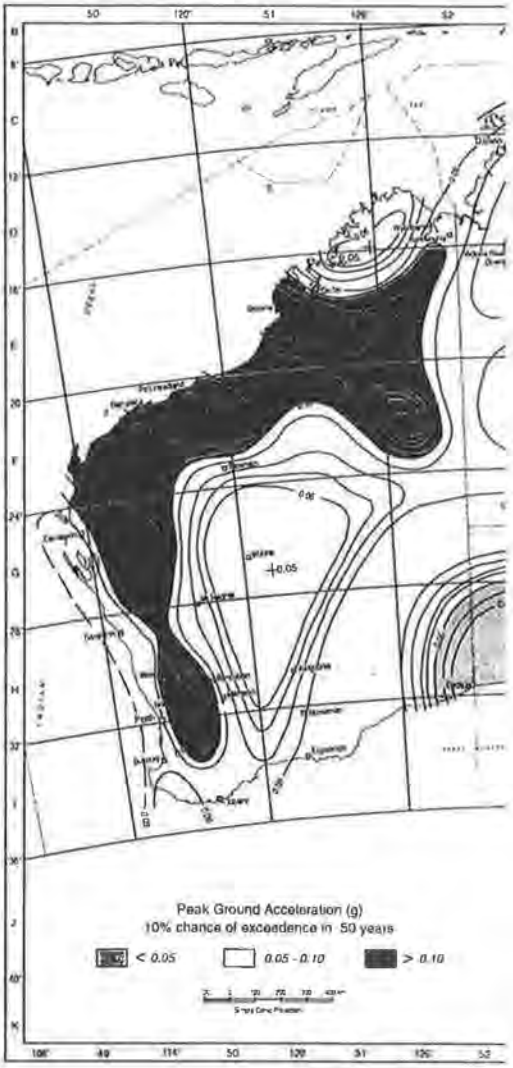
The previous edition of the earthquake standard, AS 2121, used a system of zoning based on the SEAOC document—which has four different zones of earthquake force—to establish the 'level of hazard' for a region. The SEAOC document uses Zone 1 increasing in severity through to Zone 4. In the case of Australia, only Zones 1 and 2 were used in AS 2121, but an additional Zone A, with a lesser force than Zone 1, was introduced to take into account non-ductile construction such as unreinforced masonry. Much of Australia was in Zone 0 with no specific design requirements.

However, the subcommittee revising the standard agreed that the zones used in AS 2121 were not considered appropriate for the generally low level of earthquake in Australia. Subcommittee BD/6/4 made a very conscious decision that zones with much closer contours should be used in Australia for the earthquake hazard map to avoid the problem of large steps in force levels which, while suitable for areas of high earthquake, were not appropriate in Australian conditions. It is interesting to note that similar contours have also been recently adopted in New Zealand for their latest loading standard.

The main source of data for the new standard was from the Australian Geological Survey Organization and includes data from 1856 to 1991.

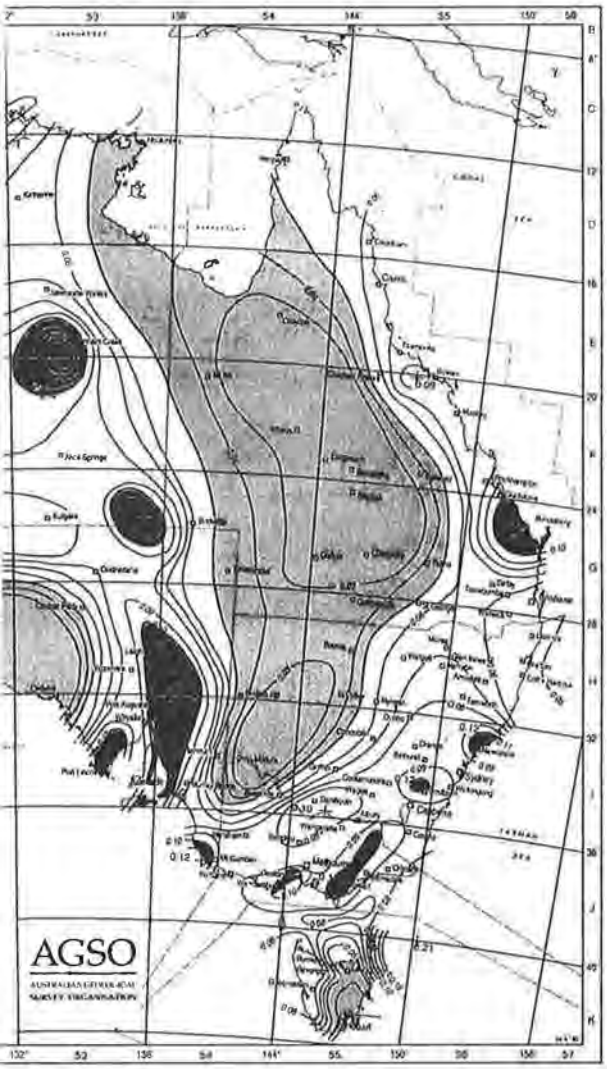
Use of the standard

The new standard applies to both domestic and general structures, with



domestic structures having a separate section. The design requirements for the minimum earthquake loads depend on the type of structure, that is, domestic or general, the type of building (whether it is a building with post-disaster functions, a building with a large number of people, or buildings of other categories), the structural system, whether the building is regular or irregular in shape and is ductile or non-ductile, and the site factor based on the soil conditions. There is a considerable body of evidence to show that buildings on soft soils are much more likely to be damaged as a result of earthquake loading than buildings

⊕ This article is reproduced with permission from the editor of TAS, Standards Australia's monthly magazine, and John Woodside a member of AEES. The map was prepared by members of a sub-committee of BD/6/4 and drawn by AGSO cartographers. It is an early version of that in AS 1170.4.



which are on stiff soil or rock, and this has been allowed for in the code. Designers will be required to assess the requirements for their buildings in accordance with the standard. This may range from no special earthquake design but some minor detailing of non-structural elements, through to detailed structural design and detailing for earthquake, depending on the various requirements of the standard.

There will be, in some cases, an increase in design effort and a small increase in the cost of the building, but Subcommittee BD/6/4 believes these costs are justified for the level of risk involved.

Flow charts are provided in the front of the standard to assist users in using the new document.

Domestic structures

Design of domestic housing, if required, is restricted to one section of the standard. Domestic housing is categorized as H1, H2 or H3, with H1 being the lowest design category and H3 the highest.

It is expected that many houses will be categorized in the lowest category (H1) which requires no specific earthquake strucural design or detailing. Detailing, where required, will generally require the positive connection of roof and floor to the walls. However, very few houses will be categorized in H3, with the requirement for specific structural design for horizontal loads. Non-structural components which are non-ductile for all design categories will require some design. This will be generally less than wind load if this is applicable.

'Deemed to Comply' details will be developed by Standards Australia following the publication of this standard which will limit or minimize the specific design requirements.

In addition to the structural design which may or may not be required, detailing for the structure may be required which includes tying of walls and members to provide horizontal resistance to earthquake loads.

A further section has been provided in the standard for detailing and design of non-structural components, including architectural, mechanical and electrical components as required. Design requirements which are set out in this section will be largely met by deemed to comply documents which will be developed as a result of the publication of this standard.

Static and dynamic analyses

A static analysis is to be carried out on general structures in two orthogonal horizontal directions when required by the standard. The static approach is a simple approach which simulates the dynamic effects of the earthquake motion which induces forces within the building structure and is familiar to most structural engineers.

This approach is known as the quasi static approach. The resulting force level is based on the assumption that the structure will undergo several cycles of in-elastic defamation during a major earthquake and the force is related to the type of structural system and its ability to sustain these defamations and dissipate energy without collapse. This section on static analysis is similar to the previous standard, AS 2121, although the equation has a different form with a response factor based on the structural system being used. In addition, there is a requirement to consider the effects of torsion due to the difference between the centre of rigidity and the centre of mass of the building, similar to AS 2121.

The standard includes a section on dynamic analysis which is not normally required except in buildings of irregular configuration, larger buildings and buildings on very soft soils. Dynamic analysis was also included in the previous standard, but the new edition has considerably more detail on this method of analysis. With the advent of more powerful computers, programs are now available for this type of analysis. This analysis is new for many engineers, and limited dynamic analysis will be required by users of the standard on a limited basis. However, the new standard does permit dynamic analysis for lesser cases if the designer wishes to do so.

The standard includes a section on structural alterations which is similar to AS 2121 but has added an appendix for guidance of designers. Standards Australia is currently preparing a separate standard on these matters which will ultimately replace this section.

This important new document, AS 1170.4, represents a major step forward in Australian design. It is a significant upgrade on AS 2121 and provides a simple and effective procedure for earthquake design. It will involve some additional requirements for design and construction in some cases, but does provide a rational approach to design and a safer Australia for earthquake loads.

The new edition of the earthquake standard may be purchased from any office of Standards Australia, or by contacting the National Sales Centre, ph (02) 746 4600, fax (02) 746 3333.

* *John Woodside is a Director of Connell Wagner Rankine and Hill. and has been the chairman of Subcommittee BD/6/4 for four years.*

News items

•**Earthquake monitoring at AGSO** AGSO has survived both the Richard's review and budget in a healthy state. Not as a statutory body but in DPIE under Minister Michael Lee, an electrical engineer and MIEAust from Gosford.

There will be a structural reorganisation and a new strategic plan.

AGSO will be required to earn at least 30% of its budget and a follow-up review will be held in 3 years.

The ASC will be combined with the Geomagnetism, Palaeomagnetism and Gravity groups as a new Observatory Group headed by Dr Denham, a member of AEES and well known in engineering seismology circles.

•**New Risk Society** The formation of a Risk Engineering Society has been sanctioned by IEAust's Board of Management.

The National Committee on Risk Engineering has been working towards the formation of a society for the past 12 months.

Their mission is to contribute to safety, health, environmental protection and productivity by providing a national focus for risk engineering and risk management.

The society is to be chaired by Mark Tweeddale, professor of risk engineering at the University of Sydney, with local chapters planned for all IEAust divisions.
Enquiries should be directed to Linda Tregonning (06) 270 6555.
(from Engineering Times, IEAust)

COURSES & CONFERENCES

• Natural Disasters: Protecting vulnerable communities. Institution of Civil Engineers, London SW1P 3AA, UK, 13-15 Oct 1993

• **AEES '93 AGM & Seminar 1993**
Monday 25 October 1993

Civil & Environmental Engineering
Melbourne University
Contact: John Wilson
Fax: 03 344 4614

The seminar is a forum for engineers, seismologists, insurance and emergency services personnel to meet and discuss current issues and new developments in the field of earthquake engineering. Flyer is enclosed.

• **Earthquake Monitoring Facilities in Australia**
at
Seismology Research Centre, RMIT
Bundoora, Victoria

Tuesday 26 October 1993
(Following the AEES Seminar)

Registration: Tess Falconer, GOMP, Australian Geological Survey Organisation, GPO Box 378, Canberra ACT 2601
fax: 06 2499986
(price: $20 at door to cover light lunch and morning/afternoon teas).

• First Egyptian conference on earthquake engineering. Dec 6-9, 1993, Hurghada, Egypt. Egyptian Society for earthquake engineering.
• The 10th European Earthquake Engineering Conference: 28 August to 2 Sept 1994, Vienna, Austria.

• **AEES & NZNSEE**
Pacific Conference PCEE '95
20-23 November 1995
Melbourne Vic Australia

(copies of flyers from Hon Secretary if available)

Earthquake publications

• *Earthquake tremors felt in the Hunter valley since white settlement* can be purchased for $18.50 (+ $1.50 postage) from Hunter House Publications, PO Box 536, Raymond Terrace, NSW 2324. (see review NZNSEE Bull. 2 1993)
• The IEAust Newcastle Earthquake Study is still available at EA Books, PO Box 588, Crows Nest NSW 2065 at the reduced price of $30.
• A number of **AGSO** (BMR) Bulletins and reports describing earthquake activity in Australia can be purchased from the AGSO Sales Centre, GPO Box 378, Canberra ACT 2601. The Australian Seismological Centre also publishes an annual report featuring the year's seismicity with summary, glossary and descriptions of the larger earthquakes (The 1991 report will be pubklished in September 1993)

AEES'92 Conference Proceedings
The attractively bound proceedings have now been published and can be purchased from the Hon Sec (at address above) for $15 which includes post and packaging to anywhere in Australia.

Membership renewal

1993

The executive hopes you will continue to support the Society by renewing your membership and participating in the annual seminar and fast approaching 1995 Pacific Conference on Earthquake Engineering

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