AEES NEWSLETTER

February 2009

Contents

President's Report

The AEES 2008 conference held at the Mt Helen campus of the University of Ballarat was a great success with its mix of themes, its keynote and student papers and the many good opportunities to meet and interact socially. Ballarat is quite central for participants from Sydney, Melbourne, Adelaide and Canberra and from Perth and Brisbane. This year there were also delegates from our neighbours; New Zealand, Papua New Guinea, Indonesia, Malaysia, China, Bangladesh and India which is a great credit to the conference organisers.

We learned at the Annual General Meeting in Ballarat that the Society is in good health and for that we owe a great deal to John Wilson and his committee of the last four years: Nelson Lam, Gary Gibson, Amy Brown and Dee Ninis, and committees of previous years. Sincere thanks to you all.

The most memorable session of AEES2008 for me was the special session on the May 2008 Wenchuan (or Sichuan) earthquake in China. There is so much knowledge about the theory and practice of earthquake engineering, as demonstrated at the annual Australian and New Zealand conferences and the four-yearly world conferences, yet earthquake disasters continue to cause unacceptable loss of life and immense suffering every year. It seems to me that the gaps between theory and practice, between theory and political will, are still far too great. It is not enough that we seismologists and engineers learn from each other, we must teach and lobby governments and industry to bring about change to prevent such tragedies.

Members of the Standards Committee convened to revise the last loading code of Australia were threatened by a member of the Australian Building Codes Board; change building standards if we must but if they lead to increased costs then the standard will not be called up. Today this pressure would, I hope, be totally unacceptable, the price of failure is too high as we should have learned from Newcastle in 1989, Meckering WA in 1968 and Adelaide SA in 1954.

As Bill Jordan pointed out at Ballarat, had the 1989 Newcastle earthquake occurred during a normal school term rather than in the Christmas holiday break, tens of school children would probably have been killed and hundreds injured. The two major hospitals were badly damaged; one was evacuated, the other, whilst not yet opened, was severely damaged. When you review the damage at Meckering in the 1968 earthquake and Adelaide in the 1954 earthquake, it is astounding there were no deaths and so few injuries. At Tennant Creek the hospital sustained damage during the 1988 earthquakes.

The first lesson we should impress on our parliamentary representatives is that we won't always be lucky, that our best strategy to prevent children and patients being killed in a future earthquake is to ensure that the schools and hospitals comply with the current loading code. Not just new schools and hospitals but all existing schools and hospitals.

AEES members have the necessary skills to inspect with government engineers all such buildings and decide which of them require action to ensure they don't collapse or partially collapse in the next large earthquake. We need AEES participants in each State and Territory.

In early December, the 20th year after Australia's most destructive earthquake, Bill Jordan and his team will host AEES2009 in Newcastle. We look forward to seeing you all there, to discuss the latest earthquakes and their effects, developments made since 1989 in developing safer communities and progress with our AEES projects.

In the next 2 or 3 years AEES must ensure that all school children and patients are as safe as possible from earthquakes. We will publish a commentary to the current loading code and a book about earthquakes and earthquake engineering in Australia for the general public (and ourselves), and will issue regular Newsletters. We can do all that with your contributions, your articles, your reminiscences, your photos.

Please contribute and join with me to welcome your new committee members; Paul Somerville (URS and Macquarie University) and Mark Edwards (Geoscience Australia), ably assisted by Sharon Anderson who runs the Secretariat and Adam Pascale who manages the AEES website.

Kevin McCue, President AEES

We note with great sadness the tragic loss of life in the recent Victorian bushfires. Engineering houses at the urban/bush interface so that the occupants can survive the next inevitable bushfire should be a high priority for government, Engineers Australia, and the insurance industry.

Vale – Professor George W. Housner 1910 - 2008

Professor George W. Housner, the Braun Emeritus Professor of Engineering at Caltech and one of the early pioneers of earthquake engineering, died aged 97 on 14 November 2008.

His interest in earthquake engineering was apparently initiated by the 1933 Long Beach California earthquake in which many un-reinforced masonry buildings failed catastrophically, including many school buildings. Although 115 people were killed, the number of deaths would have been even higher if the quake, had struck during school hours.

George Housner pioneered many of the important concepts in modern earthquake engineering, including the development of the response spectrum, the mathematical modelling of strong ground motion and analysis of the non-linear response of structures. He was a leader in the development and deployment of strong motion instrumentation and shaking machines for measuring the dynamic properties of buildings, dams and other structures. Housner's response spectrum has been incorporated in building standards worldwide and for this and other contributions he is known as the father of earthquake engineering. As a consultant and advisor he contributed to the earthquake safety of; the California Water Project, the Bay Area Rapid Transit system, tall buildings, nuclear power plants and offshore drilling platforms. His professional and public service included president of the Earthquake Engineering Research Institute and of the Seismological Society of America and chairman of the National Research Council's Committee on Earthquake Engineering Research. Housner chaired a National Academies of Sciences committee looking into the damage from the 1964 Alaska earthquake and the California Governor's Board of Inquiry into the 1989 Loma Prieta earthquake.

Housner was born on 9 December 1910 in Saginaw, Michigan, shortly after the great 1906 San Francisco earthquake and died before the next one. He received a bachelor's degree in structural engineering from the University of Michigan and did his Masters and PhD at Caltech arriving there only months after the 1933 Long Beach earthquake.

After graduating from Caltech, Housner worked for the Army Corps of Engineers, then advised the Army Air Forces in World War II. He was awarded the Distinguished Civilian Service Award in 1945 by the US War Department in recognition of his contributions to the war effort. After the war, Housner returned to Caltech as an assistant professor of applied mechanics. In 2006, he was named a Distinguished Alumnus, the highest honour the institute can bestow on graduates. Just before he died in 2008, he was chosen one of the 13 Legends of Earthquake Engineering.

Housner was elected to the National Academy of Sciences in 1972 and became a founding member of the Earthquake Engineering Research Institute. A medal in Housner's name is awarded each year by EERI. He was also instrumental in the formation of the International Association for Earthquake Engineering.

In 1981, Housner received the Harry Fielding Reid Medal of the Seismological Society of America. In 1988, President Reagan awarded Housner the National Medal of Science at a ceremony at the White House, recognising "his profound and decisive influence on the development of earthquake engineering worldwide. His research contributions have guided the development of earthquake engineering and have had an important impact on other major disciplines". Even after retirement, Housner apparently showed up each day at his Caltech office where he graciously entertained visitors from all over the world. He was a motivational speaker, his hour-long keynote speech, no notes or slides, at the 1973 WCEE in Rome was listened to in complete silence. His wise counsel will be widely missed.

LEGENDS OF EARTHQUAKE ENGINEERING

Thirteen engineers were recognized as *Legends of Earthquake Engineering* at a reception during the 14th World Conference of Earthquake Engineering held in Beijing, China in October. The *Legends* were selected from a slate of candidates who made significant contributions to the field of earthquake engineering and were nominated by a list of 125 earthquake organizations worldwide. The final selection was based on a vote of the Asian-Pacific Network of Centers for Earthquake Engineering Research (ANCER) selection committee and resulted in the awarding of 13 international Legends of Earthquake Engineering.

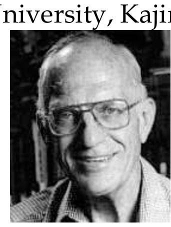
AEES congratulates the recipients for their outstanding contributions to earthquake engineering and to reducing the risk of earthquake fatalities worldwide.

Nicholas Ambraseys
Senior Research Fellow
Imperial College, London, UK

Takuji Kobori
(1920 – 2007)
Professor (Emeritus)
Kyoto University, Kajima Corp.

Kiyoshi Muto
(1903 – 1989)
Professor (Emeritus)
University of Tokyo, Japan

Thomas Paulay
Professor (Emeritus)
University of Canterbury
New Zealand



Ray W. Clough
Professor (Emeritus)
University of California
Berkeley, USA

Jai Krishna
(1912 – 1999)
Formerly Vice-Chancellor
University of Roorkee, India

Nathan M. Newmark
(1910 – 1981)
Professor (Emeritus)
University of Illinois at
Urbana-Champaign

Joseph Penzien
Professor (Emeritus)
University of California
Berkeley, USA

H. Bolton Seed
(1922 – 1989)
Professor
University of California
Berkeley, USA

George W. Housner
(1910 – 2008)
Professor (Emeritus)
California Institute of
Technology, USA

Huixian Liu
(1912 – 1992)
Professor
Inst. of Engineering
Mechanics, China

Shunzo Okamoto
(1909 – 2004)
Professor (Emeritus)
University of Todky, Japan
Saitama University, Japan

Emilio Rosenblueth
(1926 – 1994)
Professor (Emeritus)
National University
of Mexico

Australia M≥2.5

Below are a table and epicentre map of Australian earthquakes of magnitude 2.5 or more. All dates and times are Universal Coordinated Time (UTC). Compare the observed and expected number of earthquakes in the Australian region:

Observed: 8 earthquakes of magnitude 4.0 or more, none of them above 5.0;

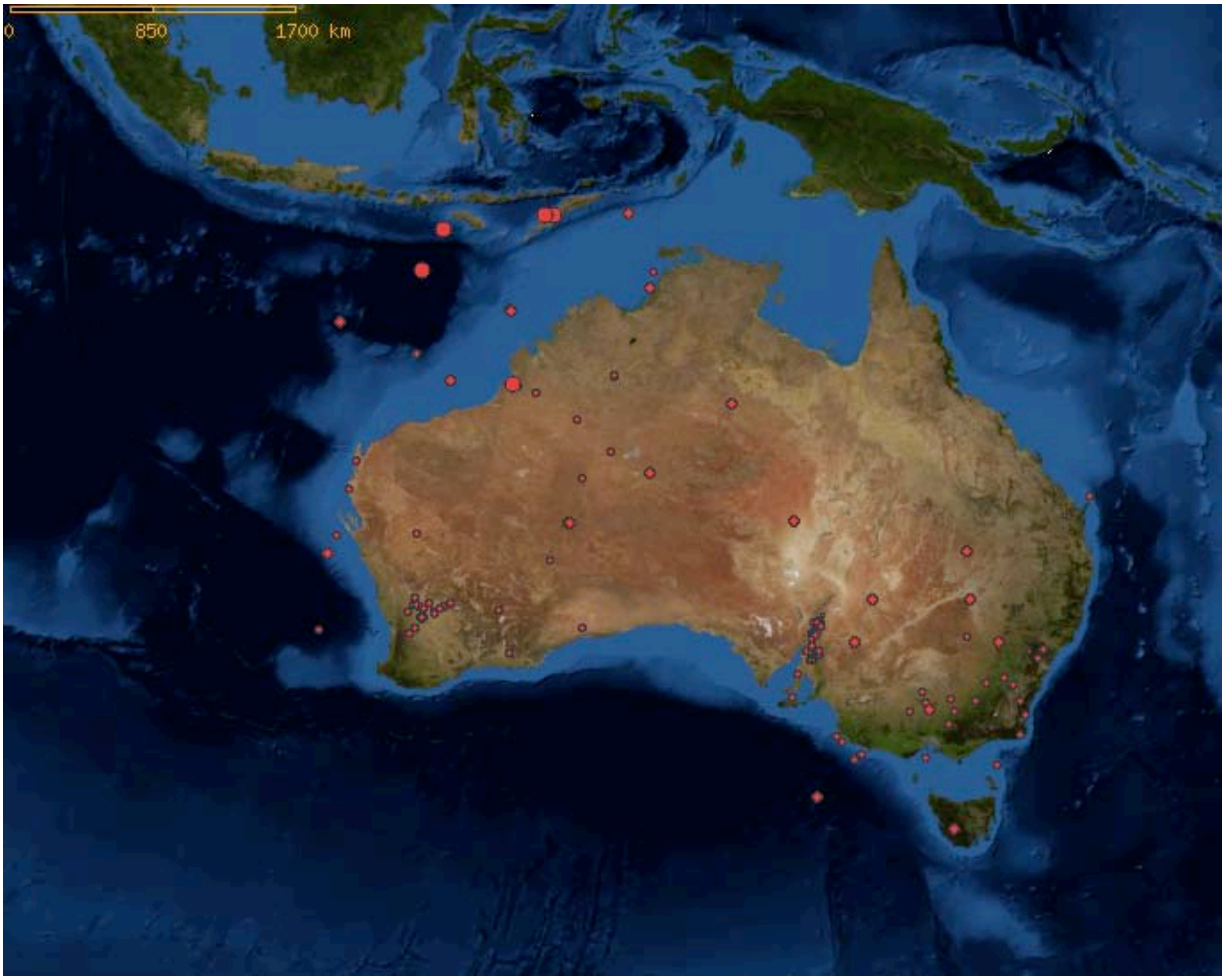
Expected: 2 earthquakes of magnitude 5 or more and 20 of magnitude 4.0 or more as predicted by a recurrence relation of the form: log(Nc) = 5.3 – M,
where Nc is cumulative number of earthquakes above magnitude M
reference (McCue – AEES 1993, Melbourne)

The largest earthquake was that near Broome WA on 28 May, magnitude 4.7, but there was no damage reported in the year. Several earthquakes were felt as noted in the 'Location' field. Epicentres are in all states and in the usual places including Southwest WA, Flinders Ranges SA and Southeast Australia where the hazard has been assessed to be relatively high. Only a single focal mechanism is known to have been derived, that of a small earthquake near Dalton NSW, magnitude 3.2, on 26 August at 0534 UTC (see separate article).

Source	Date	Time(UTC)	Lat S	Long E	Depth km	ML	Location
ADE	4/1/08	1417 40.8	37.803	140.497	13	2.9	Mt Gambier SA
QLD	12/1/08	075621.0	21.64	147.24	5	2.6	Glenavon Station Qld
ADE	12/1/08	122429.04	32.039	138.330	13	2.9	Pt Augusta SA Felt
AUST	13/1/08	161658.91	26.65	117.069	2	2.9	W Meekatharra WA
ADE	13/1/08	210105.15	32.043	138.315	10	2.9	Port Augusta SA
ADE	18/1/08	004245.47	32.059	138.319	10	3.4	NE Pt Augusta SA
AUST	18/1/08	104055.99	30.534	118.59	14	2.8	E Bonnie Rock WA
AUST	19/1/08	122406.44	33.016	122.127	0	3.2	S Norseman WA
AUST	23/1/08	152730.05	31.69	117.05	0	2.7	Meckering WA
ADE	23/1/08	193606.13	33.050	138.629	10	2.7	Peterborough SA Felt
AUST	24/1/08	032129.26	38.705	144.505	10	3.4	SE Anglesea Vic
ADE	26/1/08	232124.52	32.943	138.161	10	2.6	Port Pirie SA
AUST	28/1/08	153713.74	22.683	113.872	7	3.1	SW Learmonth WA
AUST	31/1/08	124628.71	37.047	148.067	0	2.5	SW Suggan Buggan Vic
AUST	6/2/08	064647.65	13.402	129.644	7	4.2	Darwin NT
ADE	6/2/08	164444.87	32.825	138.274	12	2.6	Booleroo Centre SA
AUST	10/2/08	125328.02	33.366	150.554	7	2.6	Lithgow NSW
ADE	12/2/08	001224.03	32.876	138.348	10	3.2	Booleroo Centre SA
QLD	13/2/08	215729.4	27.52	146.59	10	4.4	Cunnamulla Qld
AUST	16/2/08	024426.69	31.773	111.883	10	2.9	W Perth WA
AUST	16/2/08	200524.87	33.449	138.483	16	2.7	SE Gladstone SA
AUST	17/2/08	114840.38	38.506	141.022	11	3.1	S Pt Fairy Vic
AUST	18/2/08	191855.39	26.693	112.770	10	2.8	SW Carnarvon WA
AUST	22/2/08	025849.27	19.097	123.526	2	3.1	SE Broome WA
AUST	1/3/08	002437.11	36.154	144.668	10	3.7	SW Echuca Vic
AUST	5/3/08	065406.58	30.764	117.983	6	2.5	NE Bencubbin WA
ADE	7/3/08	013210.16	33.374	138.412	10	2.7	Gladstone SA Felt
AUST	9/3/08	044105.36	34.905	149.067	1	2.8	Near Yass NSW
ADE	9/3/08	070351.14	31.683	138.737	10	3.1	Port Augusta SA
AUST	17/3/08	065617.24	25.975	137.427	10	3.7	Simpson Desert NT
AUST	17/3/08	104723.95	32.468	148.449	0	2.5	SW Dubbo NSW Felt
AUST	18/3/08	10232.96	32.519	148.433	11	3.7	SW Dubbo NSW
AUST	19/3/08	071737.8	19.654	134.047	15	3.7	W Tennant Ck NT
AUST	20/3/08	051551.21	23.696	126.017	0	3.0	SW Lake Mackay WA
AUST	23/3/08	200037.86	33.418	138.308	10	3.5	Crystal Brook SA
AUST	24/3/08	173156.87	30.668	118.385	13	3.0	S Bonnie Rock WA
AUST	24/3/08	192449.26	30.649	118.392	7	2.6	S Bonnie Rock WA
AUST	31/3/08	082748.65	27.666	112.332	18	4.4	SW Carnarvon WA
AUST	2/4/08	081443.42	16.982	117.07	8	3.5	NW Port Hedland WA
ADE	3/4/08	111855.36	32.310	138.332	10	2.7	Port Augusta SA
ADE	3/4/08	211807.84	37.580	139.546	10	2.5	Millicent SA

Source	Date	Time(UTC)	Lat S	Long E	Depth km	ML	Location
AUST	5/4/08	120425.79	30.349	117.781	1	2.7	NW Beacon WA
ADE	5/4/08	190059.07	37.837	139.995	10	2.6	Millicent SA
ADE	8/4/08	123304.35	31.393	138.484	10	2.9	Port Augusta West SA
AUST	10/4/08	081313.37	30.429	116.960	12	2.8	SW Kalannie WA
AUST	11/4/08	000043.55	34.381	148.697	5	2.7	N Boorowa NSW
AUST	12/4/08	235333.4	30.925	118.023	6	2.7	W Mukinbudin WA
AUST	17/4/08	182234.3	18.709	122.519	10	3.2	S Broome WA
AUST	19/4/08	162410.37	20.47	125.698	10	2.7	Great Sandy Desert WA
AUST	21/4/08	072940.93	30.581	117.210	10	2.8	SE Burakin WA
AUST	30/4/08	211110.24	30.215	141.620	0	3.6	N Broken Hill NSW
AUST	1/5/08	135214.52	28.028	124.316	8	2.8	Yeo Lake WA
AUST	3/5/08	221431.53	31.168	117.365	5	3.7	Near Wyalkatchem WA
AUST	7/5/08	072730.56	31.149	117.352	6	3.5	Wyalkatchem WA
ADE	12/5/08	194422.21	32.8577	138.267	10	3.1	Port Pirie SA
ADE	14/5/08	224013.4	38.246	140.709	13	3.1	S Mt Gambier
AUST	17/5/08	003645.73	30.117	116.975	0	3.4	NE Kalannie WA
AUST	17/5/08	090527.78	30.664	117.501	11	2.7	North Koorda WA
AUST	17/5/08	135741.77	40.818	138.637	15	3.6	SW Mt Gambier SA
AUST	20/5/08	082512.4	23.363	129.609	0	3.6	SE Kintore NT
QLD	22/5/08	094953.9	29.06	150.94	10	3.1	Ashford NSW
AUST	23/5/08	091639.95	36.392	149.819	2	3.1	W Bermagui NSW felt
AUST	28/5/08	043052.07	18.596	122.323	0	4.7	S Broome WA
AUST	28/5/08	093524	18.43	118.92	5	3.6	N Pt Hedland
ADE	29/5/08	053555.5	31.874	138.629	10	3.1	Port Augusta SA felt
ADE	29/5/08	100546.01	31.624	138.532	10	3.1	Port Augusta SA felt
AUST	1/6/08	121426.08	24.208	113.506	10	3.1	N Carnarvon WA
AUST	9/6/08	013729.76	30.167	146.881	10	3.7	Brewarrina NSW
AUST	23/6/08	131739.3	18.176	127.722	0	2.8	Halls Creek WA
ADE	23/6/08	160456.02	37.559	139.661	10	2.6	Millicent SA
ADE	24/6/08	070258.07	38.745	140.612	10	3.5	Portland Vic
ADE	25/6/08	203450.46	31.637	138.628	10	2.8	NE Hawker SA
ADE	1/7/08	065050.24	33.092	138.707	10	3.2	Mannanarie SA Felt
AUST	2/7/08	024056.68	30.739	121.473	0	3.3	N Kalgoorlie WA
ADE	3/7/08	000757.51	33.091	138.675	10	2.5	Mannanarie SA
AUST	4/7/08	152533.5	31.7	125.965	1	2.7	N Cocklebiddy WA
AUST	9/7/08	234520.4	26.034	125.223	1	4.5	W Warburton WA
AUST	10/7/08	000528.54	26.029	125.316	9	3.6	W Warburton WA
AUST	12/7/08	113243.17	32.229	146.687	3	2.7	SE Cobar NSW
ADE	16/7/08	160048.6	25.762	137.637	10	2.5	Poeppels Corner SA
MEL	17/7/08	025822.2	35.627	147.182	10	2.7	Holbrook NSW
AUST	20/7/08	211447.35	32.004	116.759	3	2.6	NW Beverley WA
MEL	21/7/08	220100	36.24	143.66	10	2.6	Boort Vic
AUST	25/7/08	184840.86	34.691	147.714	10	2.7	Cootamundra NSW
AUST	27/7/08	064405.11	18.144	127.744	0	2.8	Halls Creek WA
ADE	27/7/08	073428.26	32.677	138.315	12	3.1	E Wilmington SA
AUST	29/7/08	110920	14.55	122.11	0	4.5	Scott Reef WA
AUST	1/8/08	172748.48	30.495	117.132	0	2.5	NW Burakin WA
AUST	2/8/08	051823.11	14.656	122.166	3	4.1	Scott Reef WA
ADE	7/8/08	235428.25	34.16	137.6	10	2.6	S Moonta SA
AUST	8/8/08	102725.69	30.466	117.281	4	2.5	NE Burakin WA
ADE	8/8/08	125025.23	35.479	137.299	10	2.7	Kangaroo Is SA
ADE	15/8/08	003041.1	32.99	138.095	7.4	2.7	Port Pirie SA
ASC	26/8/08	053402	34.78	149.21	0	3.2	S Dalton NSW
ADE	31/8/08	080234.32	33.117	138.702	10	2.9	Mannanarie SA
AUST	5/9/08	053920.22	32.848	150.776	0	3.1	Howes Valley NSW
QLD	18/9/08	165437.6	29.18	150.91	5	2.5	NSW
MEL	21/9/08	111602.21	24.665	153.295	10	2.5	Fraser Island Qld
MEL	21/9/08	130941.01	39.09	148.28	36	2.9	Flinders Island Tas
AUST	24/9/08	233117.31	35.732	144.475	8	3.4	S Caldwell Vic
AUST	30/9/08	070405.11	37.484	149.54	0	3.0	NW Mallacoota Vic
MEL	30/9/08	231754.3	26.96	151.30	5	2.6	Dalby Qld
ADE	7/10/08	083829.27	33.054	138.27	10	2.5	Port Pirie SA
ADE	7/10/08	123857.52	32.118	138.542	10	3.1	Pt Augusta SA

Source	Date	Time(UTC)	Lat S	Long E	Depth km	ML	Location
AUST	15/10/08	200503.15	35.529	145.787	8	2.6	North Berrigan NSW
ADE	18/10/08	020257.2	32.93	138.784	10	3.2	Peterborough SA (felt)
MEL	21/10/08	184855.8	25.64	152.02	4	2.5	Biggenden Qld
AUST	23/10/08	115205.63	32.477	140.656	6	4.0	SE Radium Hill SA
ADE	30/10/08	114944.4	31.08	138.982	10	2.5	NE Blinman SA
AUST	30/10/08	131151.15	36.229	145.988	10	3.2	SE Tungamah Vic
AUST	6/11/08	145627.05	30.876	116.655	8	3.2	NE Calingiri WA
AUST	14/11/08	211515	12.6	129.8	0	2.8	SW Darwin NT
ADE	16/11/08	012947.43	31.591	138.761	10	2.5	NE Hawker SA
ADE	16/11/08	020218.16	31.402	138.729	19	4.2	NE Hawker SA felt
ADE	16/11/08	024439.36	31.403	138.632	21	2.7	NE Hawker SA
AUST	21/11/08	042655	15.21	113	0	4.0	NorthWest Shelf WA
ADE	26/11/08	135308.77	31.585	138.793	10	2.7	NE Hawker SA
MEL	29/11/08	214130.27	42.517	145.983	8	3.6	Strathgordon Tas
AUST	4/12/08	053500.55	32.981	149.995	2	2.5	W Bogee NSW
ADE	4/12/08	163512.12	33.412	138.388	10	3.1	SE Crystal Brook SA
AUST	5/12/08	153005.49	22.203	127.55	3	3.0	W L Mackay WA
AUST	6/12/08	180540.92	35.17	144.332	10	2.7	East Moulamein NSW
AUST	7/12/08	040356.64	35.641	149.516	8	2.6	SE Captains Flat NSW
AUST	8/12/08	013430.68	36.881	145.718	0	2.6	SE Euroa Vic
AUST	15/12/08	165248.82	30.409	118.889	7	2.8	Near Woongaring Hills WA
AUST	28/12/08	140206	33.44	138.31	0	2.5	S Orroroo SA
MEL	18/12/08	222230.1	24.75	150.61	10	2.6	Felt Rawbelle Qld

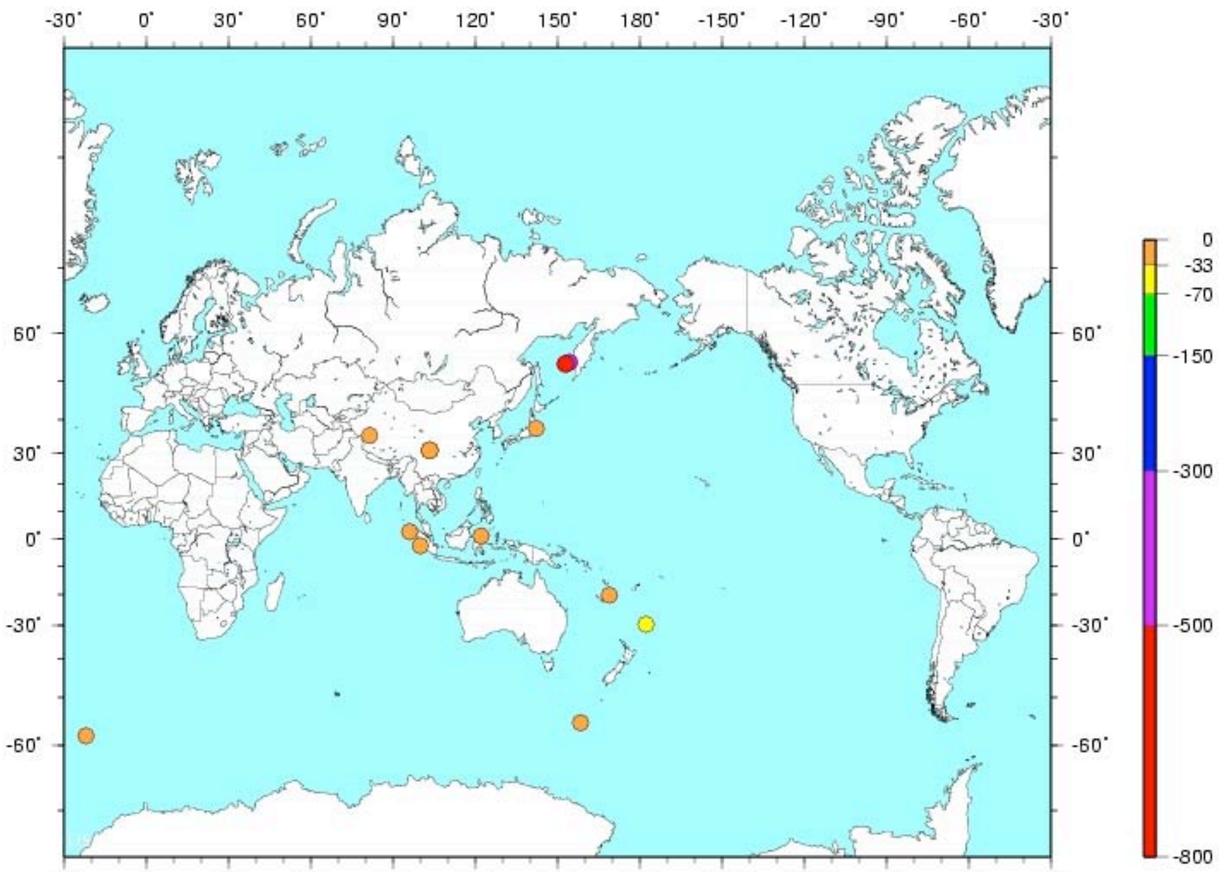


World M≥2.5

The seismicity was slightly below average with no 'great' earthquake and an average of one earthquake per month of magnitude 7 or more of which ten were shallow, the other two deep. Damage and consequent loss of life was dominated by the destructive M7.9 earthquake near Sichuan China on 12 May which was discussed at AEES 2008 and is briefly described in a separate article in this Newsletter by Professor Hong Hao. The USGS lists 87,587 people killed in this single event, some 5000 of them school children. This earthquake had a thrust or reverse mechanism on the northeast striking Longmenshan fault within the Eurasian Plate. A table and world epicentre map from the USGS are shown below.

Acknowledgment: Thanks to GA (AUST), ES&S (MEL), PIRSA (ADE) and the USGS for sharing their data.

Source	Date	Time UTC	Lat	Long	Depth km	Mw	Location
USGS	0220	080830.52	2.77	95.96	26	7.4	Sumatra
USGS	0225	083633.03	-2.49	99.97	25	7.2	Sumatra
USGS	0320	223257.93	35.49	81.47	10	7.2	Western China
USGS	0409	124612.72	-20.07	168.89	33	7.3	Vanuatu
USGS	0412	003012.60	-55.66	158.45	16	7.1	Macquarie Ridge
USGS	0512	062801.57	31.00	103.32	19	7.9	Wenchuan China
USGS	0630	061744.89	-58.22	-22.10	19	7.0	South Atlantic
USGS	0705	021204.48	53.88	152.89	632	7.7	Kamchatka
USGS	0719	023928.70	37.55	142.21	22	7.0	Japan
USGS	0929	151931.59	-29.76	-177.68	36	7.0	Kermadec Trench
USGS	1116	170232.70	1.27	122.09	30	7.3	Sulawesi
USGS	1124	090258.76	54.20	154.32	492	7.3	Kamchatka



From our Members (George Walker)

Some Comments on the Ultimate State Design Return Period for Earthquakes

Recently there was an exchange of information on the AEES electronic network about the return period earthquake ground motion which should be used for the design of structures at the ultimate strength limit state. Around the world a return period of about 500 years appears to have been commonly accepted as appropriate, supposedly based on the application of the structural reliability theory, although it appears in many ways to be more based on convention. What appears to have happened is that strength design criteria has been developed such that in combination with a load having a probability of occurrence of about 10% in an assumed 50 year life of a typical structure, which equates to an average return period of 475 years, it gives the target probability of failure. (Why it is not just termed the 500 year return period is not clear as it is not possible to estimate such extreme events with such accuracy!)

Such an approach assumes that it doesn't matter if a more extreme event occurs. Unfortunately many of the events that cause catastrophic disasters are more extreme events. Building codes have largely been developed by structural engineers with a focus on the safety individual buildings, this being the primary responsibility of individual designers. The move to limit state design and the associated development of structural reliability theory was a major milestone in the history of structural engineering design for which those involved in it can feel very proud. However so established has structural reliability theory become that it is now in danger of becoming the straightjacket that working stress design had become. It is a great theory, and a great advance on working stress design, but it also has its limitations. A major one relates to the mitigation of major disasters.

In disasters it is the performance of a whole community of buildings that is important, not an individual building. Engineers might argue that if each individual building is built to an adequate standard then the performance of the whole community of buildings will also be adequate. This assumes a linear relationship between the impact of the performance of an individual building and that of a community of buildings. However the relationship is very non-linear. A $15 billion earthquake in Australia – which is what the insurance industry considers its maximum credible event loss in Australia - will have a lot more than 5 times the impact of the Newcastle earthquake, which in current terms would probably be about a $3 billion insured loss. When dealing with disasters, the size of the community at risk is as important as the vulnerability of individual buildings, and the magnitude of the maximum credible event is more important than one with some arbitrarily assigned average return period of occurrence.

The use of 500 years as an appropriate return period for structural design appears to have originated in the relatively high seismic areas of California and New Zealand, where because of the nature of the highly active faults in the region an earthquake with a return period of 500 years will also be generally close to the maximum credible earthquake. This is not true of low seismic regions like most of Australia, where the return periods of major earthquakes close to major population centres may be several thousand years, with the estimated 500 year event being essentially a background seismic event and much less than the maximum credible event. Structural reliability theory as currently applied gives no guidance on this aspect of design, but in ignoring it the structural engineering profession is overlooking one of its responsibilities to the community. One of the major socio-economic driving forces in the world today is the concept of sustainability. There are many aspects to sustainability. Disaster management is now recognised as one of them. The modern focus of disaster management is the design of communities which are resilient to the impact of major rare events, natural or human in origin. This requires solutions that recognise all the salient characteristics of disasters including the effects of community size and importance of considering the maximum credible event.

This does not necessarily mean that buildings should be rigorously designed for the maximum credible event, although it does mean that the design level should be based on the return period of an event anywhere in the major centre of population, not the return period at a point location, which would at least ensure some account of community size is incorporated. But it does mean that the possibility of the maximum credible event should be recognised and that buildings be designed to be resilient to such events with a focus on minimisation of loss of life and structural collapse, not necessarily prevention of these. This is not novel. At the 2005 AEES conference Paul Grundy and I proposed a third limit state which we called the disaster limit state which focussed on resilience or robustness in events larger than those corresponding to the ultimate design limit state, and since then Paul has been very active in promoting the concept. May be the time has come to do more than just talk about it.

Kwang-Hua World Forum on Wenchuan Earthquake and Post-quake Reconstruction

October 9-11, 2008 Shanghai, China

A brief report by Hong Hao, member AEES, School of Civil and Resource Engineering, University of Western Australia

The major earthquake on 12 May 2008 in Wenchuan, China caused massive destructions to infrastructure and significant loss of life. The total death toll is about 80,000 plus about 400,000 injuries. More than 50 million people were affected. The direct economic loss is estimated to be more than 1000 billion Chinese Yen (about 200 billion Australian dollars), and the indirect economic loss is expected to be much more than that figure. The GDP growth of Sichun province in 2008, the most populated province in China, is 5% less and the tourism income is only about 50% of that in 2007.

The event attracted a lot of media coverage worldwide. The State Council of China on 2nd of June 2008 passed a resolution on post-quake restoration and reconstruction. As the first step it requires a re-evaluation of the seismicity and the design ground motion levels in the region, and an assessment of the design and construction practice for earthquake-resistance structures.

Earthquake engineering communities around the world also showed great concern and interest in the event. Some researchers and engineers had performed preliminary analyses of the seismicity, earthquake mechanism and structural responses based on available information and data. In view of these and the upcoming 14th World Conference on Earthquake Engineering in Beijing, China on 12-17 October 2008, the Kwang-Hua Education Foundation, a private foundation based in Taiwan, sponsored a Kwang-Hua World Forum on the Wenchuan Earthquake and Post-Quake Reconstruction on 9-11 October in Shanghai, China. The forum was jointly organized by the State Key Laboratory for Disaster Reduction in Civil Engineering in Tongji University, and the School of Civil Engineering of Tongji University, and co-chaired by Prof. Xilin Lu of Tongji University and Prof. K. C. Tsai of the National Taiwan University.

About 60 people, including researchers, academics, practicing engineers and government officers attended the forum by invitation. 35 participants were from outside mainland China, 13 from Japan, 12 from USA, 3 from Taiwan, 2 from Italy, 1 each from Australia (Hong Hao from the University of Western Australia), Canada, Hong Kong, Korea and the UK.

The topics for discussion, as specified by the forum organizer, include but was not limited to geological aspects and ground failure, structure damage (building, bridge, dam and lifelines), seismic code modification, technologies for performance improvement of earthquake-resistant structures, applications of new technologies in reconstruction, lessons and experiences gained in reconstruction in other regions hit by previous major earthquakes.

The forum consisted of presentations by participants and free discussions. A few presentations were very interesting, Prof. Yayong Wang of the Chinese Academy of Building Construction and editor of the Chinese Seismic Design Code for Building Structures made a presentation titled 'Revelation of seismic damage of buildings in Wenchuan earthquake and revision of Chinese seismic design code for buildings'. Prof. Wang said that the site investigations by himself and by researchers from the Chinese Academy of Building Construction and many other universities and institutes revealed that although the design earthquake ground motion level was below what was actually experienced, besides ground failure induced building damage, no major damage was found for buildings designed and constructed according to the Chinese Design Code for Building Structures. However, minor to moderate damage was widespread in many buildings. The Chinese code committee quickly revised the Chinese Design Code for Building Structures according to these preliminary investigations. The new code was released and implemented in September, about four months after the Wenchuan earthquake. Intensive changes had been made in the new code. The Wenchuan area is upgraded from design intensity level 7 to level 8. In particular, special considerations are required in the design of school buildings.

The presentation by Ms Yuan Feng, chief engineer of the Southwest Structure Design Institute, confirmed the comments by Prof. Wang that no collapse was found in buildings designed and constructed according to the building code. Ms Feng proudly mentioned that her institute designed many buildings in the area, including about 200 school buildings. None of them suffered major damage. Some of the residential buildings designed by her institute suffered moderate damage because of structural alteration, some of which included demolishing of some load-bearing walls for renovations by the owners. She pointed out that enforcing the design code in construction is more critical for structure protection. She also observed many columns damaged while no beams were damaged although the structures were designed according to the "strong column weak beam" philosophy. Therefore, achieving the strong column and weak beam in practice is a challenge that needs further research.

Dr. Taiki Saito from the Japanese Ministry of Construction presented the Japanese post-quake damage assessment system, which attracted a lot of interest and discussion as there is no such system in China.

Other presentations included the introduction of Japanese practice in evaluation and strengthening of the earthquake capacity of school buildings; Reconstruction of lifelines after the Kobe earthquake; Reconstruction practice after the Chi-Chi earthquake; Seismic retrofit of school buildings in Taiwan; US earthquake insurance system; and the US dam emergency action plans, etc.

The participants of the forum believed that the Chinese design and construction specifications deserve further intensive research and development in order to reduce the seismic loss. Enforcement of these specifications and construction quality control are also critical to eventually fulfil the design goals. Based on discussions in the forum, the organizer drafted a recommendation document which will be submitted to the respective Chinese authorities.

The recommendation lists 20 action plans that need to be carried out, including performing PSHA analysis to better predict the seismic actions; study the interplate and intraplate earthquake ground motion characteristics; organize and publish the recorded ground motion data during the Wenchuan earthquake; study and identify the reasons that many school buildings collapsed; review the design and construction technologies of adjacent buildings to investigate why certain buildings only suffered minor damage, whereas others collapsed; investigate the necessity of including velocity response spectrum for design of buried structures; prepare and publish a comprehensive report about the Wenchuan earthquake for documentation purpose; study the performance of dams in the area; instrument selected buildings to better understand their performance; study the influence of vertical motion on building performance with base isolation; research strategies to improve the design quality and control the construction quality; develop strategies, tools and materials and train social workers to help survivors; correlate the PGA based intensity vs. actual acceleration experienced by buildings; study the earthquake insurance programs of other countries and the possibility of implementing a similar system in China; investigate the effects of non-structural components (such as brick walls) on building performance; and develop risk-based retrofitting policies and programs for important structures such as hospital buildings in China. The recommendation is still being circulated among all the participants. It is expected to be finalised soon.

After the forum, more than half of the participants travelled to Beijing on 12 October 2008 to attend the 14th WCEE.

From our Members (Col Lynam, Brisbane)

Here is a simple gift that you could donate to your local High School and maybe capture the interest of a future Earthquake Engineer.

Vertical School Seismometer
Detect earthquakes and tremors early, even before media reports. With the Vertical School Seismometer, students can watch a developing event unfold and analyze the recordings of generated waves. Built on the proven Incorporated Research Institutions for Seismology standards, this instrument can be placed in any stable, relatively undisturbed location, and it will deliver P and S-wave earthquake signals all day. The seismometer comes with Windows software which displays a full day's recordings on a single screen, automatically saves, and organizes the data for later analysis. The software supports identification of different types of ground waves in an earthquake, extraction of the earthquake signal, and determination of the distance and intensity of the quake.

13 V 4130 Vertical School Seismometer $499.95

System Requirements: Windows 2000 or higher, USB. Size: 18 1/3□L x 8 1/4□W x 12 2/3□H; weight: 3.75 lbs.

Cited at:

http://wardsci.com/product.asp_Q_pn_E_IG0018602_A_Vertical+School+Seismometer

http://science.uniserve.edu.au/school/Seismograph/datalogger/index.html

Abstract of Interest

ISET Journal of Earthquake Technology, Paper No. 477, Vol. 44, No. 1, March 2007, pp. 71–99

On the Regional Dependence of Earthquake Response Spectra

John Douglas ARN/RIS, BRGM, 3 avenue C. Guillemin, BP 36009 45060 Orléans Cedex 2, France

Abstract: It is common practice to use ground-motion models, often developed by regression on recorded accelerograms, to predict the expected earthquake response spectra at sites of interest. An important consideration when selecting these models is the possible dependence of ground motions on geographical region, i.e., are median ground motions in the (target) region of interest for a given magnitude and distance the same as those in the (host) region where a ground-motion model is from, and are the aleatoric variabilities of ground motions also similar? These questions can be particularly difficult to tackle in many regions of the world where little observed strong-motion data is available since there are few records to validate the choice of model. Reasons for regionally dependent ground motions are discussed and possible regional dependence of earthquake response spectra is examined using published ground- motion models, observed accelerograms and also by using ground motions predicted by published stochastic models. It is concluded that although some regions seem to show considerable differences in spectra it is currently more defensible to use well-constrained models, possibly based on data from other regions, rather than use predicted motions from local, often poorly-constrained, models.

Congratulations!

We extend congratulations to former President of AEES, Prof Graham Hutchinson, who was recognised in this year's Australia Day honours with the award of Member (AM) in the General Division of the Order of Australia.

Name: HUTCHINSON, Graham Leighton
Award: Member of the Order of Australia
Date granted: 26 January 2009
Citation: For service to civil engineering, particularly in relation to the structural consequences of earthquakes through research, educational and advisory roles and contributions to professional organisations.

Know your Earthquake Engineer/Seismologist

Looking for light at the end of the tunnel - Gary Gibson loves getting into the focus of an earthquake, in this case at the bottom of a gold mine in South Africa, 3.2 km underground.

Note: Please send in your special photo for next Newsletter issue.

NZSEE 2009 Annual Conference

Date: **3-5 April, 2009**
Venue: **Christchurch, New Zealand**

The New Zealand Society for Earthquake Engineering Conference is an annual forum where current research and practice related to earthquake engineering is presented in papers and posters.

Theme: Why do we still tolerate buildings that are unsafe in earthquakes?

Four years from the enactment of The Building Act 2004, many buildings nationwide have been identified to pose significantly higher than normal risk to occupants in earthquakes. The response of the different territorial authorities has varied from proactive to passive. This conference aims to increase the awareness of New Zealand's seismic vulnerability and to explore ideas and practical steps beyond identification.

Conference session categories include:

- Pathways to Earthquake Resilience
- Lessons from Earthquakes through Time
- Mitigating the Social and Economic Impacts of Earthquakes
- Advances in Hazards Definition
- Advances in Earthquake Engineering Practice
- Planning for Earthquake Response and Recovery

2009 AEES Conference

As our President has mentioned the 2009 AEES Conference and Annual General Meeting will be held in Newcastle NSW from 4 to 6 December. More information will follow but be sure to put this date into your diary.

Guests at AEES 2008 dinner at Sovereign Hill, Ballarat
L-R: Gary Gibson, Murty Challa, Paul Grundy, John Wilson, Dave Brunsdon, George Walker, Sonja Lenz

Other Conferences

International Conference on Performance-Based Design in Earthquake Geotechnical Engineering

Date:	15-17 June, 2009
Venue:	Tokyo, Japan
Website:	www.comp.tmu.ac.jp/IS-Tokyo/
Email:	ytsoil@rs.noda.tus.ac.jp

This conference will cover a range of topics associated with performance-based design in earthquake geotechnical engineering.

ATC & SEI Conference on Improving the Seismic Performance of Existing Buildings and Other Structures

Date:	9-11 December, 2009
Venue:	San Francisco, California
Website:	www.atc-sei.org
Abstracts:	Due by 27 February, 2009

This inaugural conference, organized by the Applied Technology Council and the Structural Engineering Institute of the American Society of Civil Engineers (ASCE), is dedicated solely to improving the seismic performance of existing buildings and other structures. For full details visit the conference website.

The Conference Program Committee is currently accepting abstracts for individual presentations and proposals for complete sessions. Submission will be accepted until February 27, 2009. The conference will include both oral and poster presentations. Novel session formats, such as panel discussions and debates, are encouraged.

9th US National & 10th Canadian Conference on Earthquake Engineering

Date:	2010
Venue:	Westin Harbour Castle Hotel, Toronto, Canada
Abstracts:	Deadline 31 March, 2009 (500 word max)
Website:	www.2010eqconf.org

The 9th U.S. National and 10th Canadian Conference on Earthquake Engineering to be held in Toronto, Canada, in 2010 will provide an opportunity for both researchers and practitioners to share the latest knowledge and techniques for understanding and mitigating the effects of earthquakes. This is the first time that a conference of this scale is being organized jointly by the Earthquake Engineering Research Institute and the Canadian Association for Earthquake Engineering. The conference will provide a
unique environment to facilitate synergy between U.S. and Canadian colleagues, as well as other participants from around the world. This conference will bring together professionals from a broad range of disciplines, including architecture, structural engineering, seismology, geology, geophysics, geotechnical engineering, business, public policy, social sciences, regional planning, emergency response planning, and regulation.

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