THE SOCIETY FOR EARTHQUAKE AND
CIVIL ENGINEERING DYNAMICS

An Associated Society of the Institution of Civil Engineers

EVENING MEETING:

THE MARKET RASEN EARTHQUAKE (M=5.2) AND ADVANCES IN UK SEISMIC HAZARD ASSESSMENT FOR HIGH CONSEQUENCE INDUSTRIES

Wednesday 28 May 2008 at 18:00hrs

Institution of Civil Engineers, One Great George
Street, London, SW1P 3AA

Speakers

Roger Musson, BGS
Julian Bommer, Imperial College
Andreas Rietbrock, Liverpool University

SYNOPSIS OVERLEAF

Chaired by:

Chris Browitt
University of Edinburgh

Please note that there is no charge to attend. Seats will be allocated on a first come, first served basis. Tea and biscuits will be served from 5.30-6pm.

The 27 February 2008 Market Rasen Earthquake **SYNOPSIS**

RMW Musson, B Baptie, L Ottemoller and SL Sargeant

The largest UK earthquake in almost 25 years struck just before 01:00 GMT on 27 February 2008. The epicentre was approximately 4 km north of Market Rasen, but the earthquake was widely felt across England and Wales, with the most distant reports coming from Aberdeen, Truro, Ireland and Belgium. BGS also received reports of damage to chimneys and masonry over a widespread area. The magnitude of the earthquake is estimated at 5.2 ML (4.5 Mw), making it the largest earthquake in the UK since a magnitude 5.4 ML earthquake struck North Wales in 1984, which was also widely felt across England and Wales. Questionnaire data was gathered over the internet by BGS, which, when combined with data collected by other agencies provided a data set of over 31,000 responses from around 2,700 localities. Intensities (assessed by an automatic algorithm) were as high as 6 EMS sporadically over a wide area, but with no concentration near the epicentre, a pattern most likely explained as due to a focal depth of over 20 km. A damage survey made the day of the earthquake found only slight damage to a few chimneys in the area around Market Rasen. Does this earthquake change our view of seismic hazard distribution in the UK?

Uncertainty in Seismic Hazard Analysis for Low Seismicity Regions

Julian J Bommer

The design of critical facilities such as nuclear power plants needs to consider the loads that could be imposed by earthquakes even in regions of low seismicity because the potential consequences of damage due to such events, even though their occurrence may be associated with low probabilities. With relatively sparse historical and instrumental earthquake catalogues, and little if any association of earthquakes with tectonic structures, the development of seismicity models to represent the location, frequency and magnitude of possible future events presents a particular challenge. An even greater challenge, and one that potentially has an even more pronounced impact on the hazard estimates, is the selection of appropriate ground-motion prediction models for such regions, where strong-motion datasets are at best sparse and dominated by recordings from small-magnitude events. The presentation will briefly discuss the issues related to selecting a suite of ground-motion models for PSHA in low-seismicity regions, focusing in particular on the degree to which there may be genuine regional differences in ground motions, and the perils of using empirical equations derived from small-magnitude local earthquakes.

The Acquisition of Source, Path and Site Effects from Microearthquake Recordings using Q Tomography: Application to the UK

A. Rietbrock, B. Edwards, B. Baptie and J. Bommer

Source, site and propagation parameters are inverted from a UK database of weak motion events (2.0 > ML > 4.7). This results in the complete spectral parameterisation of over 3200 velocimetric records of 273 events from the year 1992 to 2006. The S wave is extracted from the vertical records and is processed using a multitaperFouriertransform. We initially use a nonlinear least squares logspace optimisation to obtain estimates of the attenuation parameter for each spectrum. The estimates of t* are then used to geometrically constrain a depth dependent Q model using a technique adapted from velocity tomography. We then invert for the remaining frequency dependent parameters and a collective amplitude parameter from the velocity spectra whilst fixing the newly computed attenuation parameters based on ray tracing through our Q model. The resultant amplitude parameters are then split into source moments, apparent geometrical spreading and site correction factors. We find a frequency-independent, depth-dependent Q structure. A linear relationship proportional to 0.7ML between moment magnitude (Mw) and local magnitude (ML) is found in the range of 2 to 4.7ML. The majority of stress drops are found to range from the order of 0.1 to 10 MPa. A multiple segment apparent geometrical spreading model is found to best describe the amplitude decay with distance, accounting for factors such as geometrical spreading and scattering, along with multiple phase interference in the analysis window.