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A Summary of Earthquakes in 2006

David Galloway presents a summary of seismic activity in 2006

Overseas

This year was not exceptional in terms of the number of worldwide earthquakes (Figure 1). There was one 'great' earthquake (magnitude over 8.0), ten 'major' earthquakes (magnitudes between 7.0 and 7.9) and 138 'strong' earthquakes (magnitudes between 6.0 and 6.9). These numbers are comparable with the long-term averages for these magnitude ranges, which are, one, seventeen and 134, respectively. The number of people reported killed by earthquakes during 2006 was 6,569 (Table 1), which is significantly less than in the previous three years; 76,649 in 2005, 284,007 in 2004 and 46,021 in 2003.

Most Significant

The vast majority of the fatalities in 2006 (over 87%) occurred as a result of a magnitude 6.3 Mw earthquake in Java, Indonesia on 26 May. At least 5,716 people were killed, 37,927 others were injured, over 154,000 houses were destroyed and a further 260,000 were damaged leaving around 600,000 people homeless. Most of the damage and casualties occurred in the districts of Bantul in

Contents

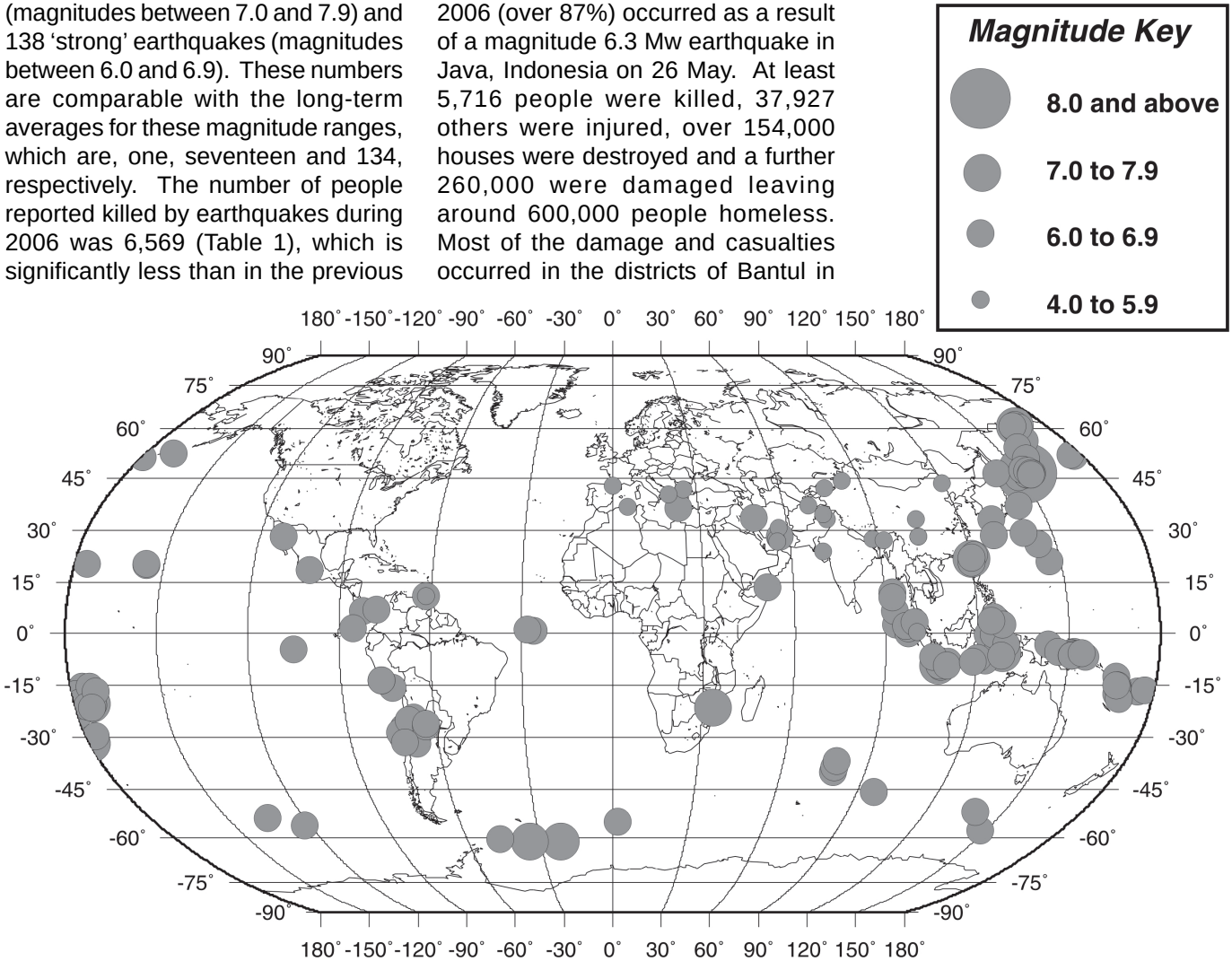

Figure 1 Notable World Earthquakes of 2006

DATE	LAT	LON	MAG	LOCATION	DEATHS
14 February	27.38 N	88.39 E	5.3 MW	Sikkim, India	2
22 February	21.32 S	33.58 E	7.0 MW	Mozambique	4
10 March	33.13 N	73.89 E	4.9 MB	Pakistan	1
14 March	3.60 S	127.21 E	6.7 MW	Seram, Indonesia	4
20 March	36.62 N	5.33 E	5.0 MB	Northern Algeria	4
25 March	27.57 N	55.69 E	5.9 MW	Southern Iran	1
31 March	33.50 N	48.78 E	6.1 MW	Western Iran	70
26 May	7.96 S	110.45 E	6.3 MW	Java, Indonesia	5,716
17 July	9.25 S	107.41 E	7.7 MW	Java, Indonesia	730
22 July	28.00 N	104.14 E	5.0 MB	Yunnan, China	22
29 July	37.26 N	68.83 E	5.6 MW	Tajikistan	3
25 August	28.01 N	104.15 E	5.2 MB	Yunnan, China	1
29 September	10.81 N	61.76 W	6.1 MW	Trinidad & Tobago	1
01 December	8.25 S	118.78 E	6.3 MW	Sumbawa, Indonesia	1
17 December	0.63 N	99.86 E	5.8 MW	Sumatra, Indonesia	7
26 December	21.80 N	120.55 E	7.1 MW	Taiwan	2
					6,569

Table 1. Earthquakes causing deaths in 2006

Yogyakarta Province and Klaten in Central Java Province. The total loss has been estimated at $US3.1 billion. Casualties were high, despite the fact that 6.3 Mw is only a moderate size of earthquake, because it was fairly shallow and occurred in a densely populated area. The earthquake epicentre was in the Indian Ocean approximately 33 km south of Bantul district. More than 750 aftershocks occurred with the largest having a magnitude of 5.2 Mw. The tectonics of Java are dominated by the subduction of the Australian plate north-northeastward beneath the Sunda plate with a relative velocity of about six cm/year. The Australian plate dips north-northeastward from the Java trench, reaching depths of 100-200 km beneath the island of Java and depths of around 600 km north of the island. The earthquake occurred at a shallow depth in the overriding Sunda plate above the dipping Australian plate.

On 17 July, a magnitude 7.7 Mw earthquake occurred south of Java, Indonesia. It killed at least 730 people, left over 9,000 injured, destroyed or damaged around 1,620 buildings, destroyed or damaged over 870 boats and severely damaged many roads in Jawa Barat and Jawa Tengah. All deaths and damage were as a result of a tsunami that was generated.

The one 'great' earthquake to occur during the year, with a magnitude of 8.3 Mw, occurred approximately 500 km south-southwest of the Kuril Islands, Russia and approximately 1,600 km northeast of Tokyo, Japan on 15 November. One person was injured at Waikiki, Hawaii as a result of a tsunami with a measured wave height of 34 cm at Honolulu, Hawaii and two docks were destroyed and another one damaged at Crescent City, California by a tsunami with a measured wave height of 176 cm. Damage has been estimated at US$750,000. It is the largest earthquake to have occurred in the central Kuril Islands since the early 20th century. It occurred as thrust-faulting on the boundary between the Pacific plate and the Okhotsk plate. In the region of the earthquake epicentre, the Pacific plate moves northwest with respect to the Okhotsk plate at a rate of about nine cm/year and subducts beneath the Okhotsk plate at the Kuril trench. The 15 November earthquake occurred at shallow depth within about 80 km of the trench axis.

Others

On 14 February, an earthquake with a magnitude of 5.3 Mw, occurred in the state of Sikkim, India. It killed two people, injured two others and caused structural damage to several buildings in and around the state capital Gangtok. The two deaths occurred as a result of landslides at Sherathang, West Bengal.

A magnitude 7.0 Mw earthquake occurred on 22 February in Mozambique, near the southern end of the East African rift system, resulting in the deaths of four people and causing injury to 36 others. Damage to over 290 buildings and power outages were reported from the epicentral area around Espungabera, Beira and Chimoio. The buildings that sustained the damage included several schools, hospitals and clinics. The earthquake was felt strongly throughout Mozambique and was also felt in the surrounding countries of Zimbabwe, South Africa, Swaziland, Botswana and Zambia.

An earthquake, on 10 March, with a relatively small magnitude of 4.9 Mb, killed one person, injured 22 others and damaged many homes in the Mirpur District, Pakistan.

A damaging 6.7 Mw earthquake, in the Maluku Province of Indonesia, on 14 March, resulted in the deaths of four people and caused injury to scores more. One of the reported deaths occurred as a result of a local tsunami

which was generated, with an estimated wave height of seven metres observed on the island of Buru. Ground cracks up to 500 metres long, liquefaction and extensive damage was reported from the islands of Seram and Buru. The majority of the damage, to almost 250 houses, occurred in the villages of Pela, Batu Jugku, Waimorot, Wailawa and Waimoly on Buru Island.

In northern Algeria, on 20 March, four people (one woman and three children) were killed, another nine were injured, 30 houses were destroyed and another 32 were damaged in the town of Laalam in the Province of Bejaia, during a magnitude 5.0 Mb earthquake. The epicentre of the earthquake was near the town of Kherrata, approximately 200 km east of the capital Algiers. Water, power and communications were severely disrupted in the epicentral region and landslides were reported to have blocked a number of main roads in the area, hampering rescue efforts. A magnitude 6.8 Mw earthquake which occurred in the same region, on 21 May 2003, killed 2,266 people, injured 10,000 others, left approximately 150,000 people homeless and destroyed over 1,200 buildings and around 45% of the health facilities in the Algiers area, causing approximately US$100 million worth of damage.

On 25 March, near the town of Fin in the Hormozgan Province of southern Iran, one person was killed as a result of an earthquake with a magnitude of 5.9 Mw. The earthquake was felt strongly at Bandar Abbas, Iran and was also felt at Abu Dhabi, Dubai, Ras al-Khaymah and Sharjah, United Arab Emirates.

In western Iran, on 31 March, 70 people were killed, over 1,300 were injured, and around 45,000 buildings were destroyed or severely damaged, during a magnitude 6.1 Mw earthquake in the region. In total, around 40 villages were completely destroyed and another 300 suffered widespread damage in the Borujerd and Dorud areas of Lorestan Province. In Borujerd, a third of the historic old city was severely damaged and numerous major historic monuments were destroyed. The relatively low death toll has been attributed to many people leaving their homes in response to a warning by authorities following a series of weaker foreshocks several hours beforehand. The earthquake was located approximately 350 km SW of the capital Tehran. The earthquake occurred as the result of stresses generated by the motion of the Arabian plate northwards against the Eurasian plate at a rate of two to three cm/year.

Two fatal and damaging earthquakes occurred in Yunnan Province, China during 2006. The first, on 22 July with a magnitude of 5.0 Mb, killed 22 people, injured 106 more and destroyed or damaged over 39,000 houses affecting some 153,000 people in the Counties of Yanjin, Daguan, Yiliang and Yongshan. The second, with a magnitude of 5.2 Mb, occurred on 25 August and killed one person, injured 31 others and caused further damage to thousands more houses in the region. A number of reservoirs, power plants, bridges and railways were also damaged as a result of these earthquakes.

On 29 July, an earthquake with a magnitude of 5.6 Mw, occurred in Tajikistan. It killed three people, injured scores more and destroyed or extensively damaged over 2,500 houses in eight settlements in the Qumsangir district, including nine schools and several health care facilities, affecting over 15,000 people. The fatalities were three young children who were killed when a wall collapsed on top of them.

An earthquake with a magnitude of 6.1 Mw, occurred on the island of Trinidad, Trinidad and Tobago on 29 September. In Trinidad, one person was killed in Gasparillo and three others were injured in the Port-of-Spain area. Several buildings were damaged on both the islands of Trinidad and Tobago. Another earthquake, magnitude 5.5 Mw, occurred in the same region, approximately 5 hours later, causing additional damage. Both earthquakes were felt strongly throughout Trinidad and Tobago and were also felt in Venezuela, Grenada, St Lucia, Barbados and St Vincent and the Grenadines.

On 1 December, an earthquake, with a magnitude of 6.3 Mw, occurred in the Sumbawa region, Indonesia resulting in the death of one person. Fourteen others were injured, 20 homes were destroyed and many more were damaged on Bima. Sixteen days later, on 17 December, another earthquake in Indonesia, with a magnitude of 5.8 Mw occurred near the island of Sumatra. Seven people were killed, more than 100 others were injured and around 680 homes were either destroyed or damaged in the Muarasipongi area. Key roads, connecting north and west Sumatera, were blocked by landslides which left some 20 villages in the area inaccessible.

A 'major' earthquake, with a magnitude of 7.1 Mw, struck near the southern coast of Taiwan on 26 December. The epicentre was approximately 25 km southwest of the Hengchun township in Pingtung County. Approximately eight minutes later, an aftershock, with a magnitude of 6.9 Mw, occurred. Two people were killed, 42 were injured, three apartment buildings were destroyed and over 130 schools were damaged as a result of this earthquake and subsequent aftershock. Several international submarine fibre-optic cables were also damaged, disrupting internet and telephone communications in Taiwan, Hong Kong, Japan, China, South Korea, Philippines, Malaysia, Singapore and Thailand.

UK Earthquakes

There were 64 earthquakes located by the monitoring network during the year (Figure 2), with 15 having magnitudes of 2.0 ML or greater and four having magnitudes of 3.0 ML or greater. Three events with a magnitude of 2.0 ML or greater were reported felt, together with a further four smaller ones, bringing the total to seven felt earthquakes in 2006.

The largest onshore earthquake of the year with a magnitude of 3.5 ML occurred approximately 8 km north-north-west of Dumfries on 26 December at 10:40 UTC, at a depth of 8 km. The BGS received a number of reports via the media, Dumfries Police and from a number of residents in the Dumfries area of Dumfries &

Figure 2. Epicentres of all UK earthquakes located in 2006 (from the Bulletin of British Earthquakes 2006)

Galloway. The reports described, "people came out into the street to see what was going on", "the whole experience was really scary", "the roof slates and timbers rattled and shook" and "I was awoken by a noise and the shaking and swaying of the house". This earthquake was followed by an event with a magnitude of 1.7 ML with a similar location, on 30 December. A macroseismic survey was launched on the BGS 'Earthquakes' web site, which yielded over 300 replies. The most distant felt reports were from the southern Glasgow area approximately 100 km away and from the Stranraer area approximately 95 km to the west. The earthquake was felt over an area of 3,600 sq km for isoseismals 3-5. The highest observed intensity was 5 EMS which was observed over an area of approximately 230 sq km. This event locates in a similar location to the magnitude 3.0 ML Dumfries earthquake of 13 May 2001, which was also felt with intensities of 5 EMS.

The largest offshore earthquake occurred in the Norwegian Sea on 18 August, with a magnitude of 3.8 ML. It was located approximately 360 km north of Lerwick, Shetland Islands. A further four events occurred in the North Sea and adjacent waters during the year, with magnitudes ranging between 2.3 and 3.3 ML.

On 12 January an earthquake with magnitude of 2.6 ML, occurred near Basingstoke, Hampshire. This earthquake is located in an area where only two other earthquakes have been recorded within 25 km of the epicentre. One with a magnitude of 3.0 ML, which occurred on 19 July 1982, was felt with an intensity of at least 4 EMS. The other event with a magnitude of 2.1 ML occurred on 27 July 1985.

An earthquake with a magnitude of 2.8 ML occurred on 19 January, with a location approximately 10 km east of Mallaig, Highland. The BGS received reports from residents in Mallaig and from Glenfinnan, which described a "loud bang followed by a loud rumbling noise", indicating an intensity of at least 3 EMS. This event locates approximately 27 km northwest of the magnitude 3.0 ML Fort William earthquake on 10 December 2005, which had a maximum intensity of 4 EMS

A magnitude 1.9 ML earthquake occurred on 20 April, with an epicentre close to Ballachulish, Highland. The BGS received a single report from a resident of Ballachulish who said, "it sounded like a blast going off and a rumble", indicating an intensity of 3 EMS. The earthquake was the largest in the general area since a magnitude 3.0 ML event on 10 December 2005, which was felt with intensities of at least 4 EMS in the epicentral area. A second event was felt in the Ballachulish area on 13 October, and was also reported felt by a resident of Ballachulish, who "felt a slight shaking", indicating an intensity of 2 EMS.

An earthquake with a magnitude of 1.5 ML occurred near Anglesey, North Wales, on 23 May. The BGS received reports via BBC North Wales stating that several residents in the south Anglesey area felt the tremor.

On 8 June, a magnitude 2.9 ML earthquake occurred near Shieldaig, Highland. The BGS received a number of reports from people in Gairloch, Achnasheen, Stromeferry and Ardaneaskan, Highland region. Reports such as, "the whole floor vibrated", "the whole house shook", and "we thought the chimney had fallen down", indicated an intensity of at least 4 EMS. A magnitude 0.4 ML earthquake also occurred in the Shieldaig area on 29 June.

An earthquake with a magnitude of 1.8 ML occurred on 19 December near Looe, Cornwall. The BGS received reports of the earthquake being felt by residents in Carludden, St Austell and Herodsfoot. The residents reported "thought it was thunder, "it only lasted about a second" and "the whole house really shook". Historically, the largest event in the region with a magnitude of 3.4 ML, occurred on 12 August 1852 near Callington, Cornwall and was felt with intensities of approximately 4 EMS.

In the Gruinard Bay area of the Highland region, two earthquakes with magnitudes of 2.0 and 1.6 ML occurred on 6 February and 2 April.

Two earthquakes, both with magnitudes of 1.1 ML, occurred in the Ludlow area of Shropshire 8 minutes apart, on 23 March. Another event in the same area, with a magnitude of 2.0 ML, occurred on 5 November.

The 'Bulletin of British Earthquakes 2006' edited by B A Simpson and D D Galloway and previous years' bulletins can be obtained from BGS Seismology and Geomagnetism or from the Seismology Website at http://www.earthquakes.bgs.ac.uk/. For further details contact: D D Galloway, Seismology and Geomagnetism, British Geological Survey, Murchison House, West Mains Road, Edinburgh, EH9 3LA, Scotland, UK.

Report on Building Damage from the 28th April 2007 Kent (Folkestone) Earthquake and Intensity Evaluation

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On Saturday April 28, 2007 an earthquake of magnitude Mw 4.0 (BGS) shook the county of Kent, United Kingdom. Early reports from Shepway Council revealed that damage had occurred to buildings in Folkestone and that one person had been injured in the earthquake. On hearing news of the earthquake, the authors carried out walk-over surveys of Folkestone on the 28th April and on the 1st May 2007, covering the areas shown with red markers on Figure 1.

Observed Damage

The walk-over surveys revealed the damage to be concentrated over a localised area in the north of Folkestone. Affected houses were predominantly Victorian red-brick masonry houses with timber joist floors, pitched roofs and brick chimneys. The houses ranged between two- and three-storeys in height (above ground), some also having basements. These were mainly built for housing workers and have not been well-maintained.

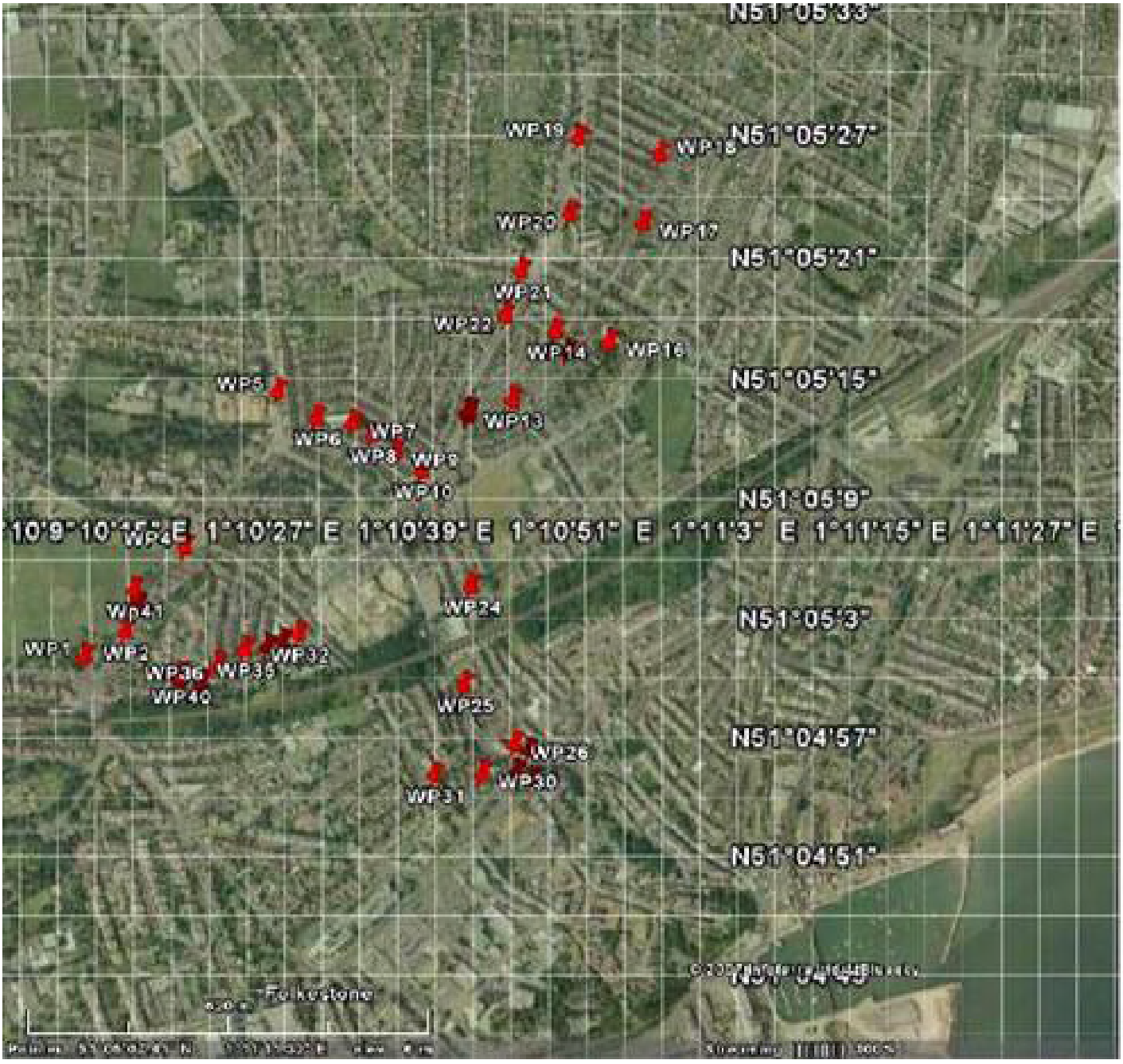

Figure 1. Map of the locations in Folkestone visited by the authors during the walk-over surveys of the 28th April and1st May 2007. (Base map from Google Earth).

Figure 2. Examples of typical clay chimney pots (left) and the mortar build-up for chimney pots (right).

By far the most common form of damage observed was chimney damage ranging from moderate to partial collapse. In most roads chimney damage was observed in 10-20% of buildings (e.g. in Black Bull Road), however in some roads (e.g. northern end of Marshall Street, Broadmead Road) this damage rate rose to 60-70%. The pattern of failure of chimneys presented no particular orientation, thus not giving insight into directivity of ground shaking.

The chimneys consist of brick stacks on which multiple cylindrical clay chimney pots are mounted with mortar (see Figure 3). The heavy clay chimney pots were commonly seen to dislodge during the ground shaking, often together with bricks in the chimney stacks. Some chimneys were observed to be damaged more than others despite being of similar type and in close proximity (see Figures 2, 3 and 4). The majority of damage seemed to occur in chimneys that had not been maintained and had lost mortar or had suffered some sulphur intrusion. However, this was not always true. Some chimneys that had been re-pointed with cement mortar, which tends to be less flexible than the original lime-mortar, were also seen to be damaged. The failure of chimneys was also seen to cause secondary damage to roofs. In most cases this was limited to the removal of roof tiles (commonly seen in the lea of falling chimney pots) and in rare cases damage to the roof structure (Figure 4).

Other non-structural damage observed was damage to a gable-end wall in Black Bull Road and the cracking of plaster in some houses. The authors were able to visit the interior of a house in Linden Road where minor cracking of plaster was observed. Cracking was mainly seen to occur along joints of ceiling plaster board panels. Diagonal cracking of plaster was also observed to occur above door frames. This sort of damage will only require minor cosmetic repair.

Some light structural damage was seen in a very few locations, mainly on Radnor Park Road and Broadmead Road. Here, buildings were observed to have suffered some vertical cracking of walls and lintels (Figures 5 and 6). It is interesting that this observation differs from the damage reports given by the news which seem to relate the worst affected areas as being Black Bull road, Marshall Road and Linden Gardens where more spectacular chimney failures occurred.

In interpreting structural damage to houses in Folkestone, care must be taken to consider their history and the possible presence of existing damage. Folkestone was subjected to bombing in the Second World War and although further investigation is required, it may be that some of the structural cracking may first have occurred during this era, and was aggravated by the earthquake ground shaking. Knowledge of local history proved important when surveying the only school damaged by the earthquake, Harvey Grammar School. This school is located about 2km west of the main areas of damage and was built in 1912 to have symmetrical facades. During WWII the western façade was bombed and later rebuilt in 1945. The “plane of weakness” locally created between the old school building and the newer façade partially explains why this particular section suffered cracking along its height and especially at its connection with the old building.

The only case of Moderate damage was observed in the building adjoining Grace Independent Baptist Church

Figure 3. Similar chimneys damaged to different extents at two ends of same building on Black Bull Road.

Figure 4. Park Farm Road. Chimney damage causing secondary damage to the roof.

and School on Grace Hill. This building was cordoned off and condemned as it was reported to have suffered severe internal damage. A vertical crack was observed along the front of the building. Some possible torsion of the building was observed, although its severity was difficult to determine from rapid visual inspection. The authors consider this building to be particularly susceptible to earthquake damage due to its irregularity in elevation and location, (i.e. it is built on a slope so that the front is 3 storeys and the back is 4 storeys high, see Figure 7).

No recently constructed masonry buildings were seen to be damaged by the earthquake. This is to be expected in a small earthquake and highlights the importance of good construction and maintenance in helping resist strong ground-shaking.

Intensity Assignment

Current data from Shepway Council reports that up to 2500 buildings were damaged to some degree during the earthquake, the vast majority having damage to chimneys (data as of 26th July 2006, Nick Lewington, Building Control, Shepway Council). 300 of these buildings required immediate intervention to secure the chimneys but no buildings had to be demolished following the earthquake and only one building was found unsafe for immediate habitation.

Most building damage in Folkestone can be classified as Grade 1 on the European Macroseismic Scale (EMS-98, Grunthall, 1998) for masonry. This corresponds to no structural damage and slight non-structural damage, described by the Scale to consist of hair-line cracks in very few walls, fall of small pieces of plaster only, fall of loose stones from upper parts of buildings in very few cases.

Assigning EMS-98 masonry building damage Grade 2 to some buildings in Folkestone requires more judgement from the assessor. Grade 2 damage is defined as slight structural damage with moderate non-structural damage. This is described to consist of cracks in many walls, fall of fairly large pieces of plaster and partial collapse of chimneys. Whilst the partial collapse

Figure 5. Broadmead Road. Vertical cracks in lintels, window sill and wall.

Figure 6. Broadmead Road. Large crack in the external wall of a house.

Figure 7. Moderately damaged building on Grace Hill.

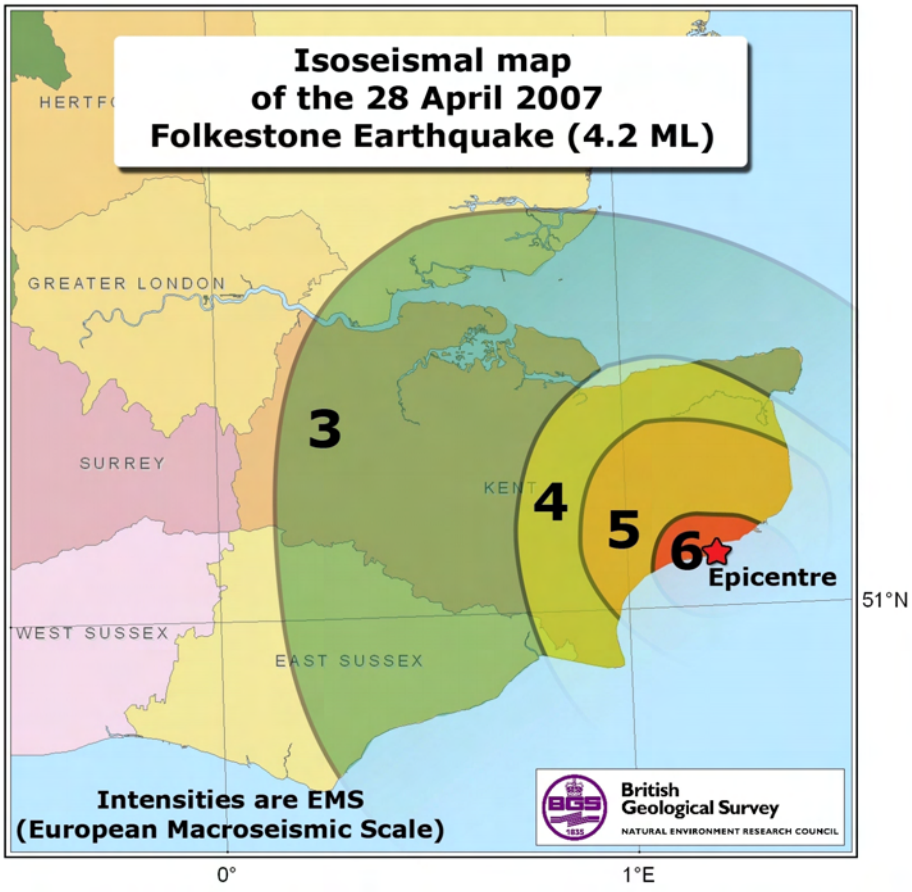

Figure 8 Folkestone Intensity Map

of chimneys certainly occurred extensively in Folkestone, the criteria of structural cracks in many walls was not observed except for in a small number of properties on Broadmead Road and Radnor Park Road. However, even this damage would be at the lower bound of Grade 2.

Based on the definitions of the EMS-98 vulnerability table (Grunthall, 1998), the typical buildings damaged would fall into the EMS-98 vulnerability class Category B. In the areas visited by the authors where it could be stated that "many" buildings of vulnerability Class B suffer damage Grade 1 (i.e. Radnor Park Road, Broadmead Road, Linden Crescent, Black Bull Road and Marshall Street), it was observed at best that very few suffered Grade 2 and no damage to Class C building was observed. These roads would therefore fall within Intensity Level VI (Slightly Damaging), but again would lie at the ower bound of this intensity class. The areas immediately surrounding those stated above would fall within Intensity V (Strong), i.e. Damage to Grade 1 in a few buildings of vulnerability Class A and B. This would soon attenuate to Intensity IV for the rest of Folkestone.

These observations differ with the intensity maps produced by BGS [Reproduced here as Figure 8] (Also reproduced in SECED Newsletter Vol. 20 No. 2, and available at: http://www.earthquakes.bgs.ac.uk/), which peak at Intensity VII in central Folkestone and have wide isoseismals of Intensity VI and V extending far beyond the bounds of Folkestone. The BGS made preliminary assessments based on their online macroseismic questionnaire. However, as it is well-known that such questionnaires are unreliable for assigning large intensity values, they also sent a team to look at the damage to verify the high levels of intensity being assigned by the questionnaire (Musson and Walker, 2007).

So why the discrepancy? This discrepancy arises from the assignment of Grade 2 and 3 damage by BGS to housing in Folkestone where severe chimney damage has occurred. Essentially their interpretation of the EMS-98 Intensity damage scale is that only one element of the description of damage needs to be satisfied (i.e. damage to chimneys) to assign the level of damage. However, the general understanding in earthquake engineering is that all descriptive elements of the damage state should be satisfied in order for the damage state to be achieved. It is clearly wrong to assign intensity values based on one element only, more so if the assessment is made on the basis of a non-structural element such as a chimney. These values clearly can therefore not be used to compare the effects of the Folkestone earthquake with other European or international earthquake events, which assign EMS intensity values based on a comprehensive satisfaction of the descriptive criteria in the damage scales.

In view of these arguments it is the authors' opinion that the BGS mapped intensity levels need to be decreased to values consistent with the observed building damage, as suggested herein. The authors would also like to invite comments from SECED members on this issue and a reply from BGS.

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NOTABLE EARTHQUAKES JANUARY - JUNE 2007

(CONTINUED FROM PAGE 12)

YEAR	DAY	MON	TIME UTC	LAT	LON	DEP	MAGNITUDES ML	MB	MW	LOCATION
2007	14	MAR	16:54	53.46N	1.25W	2	1.7			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	17	MAR	01:56	53.46N	1.19W	2	1.6			MALTBY, SYORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	19	MAR	05:31	53.46N	1.20W	2	1.5			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	20	MAR	13:03	53.46N	1.25W	2	1.4			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	21	MAR	09:26	53.45N	1.23W	2	1.7			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	22	MAR	02:05	53.46N	1.24W	2	1.2			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	22	MAR	02:23	59.63N	2.37W	16	2.7			OFFSHORE ORKNEY
2007	23	MAR	01:37	53.46N	1.23W	2	1.6			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	25	MAR	00:40	20.66S	169.36E	16			7.1	VANUATU
2007	25	MAR	00:41	37.32N	136.62E	5			6.7	HONSHU,JAPAN
One person killed, another 55 injured and over 500 houses were either destroyed or seriously damaged in the epicentral region.										
2007	27	MAR	15:37	53.48N	1.21W	2	1.3			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	29	MAR	22:59	53.45N	1.22W	2	1.4			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	30	MAR	08:15	53.76N	1.17E	10	2			SOUTHERN NORTH SEA
2007	01	APR	20:39	8.46S	157.04E	10		8.1		SOLOMON ISLANDS
At least 54 people killed and several villages destroyed by the earthquake and resultant tsunami. Over 300 homes, many schools and the village hospital destroyed in Sasamunga, over 500 homes destroyed in Gizo and many other homes destroyed in Lefung, Taro and Ranongga. Damage also occurred on Woodlark Island, Papua New Guinea when 30 houses and a church were destroyed as the tsunami ran inland for over a kilometre.										
2007	01	APR	20:47	7.17S	155.78E	10			6.6	SOLOMON ISLANDS
2007	15	APR	03:19	34.81N	136.24E	16			5.4	WESTERN HONSHU
Twelve people injured and 66 buildings damaged in the prefectures of Mie, Nara and Shiga. Felt throughout western Honshu and eastern Shikoku.										
2007	21	APR	17:53	45.24S	72.65W	37			6.2	AISEN, CHILE
Three people killed and seven others still missing due to a 7.6m tsunami caused by rockslides falling into a narrow fjord near Puerto Aisen.										
2007	24	APR	04:08	54.00N	3.47W	5	1.5			IRISH SEA
2007	28	APR	07:18	51.08N	1.17E	2	4.3			FOLKESTONE, KENT
One person injured, damage to several buildings and disruption to the local electricity supply. Twelve aftershocks recorded between 28 April and 5 May 2007 with magnitudes ranging between 0.7 and 1.8 ML. The earthquake was felt throughout southeast England, with a maximum intensity of 7 EMS recorded at Folkestone.										
2007	6	MAY	21:11	19.40S	179.35W	676			6.5	FIJI ISLANDS REGION
2007	28	MAY	05:27	53.37N	2.44E	5	2.5			SOUTHERN NORTH SEA
2007	2	JUN	21:34	23.03N	101.05E	5			6.1	YUNNAN, CHINA
Three people killed, 562 others injured, over 11,400 houses collapsed and another 382,000 houses were damaged affecting over 536,000 people in Ning'er, Jinggu, Mojiang and Jiangcheng counties. Damage is estimated at US$310 million.										
2007	4	JUN	17:34	57.01N	1.81E	10	3.9			CENTRAL NORTH SEA
Felt on a jackup rig alongside an oil platform in the Elgin Franklin field (3 EMS).										
2007	7	JUN	05:53	66.32N	7.52E	10	3.8			NORWEGIAN SEA
2007	9	JUN	13:03	56.28N	5.01W	9	1.6			INVERARAY, S'CLYDE
2007	13	JUN	19:29	13.55N	90.62W	23			6.7	OFF GUATEMALA
Some houses damaged in Guatemala City and landslides reported in Escuintla, Guatemala. Felt in El Salvador, Mexico and in parts of Nicaragua.										
2007	17	JUN	22:06	56.18N	10.34W	15	2.2			NORTHERN ATLANTIC
2007	24	JUN	00:25	55.65S	2.63W	10			6.5	MID-ATLANTIC RIDGE
2007	28	JUN	02:52	7.97S	154.63E	10			6.7	PAPUA NEW GUINEA
2007	20	JUN	00:06	53.41N	2.69W	11	1.6			ST.HELENS, MERSEYSIDE

Issued by: Davie Galloway, British Geological Survey, August 2007.
Non British Earthquake Data supplied by: The United States Geological Survey.

NOTABLE EARTHQUAKES JANUARY - JUNE 2007

Reported by British Geological Survey

YEAR	DAY	MON	TIME UTC	LAT	LON	DEP KM	MAGNITUDES ML	MB	MW	LOCATION
2007	07	JAN	01:50	61.92N	1.01E	15	4.9			NORWEGIAN SEA
Felt on the Shetland Islands and in Norway (3 EMS).										
2007	13	JAN	04:23	46.24N	154.52E	10	8.1			KURIL ISLANDS
2007	21	JAN	07:38	39.59N	42.86E	3		5.1		EASTERN TURKEY
Two people slightly injured and damage to some older houses in the Agri area.										
2007	21	JAN	11:27	1.07N	126.28E	22			7.5	MOLUCCA SEA
Four people killed, 4 others injured and some minor damage in Manado, Sulawesi, Indonesia.										
2007	21	JAN	13:45	62.41N	6.95E	15	3.7			SOUTHERN NORWAY
Felt Norway (3 EMS).										
2007	23	JAN	17:32	51.66N	2.10E	15	3.5			SOUTHERN N.SEA
2007	25	JAN	21:59	57.41N	5.69W	7	2.4			APPLECROSS
2007	28	JAN	10:30	57.75N	6.15E	20	4.4			EASTERN NORTH SEA
Felt southern Norway (3 EMS).										
2007	30	JAN	04:54	54.74S	146.30E	11			6.8	MACQUARIE ISLAND
2007	30	JAN	21:37	20.99N	144.70E	30			6.6	MARIANA ISLANDS
2007	31	JAN	03:15	29.78S	178.00W	34			6.5	KERMADEC ISLANDS
2007	18	FEB	20:10	56.18N	4.93W	5	2			LOCHGOILHEAD
Felt Lochgoilhead, Highland region (3 EMS).										
2007	18	FEB	20:10	56.18N	4.94W	5	2.3			LOCHGOILHEAD
Felt Lochgoilhead, Highland region (3 EMS).										
2007	20	FEB	08:04	1.03S	126.98E	11			6.7	KEPULAUAN SULA
2007	6	MAR	03:49	0.49S	100.50E	19			6.4	SUMATRA,INDONESIA
At least 67 people killed, some 830 injured and over 43,000 houses either damaged or destroyed in the Payakumbuh/Solok area.										
2007	6	MAR	05:49	0.48S	100.55E	20			6.3	SUMATRA,INDONESIA
Additional damage and casualties in the Payakumbuh/Solok area.										
2007	6	MAR	13:05	2.08N	76.50W	43		5		COLOMBIA
Nine people injured and several buildings either destroyed or damaged in the Sotora, Purace, Sierra Cauca and Timbio areas.										
2007	6	MAR	22:32	33.49N	48.93E	16		4.7		WESTERN IRAN
Over 35 people injured and some buildings damaged in Dorud.										
2007	7	MAR	05:36	53.45N	1.22W	2	1.7			MALTBY,S.YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	8	MAR	02:31	53.46N	1.24W	2	1.7			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										
2007	9	MAR	16:00	53.45N	1.21W	2	1.6			MALTBY,S YORKSHIRE
Coalfield type event. Felt Maltby area (2 EMS).										

(CONTINUED ON PAGE 11)

Forthcoming Events

30 January 2008?
TBA
ICE 6.00pm

27 February 2008
The Design of Steel Structures Against Earthquake. A joint SECED/IStructE meeting.
ICE 6.00pm

26 March 2008?
TBA
ICE 6.00pm

SECED Newsletter

The SECED Newsletter is published quarterly. Contributions are welcome and manuscripts should be sent on a PC compatible disk or directly by Email. Diagrams, pictures and text should be in separate electronic files.

Copy typed on paper is also acceptable. Diagrams should be sharply defined and prepared in a form suitable for direct reproduction. Photographs should be high quality (black and white prints are preferred). Diagrams and photographs are only returned to the authors on request.

Articles should be sent to:

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SECED

SECED, The Society for Earthquake and Civil Engineering Dynamics, is the UK national section of the International and European Associations for Earthquake Engineering and is an affiliated society of the Institution of Civil Engineers.

It is also sponsored by the Institution of Mechanical Engineers, the Institution of Structural Engineers, and the Geological Society. The Society is also closely associated with the UK Earthquake Engineering Field Investigation Team. The objective of the Society is to promote co-operation in the advancement of knowledge in the fields of earthquake engineering and civil engineering dynamics including blast, impact and other vibration problems.

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SECED Website

Visit the SECED website which can be found at http://www.seced.org.uk for additional information and links to items that will be of interest to SECED members.
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