

# THE LINCOLNSHIRE EARTHQUAKE OF 27 FEBRUARY 2008

A FIELD REPORT BY EEFIT



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**THE LINCOLNSHIRE EARTHQUAKE OF  
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# EEFIT

## EXECUTIVE SUMMARY

On 27th February 2008 at 00:56 hours (UTC), England and Wales were shaken by an earthquake which epicentre was located near the town of Market Rasen. The magnitude of the event, as given by the British Geological Survey, was of 5.2 ML and is the largest UK earthquake recorded since 1984. The BGS, UK engineering and insurance related companies carried out damage field surveys at the time, finding out that even though the event was felt in far distant places such as Ireland and Aberdeen, most of the actual physical damage occurred on chimneys and walls on houses around the areas closer to the epicentre. Since the United Kingdom is located on the stable continental region of Europe, seismic activity is low and according to the BGS events of magnitude around 5.2-5.4 occur around every 30 years. This document is a succinct summary of key aspects from this event.

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## **ACKNOWLEDGEMENTS**

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## 1.0 EARTHQUAKE PARAMETERS

Table 1 presents a summary of key earthquake parameters as determined by three seismological agencies. Differences on the magnitude reported come from the way each agency estimates this parameter and from the scale used. The Lat/Long location of the epicentre are similar (differences up to about 6 kilometres) while the focal depth assigned by the USGS corresponds to a generic one given to shallow crustal events.

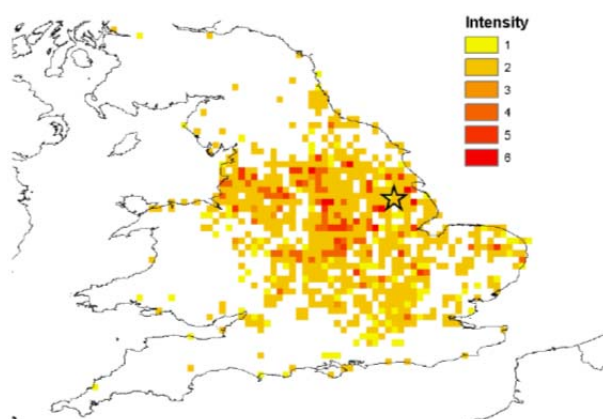
**Table 1:** Earthquake parameters as assigned by different seismological agencies

Agency	Latitude	Longitude	Magnitude	Depth (km)
ISC	53.3176	-0.3195	4.8 mb	9.4
BGS	53.4	-0.332	5.2 ML	17.8
USGS	53.321	-0.3136	4.7 Mw	30.0

## 2.0 OBSERVED DAMAGE

The large majority of single family dwellings in the UK are made of masonry, which has very high vulnerability to ground shaking. However, due to the low level of seismic activity in the UK these constructions are not exposed to levels of ground shaking that would cause significant damage. Consequently damage on single family houses are mainly concentrated on chimneys and to a lesser degree to some walls.

Figure 1 presents the EMS macroseismic intensity map as estimated by the BGS (2009), while Figures 2 to 5 present photos of the typical damage observed in Gainsborough and Market Rasen, the towns mostly affected by the event (the photos were taken while the author was affiliated to ARUP).



**Figure 1:** Macroseismic intensity EMS map (source: BGS, 2009). “The figure shows isolated values of 6 EMS at 59 locations”.



**Figure 2:** Typical damage observed to Chimneys. Photo taken at Gainsborough



**Figure 3:** Detail of damage observed to Chimneys at Gainsborough (top). Please note that damage was not widespread (bottom) but localized on individual houses.



**Figure 4:** Damage on party wall at Gainsborough



**Figure 5:** Roof and chimney repairs being undertaken two days after the event.

Large commercial and Industrial facilities would tend to be built with steel and/or reinforced concrete so their vulnerability to the levels of shaking induced during the Lincolnshire earthquake is minimal. During the field survey carried out at the time, no damage was observed on these kinds of structures.

### **3.0 LOSSES**

The insurance penetration rate of residential buildings in the UK could roughly be estimated at 90%, and hence insured losses could be used as a good proxy for economic losses. According to the Association of British Insurers (ABI) the cost of insured losses from the Lincolnshire earthquake was around £30 million at the time.

Even though these losses are not negligible, as a reference point for losses from other catastrophic events in the UK, it is worth listing the insured losses from the July 2007 flood events that were in the order of £1.4 billion while the June 2007 flood losses were in the order of £1.7 billion. Examples of losses related to Winter Storms are about £1.5 billion (in today values) from the 87J (1987) event, and



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in the order of £400 million from Kyrill (2007). Last year (2013) winter storm Christian in October produced insured losses of around £100 million. These historical losses place those coming from the Lincolnshire earthquake in the general catastrophe relevance framework for the UK.

## **4.0 SEISMIC RISK**

As aforementioned, it is considered that the residential building stock in the UK is very vulnerable to earthquakes, though the seismic hazard is very low as for the corresponded seismic risk to be considered of relevance for the UK. The outcomes from the Lincolnshire earthquake, that roughly represents an event with a level of magnitude expected to occur in average about every 30 years, confirm these aspects.

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## Earthquake Engineering Field Investigation Team

EEFIT is a UK based group of earthquake engineers, architects and scientists who seek to collaborate with colleagues in earthquake prone countries in the task of improving the seismic resistance of both traditional and engineered structures. It was formed in 1982 as a joint venture between universities and industry, it has the support of the Institution of Structural Engineers and of the Institution of Civil Engineers through its associated society SECED (the British national section of the International Association for Earthquake Engineering).

EEFIT exists to facilitate the formation of investigation teams which are able to undertake, at short notice, field studies following major damaging earthquakes. The main objectives are to collect data and make observations leading to improvements in design methods and techniques for strengthening and retrofit, and where appropriate to initiate longer term studies. EEFIT also provides an opportunity for field training for engineers who are involved with earthquake-resistant design in practice and research.

EEFIT is an unincorporated association with a constitution and an elected management committee that is responsible for running its activities. EEFIT is financed solely by membership subscriptions from its individual members and corporate members. Its secretariat is generously provided by the Institution of Structural Engineers and this long-standing relationship means that EEFIT is now considered part of the Institution.

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