

# Urban earthquake events and businesses: Learning from the 2007 Gisborne earthquake in New Zealand

Dr Felicity Powell reports on the findings of a study conducted three months after the Gisborne earthquake investigating its effect on businesses in the area.

## The Australian experience

Australia recently experienced the largest earthquake ever recorded in Kalgoorlie/Boulder region of Western Australia. At 08:17 hours on Tuesday 20th April 2010 a magnitude 5 Earthquake occurred approximately five kilometres South West of the Kalgoorlie city centre. The initial event was followed by a significant number of minor aftershocks. This earthquake surpassed a previously recorded magnitude 4.5 earthquake event recorded in 1987.

Assessments of the damage caused by the earthquake identified the historic Boulder shopping/business precinct as having sustained the most damage with the main Street of Boulder closed until buildings in the area were deemed safe by structural engineers. Building damage included extensive cracking to walls and building facades, most of the damaged buildings were built at the turn of the last century and are a part of Boulder's history.

*Information kindly supplied by Trevor Tasker, Regional Director, Fire & Emergency Services Authority of Western Australia Operational Service, Goldfields/Midlands.*

## ABSTRACT

The earthquake of 20 December 2007 off the coast of Gisborne provided the first opportunity in 50 years to examine the impacts of an earthquake on a sizeable urban settlement in New Zealand. The investigation focussed on individual businesses, a unit of analysis often overlooked in disaster research. Three months after the earthquake, businesses throughout the Gisborne region were surveyed to determine the nature of the earthquake's short-term impact on businesses, their vulnerability and initial recovery experience.

## Background

After a major natural disaster it is important that businesses reopen quickly in order to provide income and employment to residents, and thus aid the recovery process. A variety of problems face a community whose business district is damaged by a disaster, including the loss of income from business rates or the potential loss of large and/or important employers (Tierney 1994). If businesses are forced to close for a long period of time, they are less likely to recover in the long-term (Webb et al. 2000). Longitudinal studies of natural disasters in the USA found that very few companies fail in the short-term, and some struggle for several years to restore their business before eventually closing down (Alesch 2005). Induced economic activity, mainly in the building sector, may also obscure the impact of a disaster on the local economy in the short-term as repair and restoration work is carried out (Butcher et al. 1998).

This study focuses on the business community in the Gisborne region and was initiated after an earthquake on Thursday 20 December 2007 centred 50 km southeast of the city of Gisborne<sup>1</sup>. The main axis of motion of the magnitude 6.8 earthquake ran parallel with Gladstone Road, the main street running through Gisborne's central business district (CBD). With the earthquake taking place a few minutes before 9pm, customers and staff vacated

<sup>1</sup> Gisborne, on the east coast of New Zealand's North Island, has an urban population of 33,700 and is remote from other urban settlements, the nearest being Whakatane about 3 hours drive away (Statistics New Zealand 2008a).

stores, restaurants and bars in the dark as nearly all power substations in the district temporarily lost power. Within minutes the police cordoned off the CBD, and police and security guards ensured the area was secure overnight to prevent looting. Although access to the CBD was restricted, anecdotal accounts relate how business owner-managers, staff and families spent the night clearing debris in order to reopen as usual the next day (see for example The Gisborne Herald 2007, 2008). Their efforts were to no avail as the CBD did not reopen until Saturday because all buildings in the CBD had to be assessed by structural engineers. Estimates of payouts for the Gisborne earthquake stand around NZ\$55 million (Brennan 2008; ICNZ 2008), indicating that even though final rebuilding costs are not yet known, the earthquake will be significantly less costly than New Zealand's last major earthquake in Edgumbe<sup>2</sup>.



Courtesy: Felicity Powell

**Damaged and vacated buildings fronting Gladstone Road, the main thoroughfare in Gisborne's CBD.**

Disaster research tends to place greater emphasis on units of analysis other than businesses, such as families, households and government agencies (Webb et al. 2002; Zhang et al. 2009), and it is therefore the intent of this study to fill this knowledge gap. Further, there had been no significant earthquake affecting an urban settlement in New Zealand since 1931 when an earthquake virtually destroyed the centre of the city of Napier and had a death toll of 256 (Wright 2001)<sup>3</sup>. Whilst the Gisborne earthquake in 2007 was neither as costly nor as destructive as it might have been, it presented an opportunity to learn about an urban earthquake event, investigating the characteristics of the impacts of an earthquake on businesses, the preparedness measures that businesses had in place, and the initial recovery of businesses and the community. This paper reveals the findings of this study conducted three months after the earthquake and forms the first stage of a two-part investigation into the earthquake's effect on businesses in Gisborne.

## Method

This study employed a postal questionnaire, using a combination of open and closed questions. The questionnaire was divided into five sections, gathering information on the businesses themselves, the nature of the damage to the business, the extent that trading was interrupted, the preparedness measures that had been in place, and details about the initial recovery from the earthquake. Some of the questions, relating to preparedness and the damage, were similar to those used in other studies by Webb et al. (2000) and Chang and Falit-Baiamonte (2002) to enable comparisons with research completed on similar issues.

The earthquake affected a large geographic area, and it was decided that questionnaires should be sent to businesses throughout the Gisborne region, rather than focus on the city alone. There are 4971 enterprises in the region (Statistics New Zealand 2008b), and in order to capture the views of as many businesses as possible and to obtain a reasonable sample size, an initial target of 1000 businesses was set. Businesses were chosen from the Gisborne region telephone directory, using a purposive selection technique of every tenth business in the directory until 1000 had been selected. Once duplicates were removed this number was reduced to 925. The questionnaire was sent by post in March 2008<sup>4</sup>.

In total 286 surveys were returned using a Freepost service, giving a response rate of 31%. One survey was excluded as it was largely incomplete. Answers to the questionnaire were coded and entered into Microsoft Office Excel 2003 for statistical analysis. The findings of the questionnaire are presented in the next section. As confidentiality was assured to respondents, care has been taken to ensure that details are not attributable.

## Findings

In the results presented here, the patterns of damage and loss are described. Disruption to trading is also outlined, looking at the causes of temporary closure and at the resultant loss of income. The survey data revealed the ways in which businesses began their initial recovery from the earthquake, exploring who and what assisted them, the preparedness measures in place, and how costs incurred by the earthquake will be recovered.

### Patterns of damage and loss

Businesses were asked about the different ways in which the earthquake caused damage, including structural damage to the building; non-structural damage (e.g. windows, light fittings); damage to furnishings and furniture, machinery and office equipment, and stock; disruption in the supply of utilities, sewerage and transport; damage to the immediate locality (e.g. footpath, neighbouring building); and, personal injury.

<sup>2</sup> The magnitude 6.5 Edgumbe earthquake in 1987 resulted in NZ\$330 million in payouts (adjusted for inflation to 31 December 2007) from the Earthquake and War Damages Commission and co-insurers (ICNZ 2008).

<sup>3</sup> Although the Edgumbe earthquake was of a large intensity it was in a predominantly rural area.

<sup>4</sup> In order to facilitate a high response rate, an incentive for recipients to return surveys was offered in the form of book vouchers to be awarded to a respondent whose name would be drawn at random from all survey respondents.

As might have been anticipated most of the damage occurred to respondents located in the CBD. Of the 285 respondents to the survey, 162 (57%) received some form of damage. About half of these (n=80) reported only one form of damage, and in the worst cases four firms in the CBD stated that they had experienced more than six types of damage. A total of NZ\$1.92 million was estimated as the value of the damage incurred, although not all companies that sustained damage provided an estimate of its value.

Patterns of damage were examined across industry sectors. A greater proportion of businesses in the wholesaling, health, finance, manufacturing, education and retailing sectors were found to have sustained damage. This compares to the construction, agriculture, transport and cultural sectors, in which fewer firms were affected.

A little under a quarter of all respondents closed their businesses for a short while after the earthquake. Nearly all of these closures occurred in the CBD where the area was cordoned off for building inspections. Most of the businesses that closed temporarily were either retailers or take-away food outlets. The main reasons given for temporary closure were remaining shut to clean up the interior and waiting for structural assessment of the building. Eighteen businesses, all in the CBD, lost more than a day's trading.



Six weeks after the earthquake, this furniture retailer tries to shift damaged stock.

A consequence of the earthquake occurring just before Christmas is that estimates of lost revenue due to business closure are probably higher than if the earthquake had occurred at another time of year. The total amount of revenue lost was estimated to be NZ\$0.57 million, of which NZ\$0.39 million was lost by retailers. These figures may be an underestimate as not all businesses that closed provided an estimate of their losses.

### Measures in place to reduce vulnerability

Measures to mitigate the effects of an earthquake were in place in a substantial proportion of businesses, with only 39 (14%) respondents acknowledging that they had no measures in place. There appears to be some bias in the sectors in which businesses had no measures, with slightly more than a quarter of companies operating in each of the agricultural and construction sectors falling in this category. Table 1 reveals the frequency of utilisation of the measures that businesses had in place. The most frequently utilised measures are insurance policies and the provision of first aid resources. In most cases businesses relied on multiple measures, with only 16% dependent on only one type of measure, and 27% of respondents having more than three types of measure in place. The mean number of measures taken is 2.9.

It is evident that there is a greater propensity to use low-level preparedness measures, like insurance policies and first aid kits, rather than high-level measures, such as business continuity plans or carrying excess capacity (Spittal et al. 2006). Only in the use of property insurance is there no difference in behaviour between small, medium and large sized companies, as the take up of this is in the range of 77-80% for all sizes of business. The utilisation of other measures, such as disaster preparedness and business continuity plans, business interruption insurance, structural and non-structural measures, increased with the size of the company. Larger companies also seem more likely to take more measures, however the small number of large companies that responded to this survey (n=9) make it difficult to be conclusive on this.

TABLE 1. Frequency of preparedness measures adopted by businesses

Type of preparedness measure	Number of businesses (% of total survey respondents)
Property, stock and equipment insurance	221 (77)
First aid kit and/or first aider	164 (57)
Business interruption insurance	117 (41)
Stored water and other essential supplies on premises	55 (19)
Non-structural (e.g. fastening cupboards to walls)	43 (15)
Disaster preparedness plan	30 (10)
Structural reinforcement of building	28 (10)
Business recovery and/or continuity plans	25 (9)
Regular earthquake drills for evacuation	19 (8)
Intentionally carried excess capacity (e.g. held additional stock or spare equipment)	14 (5)
No measures	39 (14)

Courtesy: Felicity Powell

## Initial recovery

To build a picture of the path to recovery of businesses, respondents were asked who had assisted them and the sources of finance they intended to use to pay for repairs and replacements, and to recover lost revenue. About a third of companies reported that they had received assistance with clearing up and/or reopening their business. Employees were the most often used source of assistance for recovery, cited by 29% of respondents, and were the dominant source of assistance for medium and large businesses. For small firms, the most important resource was family.

Respondents who incurred damage or had to close temporarily were asked to specify how they intended to recover their losses. A high proportion of companies had some form of insurance policy, but this was not the most commonly used means of cost recovery. Only about a quarter of businesses that incurred damage indicated their intention to claim from their insurance policies, while more than half intend to cover costs by drawing from cash flow or savings. The latter typically incurred small amounts of damage, although one company reported its intention to pay for NZ\$100,000 damage from its own resources. For those businesses that lost money due to temporary closure, the situation was similar to those who had incurred physical damage. Of the 68 businesses that had to close for a short time after the earthquake, a little more than half had taken out business interruption insurance and only 19% (n=13) intended to make an insurance claim.



Courtesy: Felicity Powell

**Although this pharmacy was able to continue trading as normal, the sidewall of the building had to be supported.**

Almost two-thirds of survey respondents stated that there had been no impact on their business revenue. However, whilst most businesses experienced no change in income, 20% of businesses saw a decline, and this was on an ongoing basis for 3% of respondents. Businesses in the retailing sector and the accommodation and café sector seemed most vulnerable to a short-term downturn in trade. Five of the nine businesses that suffered a sustained downturn in business were CBD-based retailers. By way of contrast, 14% of respondents experienced improved revenue after the earthquake, with 4% seeing an increase in revenue on an ongoing basis. These businesses were mainly in the construction or retailing sectors or in some other way associated with repair work.

## Pathways to community recovery

Respondents were also asked what they believed were reasons for the speedy recovery of Gisborne businesses reported in the media (TV3 News 2007). The most frequently cited reason was that the earthquake coincided with the Christmas peak season, with 20% of all survey respondents suggesting this was the main motive for a quick recovery. Closely associated to this, 15% of respondents indicated that businesses wanted to or had to reopen quickly in order not to lose sales. A second category of reasons relates to the Gisborne community. In particular 19% of respondents referred to the ways in which people pulled together or worked hard to facilitate recovery. The importance of community spirit or support from the community (11%) and the special character or resilience of Gisborne people (6%) were also given as reasons.

Characteristics of the earthquake were cited: 17% noted that the damage caused by the earthquake had been localised, not very destructive, and was relatively short in duration. The role that particular groups played in facilitating recovery were also mentioned, namely tradespeople (5%), and recovery experts including the Gisborne District Council, emergency services, Urban Search and Rescue, and Civil Defence (each cited by approximately 3%). Finally, pre-disaster planning and the response to the earthquake were recognised: 10% of people believed that the quick response and/or assessment of damage were important to the city's recovery, and suggested that effective pre-disaster planning had assisted (3%).

## Discussion and conclusions

This study set out to investigate the impacts of the 2007 earthquake on the Gisborne region's business community and to document aspects of the initial recovery phase. The results established that whilst the worst of the physical damage was incurred by businesses based in Gisborne's CBD, companies located outside the city centre, including rural parts of the region, also experienced damage. Even within the CBD, there were inequalities in the extent of the damage sustained, with some businesses suffering multiple forms of damage and others receiving none. This picture of localised damage is consistent with studies of business districts in the USA affected by earthquakes (Chang and Falit-Baiamonte 2002; Kroll et al. 1991). However, studies elsewhere identified the size of a business as an important indicator of vulnerability (Alesch et al. 2001; Chang and Falit-Baiamonte 2002; Dahlhamer 1998, cited in Webb et al. 2000; Kroll et al. 1991), but there is no evidence to suggest that smaller companies in Gisborne were more vulnerable to the short-term damage and disruption effects of this earthquake.

The survey findings support the conjecture that industry sector affects vulnerability (Meszaros and Fiegenger 2002; Webb et al. 2000). Businesses in the retailing and wholesaling sectors, which other studies have observed to be the most vulnerable, were amongst the sectors most likely to have received damage or closed temporarily after the earthquake. As the CBD was closed for trading for a whole working day just before Christmas, retailers

and fast food outlets lost more income due to their closure than other types of businesses. For a handful of organisations, losing a day's trading was the start of a more sustained downturn in trade. In comparison, businesses associated with the recovery and rebuilding process, including retailers/wholesalers of furniture and building supplies, benefitted from the earthquake with short- and long-term increases in revenue; a fairly typical experience after a natural disaster event (Dahlhamer 1998, cited in Webb et al. 2000; Kroll et al. 1991; Meszaros and Fiegner 2002; Tobin 1999). Also noteworthy is that businesses in the construction sector were the least likely to have experienced any damage after the earthquake. An explanation for this is that most construction businesses were located outside the more intensely damaged CBD.

At first sight the overall level of preparedness for a natural disaster amongst businesses seems quite high compared to other places (Tynan 2003), since only a small proportion of businesses had no measures in place, and the mean number of measures adopted is a little under three. However low-level preparedness measures that are simple to acquire and maintain are preferred to high-level measures that are time-consuming or resource intensive, like preparing business continuity plans or conducting earthquake drills (Webb et al. 2002). This study confirmed findings elsewhere that larger businesses are more likely to take high-level preparedness measures (Dahlhamer and D'Souza 1997; Webb et al. 2000).

The observed high consumption of insurance policies and first aid measures obscures the true vulnerability of many businesses in the region. The former may offer only limited financial assistance to policyholders, and the latter would only be useful in the immediate aftermath of a disaster. The employment of other earthquake preparation measures, such as a disaster recovery plan, earthquake drills or simple non-structural measures like fastening cupboards to walls, is low compared to other places that have been affected by a natural disaster (Dahlhamer and D'Souza 1997; Webb et al. 2000, 2002). The results suggest few businesses have effective measures in place to minimise the short- and long-term impacts of an earthquake.

This study found that many insurance policy holders, in the region of 72-81%, would not be making a claim against their policies, covering their losses instead from their own finances. This low propensity to claim is consistent with studies of businesses affected by a natural disaster elsewhere (Alesch et al. 2001; Chang and Falit-Baiamonte 2002; Webb et al. 2000). It suggests that the losses of around three-quarters of businesses are not discernible in official estimates of the earthquake's economic impacts, and that damage to businesses and the wider community in the Gisborne region was possibly more extensive than implied by statistics reliant on insurance claims. Another area for concern arising from the sources of finance used to recover losses or pay for damage is that, because many businesses are self-financing the costs of the earthquake, there may be implications for their long-term viability.

The results of this study paint an interesting picture of the factors people believe assisted the speedy reopening of businesses. From the literature it was anticipated

that the features of the earthquake, post-disaster community resources, external support, and planning and reconstruction strategies would be identified as significant factors (Drabek 1986; Lindell et al. 2006). All but external support were cited as important by respondents, but, in addition to these factors, economic urgency was identified in Gisborne as being the most important pathway to recovery. Perhaps fearful that their local economy might be entering a recession and that a natural disaster would be likely to exacerbate existing economic trends in their community (Alesch et al. 2001; Cross 2001), the people of Gisborne rallied to enable businesses to reopen quickly to capitalise on Christmas spending, fulfil orders, and to meet the anticipated demand from visitors and especially for the annual Rhythm and Vines music festival due to take place on New Year's Eve.

In conclusion, the findings of the Gisborne study largely support findings from similar studies elsewhere. Several outcomes from this study could be of interest to policy-makers and emergency managers. The evidence implies that businesses in the region are probably insufficiently prepared for a more destructive natural disaster, appearing to disregard official advice to prepare and plan to minimise the risk of hazard events (MCDEM undated). As a result businesses affected by the December 2007 earthquake may be ill-equipped to recover fully from both its physical effects and the temporary downturn in revenue at what should have been the peak time of the year for trading. These difficulties may be exacerbated by businesses self-financing their losses. Official representations of the effects of the earthquake are probably underestimated, and a lack of understanding of the true extent of the financial impacts of the disaster may mean that insufficient support and assistance was provided to the Gisborne community. Whilst confidence can be gained from the community's solidarity and its response to the economic urgency caused by the earthquake, there is a need to understand the longer term impacts of the earthquake to confirm whether or not businesses in the region are resilient to natural disasters.

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