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# Public perceptions of building seismic safety following the Canterbury earthquakes: A qualitative analysis using Twitter and focus groups

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ABSTRACT

Following the 2010 and 2011 Canterbury earthquakes, the subject of building safety has had a high profile in New Zealand, with building seismic standards coming under scrutiny. Greater public interest in commercial building safety, and policy aims of increasing investment in seismic improvements for disaster risk reduction requires better methods of communicating building risk, and the elements that affect structural damage. Two qualitative analyses were conducted; an analysis of Twitter postings in the immediate wake of the February 2011 event, followed by focus group analyses of perceptions almost two years later. Life-preservation was found to be more important than functionality of buildings, and experience was found to affect the features the public look for to identify "safe" buildings. The most important feature was found to be the provision of safe exits from buildings, rather than design features such as height and materials. Recommendations for better communication of the meaning, benefits and limitations of building seismic standards are made.



## 1. Introduction

On February 22nd, 2011, a large M6.3 earthquake struck the Canterbury region of New Zealand (including the city of Christchurch), killing 185 people [25]. This earthquake followed a series of earthquake events, including a damaging, larger magnitude event in September 2010, but was the first to result in fatalities. The February event generated stronger ground shaking that exceeded levels ever expected in Canterbury, and therefore not designed for in the region's building stock [20]. The vast majority of the fatalities in the February event occurred due to the failure of two Christchurch CBD buildings (the Canterbury Television (CTV) Building, and PGC House), with 39 of the remaining fatalities caused by falling unreinforced masonry in the central city [5]. As a country with a known seismic risk, New Zealand has high building standards; however these have come under scrutiny following the earthquake events, both within Canterbury, and across New Zealand. High profile building failures may have shaken the trust of the general public in building design and expert opinion as at least one of the buildings (CTV) was thought to meet the required standard (but found by the Inquiry to have been incorrectly permitted, [6]). The Inquiry therefore called for a review for improving education and the communication of risk to the public, and the public perception of building safety was identified as a key area for research by the New Zealand government (http://www.eqclearinghouse.org/2011-02-22-christchurch/2011/03/21/calling-on-social-scientists-to-inform-recovery-decisions-anne-wein-u-s-geological-survey).

All new buildings in New Zealand are required to be able to withstand a "moderate" earthquake, with the level of earthquake force defined as moderate dictated by the purpose of the building [4]. For example, to meet the building code dictated by the Act, which outlines performance criteria for aspects including structural stability, durability, fire safety and access, buildings with a post-disaster function (e.g. hospitals, police stations) need to be able to withstand a higher level of shaking than a building with only a few occupants and less requirement for business continuity (e.g. a small office). As a minimum standard, existing buildings are expected to withstand one third the earthquake force of a similar new building on the same site; this standard is commonly referred to as meeting "33% of code". Buildings below 33% of code are referred to as "earthquake-prone"; however varying timelines have been put in place by legislators for owners to improve their buildings to comply with this standard. The Royal Commission of Inquiry [5] into the earthquakes has since made a range of recommendations into both the terminology and application of the building codes, in large part due to public confusion regarding their meaning. Based on their research, Egbelakin et al. [12, p. 687] also identify a need to increase support for, and confidence in,

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mitigation activities and decision making around earthquake-prone buildings through the development of “an accessible building seismic risk information system”.

Design and materials are key features in determining the compliance level of a building, however there is no easy way for a member of the public to judge the safety of a building without a professional assessment. Despite this, some may attempt to judge buildings by features such as construction material (e.g. judging brick or concrete as less safe than steel or timber), based on previous experiences or naïve logic. Previous research [1] has also suggested that the age of buildings may have an impact on the public's assessments of safety, particularly in terms of retrofitted buildings being viewed as less safe than new. Building owners are also often reluctant to engage in retrofitting activities in part due to a lack of belief in their efficacy, as well as their overall perceptions of earthquake risk and the financial outlay required [9–11].

A recent survey [27] has suggested that nationally, 65% of the general public are confident that commercial buildings in New Zealand are safe. In the Canterbury region, this confidence reduces to 44%. The general public, particularly in areas where there is direct experience with a severe earthquake, appear to have a heightened perception of the risk posed by commercial buildings. As the public are the ultimate users of commercial spaces, it is therefore important that social perceptions of risk are considered in economic and policy decision making [31], and a compromise between public perspective and expert knowledge reached [21]. There is currently a lack of information of the public's understanding of building seismic safety [2], in particular relating to safety upgrades [32] and the building features that give reassurance.

Research suggests that the public perception of any type of risk is rarely aligned with that of expert decision makers. A proposed reason for this mismatch is that while experts base their opinions on objective measures of risk (e.g. annual mortality risk), lay-people incorporate more emotive reactions, such as “dread” or the “unknown” [28]. The level of risk perceived can also be affected by factors such as exposure to risk, the outcome severity of the event, probability neglect [30], or perceived control [22]. Previous New Zealand research [23,24] has suggested that the Canterbury events led to an increased perception of risk of an earthquake both in this region and in others with comparably low actual risk, but did not increase the perceived risk in Wellington (an area with a higher objective risk), at least in the short term. It is therefore of interest to examine both the immediate reaction of the public to an actual event, as well as the sequence of events that follow that provide greater chance for education and reflection.

Research has previously found an increase in the rate of Twitter use during natural hazard events [19]. The use of social media for crowdsourcing information in disasters, including building damage is a rapidly growing area of research and development (for example, see [8,15,29]) with such technology providing potentially relevant information much faster than mass media are able to report [29]. A number of studies have begun analysing social media to give some insight into the impact of disasters on affected populations both physically and emotionally [7]. Social media is a useful tool for information collection and dissemination; however studies have also found the potential for false information to be shared, or exaggerated levels of risk portrayed to, and perceived by, the public [18].

The Canterbury earthquakes were the “first high-impact geological event to affect New Zealand in the ‘internet age’” [16]. Therefore, social media channels were used extensively for information sharing over the course of the earthquakes. Bruns and Burgess [3] analysed Twitter data in the wake of the Canterbury earthquakes, with a focus on the use of social media for communication in a crisis. The authors emphasise the importance social media had in Christchurch as an information gathering and disseminating tool. These authors found the main hashtag (e.g. keyword used to signify subject area, prefixed by the symbol “#”) in use following the Canterbury earthquake was #eqnz, with nearly 50,000 tweets generated that day from 20,000 unique users [3].

The current risk landscape in New Zealand (and around the world) has led to increased interest in building safety factors, both in regards to public anxiety and legislative implications. This study seeks to determine whether there are changes to the way building risk and expert opinion could be communicated to the public in order to relieve public anxiety and acceptance of building standards. The study uses a mixed methods approach to examine the issue of building safety perception in the wake of the Canterbury earthquakes. It first extends the use of Twitter data to a semantic analysis of the discussion between users of the immediate, topical building issues in the days following the February 2011 Canterbury earthquake (using a similar method to Gelernter and Mushegian [14], focussing on counts of building keywords rather than location keywords). The themes of the Twitter analysis are then extended in two focus groups conducted two years following with participants from Christchurch who had been working in the city at the time of the earthquake. The two studies form an exploratory analysis of what features of buildings the general public look for in judging buildings as safe or unsafe, to be further studied in a future quantitative study.

## 2. Study one: Twitter analysis

### 2.1. Method

#### 2.1.1. Materials and analysis

A database of 254,000 tweets was collected during the 18 days following the M6.3, 22 February 2011 Canterbury earthquake using a combination of hashtag (including #eqnz and #chch) and keyword searches. Using QSR NVivo Version 10.0, a text search query was used to select all tweets containing the word ‘building’, giving a subset of 5736 tweets. These tweets form the basis for all reported analyses.

A word frequency analysis was conducted to identify keywords within these tweets. The results of this analysis were then assessed by the researchers to identify those results relevant to perception of structural risk (as some common themes were not used in an appropriate context). The analysis also includes “re-tweeting”, which is the re-posting of someone else's tweet. The practice of re-tweeting means that one specific topic can quickly propagate and become more relevant in the Twittersphere, as the more one tweet is shared, the more the importance of the tweet grows inside the user-community. Re-tweeting is also a key method by which mass media information is relayed [33]. Therefore the amount of re-tweets was of interest in gauging the strength of perceptions as being beyond a single user.

### 2.2. Results

Table 1 below presents the frequency of the major themes from the tweet database, and the representativeness of these tweets within the overall database. As can be seen in the table, the most common relevant themes related to building in the tweet database were ‘failed’, ‘old’, ‘codes’, ‘heritage’, and ‘Wellington’. Each is discussed in turn below (see also summary Table 2 at the end of this section).