

Planning for earthquake hazards in New Zealand: a study of four regions

Introduction

During historic times in New Zealand there have been a number of earthquakes large enough to cause fatalities and damage, and disrupt everyday life (*figure 1*). Due to the nature of New Zealand's placement on the Australian-Pacific plate boundary and the number of faults that are present as a result (*figure 2*), it is reasonable to expect that high magnitude earthquakes will continue to occur in the future. Planning in advance for these earthquakes is the most effective means of minimising or mitigating any adverse effects.

A study was conducted to investigate how New Zealand regional and local authorities (regional and district councils) plan for earthquake hazards. A number of regional and district councils from the North Island were chosen for the study and their plans and policy statements analysed to identify to what extent earthquake hazards are incorporated into these

by J Becker & D Johnston,
Institute of Geological
and Nuclear Sciences

documents. Initially 24 plans and policy statements from the regions of Hawke's Bay, Bay of Plenty and Waikato were studied. This work has since been supplemented by further research carried out on nine plans and policy statements from the Wellington Region also.

This paper will first outline the legislation that covers natural hazards in New Zealand and will then detail some aspects of planning for hazards. Following this, it will then go on to explain the method of collecting data, and the results of the data collected. Finally we draw some conclusions on the methods used by regional

and district councils to plan for earthquake hazards and the effectiveness of the present planning system for mitigating against earthquake hazards in New Zealand.

Legislation covering natural hazards

The Resource Management Act 1991 (and amendments)

Throughout the 1980s and early 1990s an extensive series of reforms took place in New Zealand. It was decided to devolve decision making from central government to the regional and local authorities where problems occurred. Re-organisation occurred at central government level (for example, this included a new Ministry for the Environment, Parliamentary Commissioner for the Environment and Department of Conservation) and at regional and local level with the amalgamation of existing councils and the establishment



Figure 1: A selection of New Zealand's historic high magnitude earthquakes (GNS).

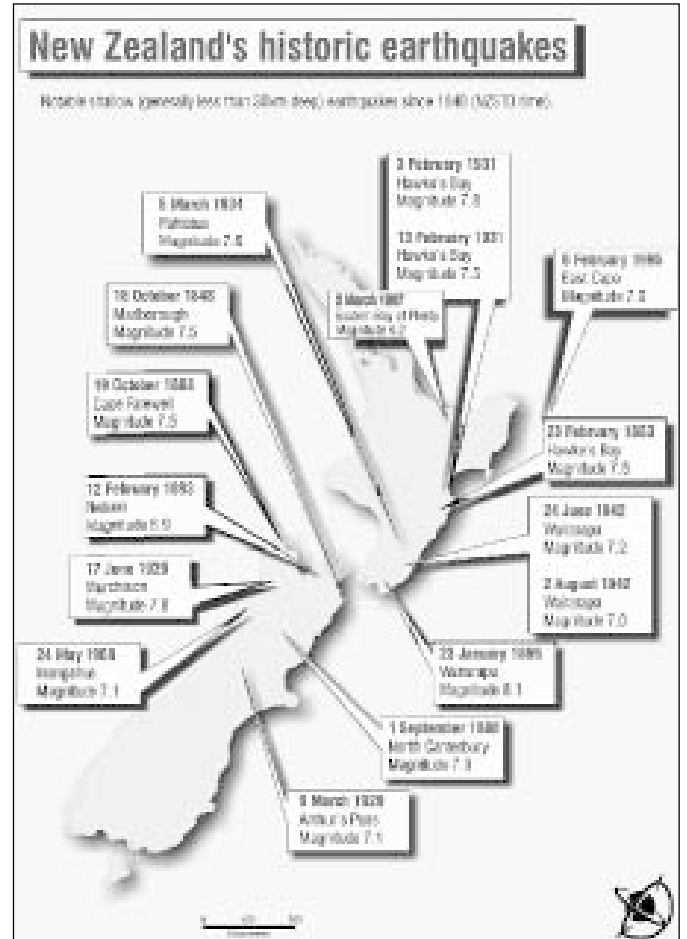


Figure 2: Identified active fault lines in New Zealand (GNS).

of new district and regional councils (Ericksen *et al.* 2000).

As a result of the reforms, New Zealand is now divided into 16 regions that come under the jurisdiction of regional authorities (or in some cases, unitary authorities). These regions are divided again into districts, with different regions containing varying numbers of districts and some districts being positioned so they lie within several regional boundaries.

New Zealand's Resource Management Act 1991 (RMAct) came into being as the government reforms took place and reflected the notion of sustainable management of natural and physical resources. It replaced nearly 70 statutes, regulations and orders with a single comprehensive legislative framework (Ericksen *et al.* 2000). Under this legislation, regional and local councils have overlapping functions and it was anticipated at the outset that councils would work toward the goals of the RMAct in a cooperative partnership, along with relevant central government agencies (May *et al.* 1996).

Both regional and district councils are required by the RMAct to prepare regional policy statements and district plans respectively in which they must identify significant resource management issues of the region, state how they will be dealt with and state expected environmental outcomes. Regional councils are also allowed to prepare regional plans but this is not mandatory. The RMAct requires that district plans and policy statements should not be inconsistent with the region's regional policy statement, however as long as they are not inconsistent there is no requirement for districts to recognise similar issues or follow the same path in dealing with similar matters.

In terms of natural hazards, the RMAct gives both regional and local authorities the function of controlling land use for the purpose of avoiding or mitigating natural hazards (Section 30 (1)(c)(iv) and 31(b)). In general hazard threats of regional level significance are regarded the responsibility of regional councils, while territorial authorities are responsible for hazards of district level significance (Hinton and Hutchings 1994). Plans and policy statements must be prepared in accordance with council functions under Section 30, making it necessary for regional and district councils to consider the avoidance or mitigation of natural hazards when preparing such documents. While the legislation requires that local and regional authorities control land use for the

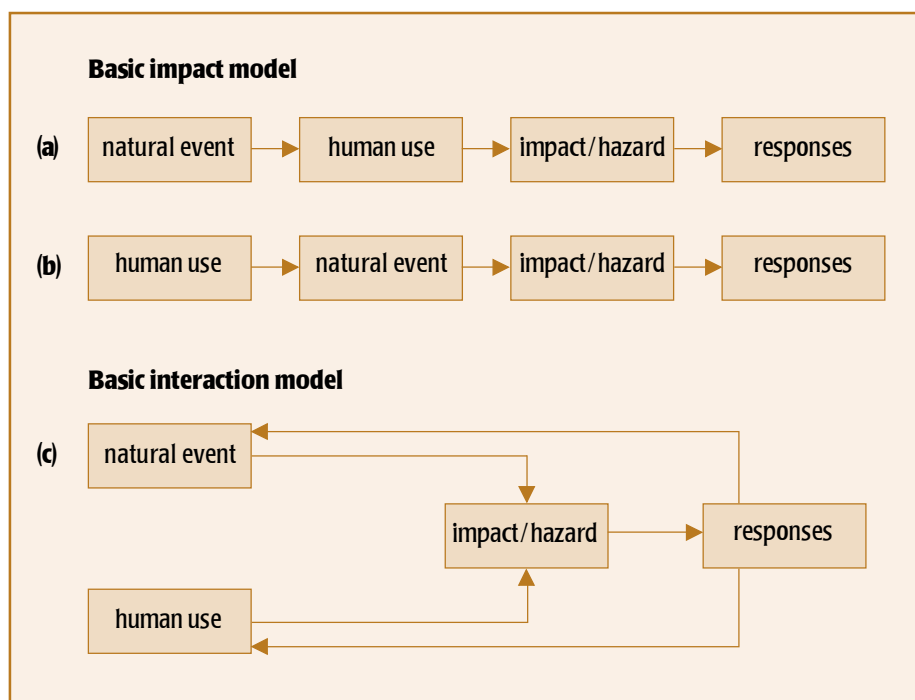


Figure 3: Basic impact models (a) and (b) and an interaction model (c) show differences in assumed relationships in studying natural hazards and approaches to managing them (adapted from Kates 1985, in Ericksen *et al.* 2000).

purpose of avoiding or mitigating natural hazards, the RMAct does not prescribe how these requirements are to be met, leaving councils to follow their own methods (Ericksen *et al.* 2000).

At central government level, the Ministry for the Environment has the authority to prepare a national policy statement and standards for natural hazards (Section 34) but these are not mandatory (Ericksen *et al.* 2000; Nathan and Van Dissen 2001). The New Zealand Coastal Policy Statement, which was required by law, is the only national policy statement that has a small section that includes several policies on natural hazards.

The definition of 'natural hazards' in the RMAct has come under some scrutiny since the Act came into being. Section 2 of the Act states:

Natural hazard means any atmosphere or related earth occurrence (including earthquakes, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind drought, fire or flooding) the action of which severely affects or may affect human life, property, or other aspect of the environment.

Ericksen *et al.* (2000) suggest that this definition leans toward a model of natural hazards where natural events adversely affect humans causing a hazardous situation (Figure 3a and b). Natural hazards may be better captured in an interactive model (c) where natural hazards are a function of both natural events and human uses, including measures taken to reduce their damaging effects. The definition of

natural hazards in the RMAct does not specifically exclude councils from taking a more interactive approach to natural hazards, but neither does it explicitly define what other interactions may occur. This makes the definition limiting and confusing, with different people taking it to mean different things, and thus acting in different ways (Ericksen *et al.* 2000).

Building Act 1991

As well as the RMAct, the Building Act 1991 (and Building Amendment Acts 1992, 1993, 1996) must also be considered when planning for natural hazards. The main difference between the Building Act and the RMAct is that the Building Act concerns a building's construction and subsequent use while the RMAct, affects the placement of the building as it relates to hazardous land (Ericksen *et al.* 1996).

Under the Building Act 1991 all building work must comply with the Building Code 1992 (Section 7(1)).

Section 31(2) (a) requires that information about site-specific natural hazards (including, but not limited to, erosion, aluvion, alluvion, falling debris, subsidence, inundation and slippage) known to local authorities but not apparent in the district plan, be provided when a Project Information Memorandum (PIM) is issued for a building project.

Section 36 of the Building Act prevents the issue of a building consent for building on land, which is affected by certain (site specific) natural hazards, unless the hazards have been avoided or

mitigated. Under section 36(2) a building consent can be issued in certain circumstances, and a section 36(2) notice is then registered on the title. Once the notice has been registered on the title, a local council is then exempt from liability, should the building be damaged by a natural event (Ericksen *et al.* 1996). It must be noted, however, that the Building Act makes no mention of fault lines or earthquake hazards when listing the types of hazards covered by Section 36. The hazards listed in this section and covered by law include erosion, aluvion, alluvion, falling debris, subsidence, inundation and slippage. The omission of earthquake hazards in the legislation means that councils are not required to refuse the issue of a consent to build on property where a fault line or earthquake hazard is present. They also cannot register a section 36(2) notice on the title on the basis the land is vulnerable to earthquakes (Parliamentary Commissioner for the Environment 2001).

Other statutes

In addition, other statutes exist that also refer to aspects of emergency management, but are not covered in this overview. These include the Local Government Official Information and Meetings Act 1987, the Civil Defence Act 1983 (and Civil Defence Amendments Acts 1988, 1989) and the Civil Defence Emergency Management Bill currently before parliament.

What constitutes a 'good plan'?

A good plan will contribute to a community's ability to successfully mitigate against or reduce natural hazards. There is no single definition of what constitutes a good plan. Kaiser *et al.* (1995) have defined some of the elements that contribute to creating a good plan:

- the plan documents the existing local conditions and issues, and identifies and guides selection of alternative solutions
- the plan has clear and comprehensive goals that represent the shared local vision of a liveable community
- policies in the plan serve as a general guide for action to make decisions and achieve goals.

Several overseas research projects have been completed on what constitutes a 'good plan' with regards to natural hazards (e.g. Berke and French 1994; Burby and Dalton 1994; Dalton and Burby 1994; Berke *et al.* 1996; Burby *et al.* 1997). These studies supported the ideas of Kaiser *et al.* (1995) and also found that better quality plans promote more extensive use of land use controls in hazardous areas.

In addition, Burby and Dalton (1994) found that plan quality was a strong predictor of community success in limiting hazard area development.

Berke *et al.* (1996) has identified five dimensions of local policy context that are related to policy outputs:

- local commitment to hazard mitigation
- local capacity to plan
- the local perception (or concern) of threat from natural hazards
- feasibility of taking natural hazard mitigation action in the land development market
- degree of threat posed by hazards—they suggest that as these variables increase, the quality of local plan mitigation elements increase.

A number of New Zealand studies have also been involved in researching what a 'good plan' consists of (e.g. Dixon *et al.* 1997; Berke *et al.* 1999; Berke *et al.* 2000), with a few research projects looking specifically at New Zealand policies that relate to natural hazards (e.g. Berke 1994; Berke *et al.* 1997). Berke (1994) found that none of the eight plans and policy statements he analysed included information on emergency response or specified potential losses from natural hazards in hazard prone areas, while Berke *et al.* (1997) found that only a small number of plans analysed included this information. Berke *et al.* (1997) also noted that New Zealand has an uneven coverage of hazard and vulnerability databases and completed hazard maps over its regions and districts.

Method

The purpose of this study was to investigate whether earthquake hazards are identified in plans and policy statements from the North Island, and to detail what provisions councils make for earthquakes. For the initial study, Hawke's Bay, Bay of Plenty and Waikato regions were chosen and in all a total of 24 district plans and regional policy statements from those regions were analysed (Figure 4).

A number of districts fall under the jurisdiction of several regions, so for the purpose of this study we made the following groupings:

- Hawke's Bay Region—Napier City, Hastings District, Wairoa District, Central Hawke's Bay District.
- Bay of Plenty Region—Opotiki District, Tauranga District, Western Bay of Plenty District, Kawerau District, Whakatane District and Rotorua District.
- Waikato Region—Otorohanga District, South Waikato District, Waikato District, Franklin District, Waitomo District, Hamilton City, Thames-Coromandel

District, Hauraki District, Waipa District, Matamata-Piako District and Taupo District.

Using plans and policy statements available as of May 2000 from the regions and districts listed above, a content analysis was undertaken. This involved:

- a) deciding which aspects of earthquake hazards and hazards in general to identify as being present in plans and policy statements—the categories that were used are presented in *table 1*.
- b) reading through each plan or policy statement and using a simple coding system to denote whether or not a category was present in a plan—for each category yes=1 and no=2, in some cases the question was not applicable and 0 was entered as a data figure.
- c) statistical analysis of the coding using Cramér's V statistic to determine the frequency of elements and the relationship between regional policy statements and district plans.

The regions of Hawke's Bay, Bay of Plenty and Waikato are all located in the central North Island and are subject to varying degrees of earthquake hazard. In undertaking a probabilistic seismic hazard analysis (PSHA) of New Zealand, Stirling *et al.* (1998) found that the maps they generated showed the highest levels of peak ground acceleration and 0.5 s spectral acceleration along the axial tectonic belt (i.e. Southern Alps in the South Island), the subduction zones and the Taupo Volcanic Zone. Hawke's Bay Region is located close to the Hikurangi Subduction Zone, while the Taupo Volcanic Zone is situated within the Bay of Plenty Region, both of which, according to the models, are areas of high earthquake hazard. In contrast while the southerly and easterly parts of the Waikato Region are located within the Taupo Volcanic Zone, much of the region lies to the west in a lower hazard area.

After the initial study of central North Island regions was completed, the same process was repeated for the Wellington Region using the regional policy statement and eight district plans available as of April 2001 (nine in total). The districts located in the Wellington Region include Wellington City, Hutt City (Lower Hutt), Upper Hutt City, Porirua City, Kapiti Coast District, South Wairarapa District, Carterton District and Masterton District. In terms of earthquake hazard Wellington Region is located in an area of high earthquake hazard. In fact Stirling *et al.* (1998) report that out of all the major urban areas of New Zealand, Wellington City is subject to the highest seismic hazard.

Results

Relationship between policy statements and plans

From analysis of the data it was found that plans and policy statements vary between regions and districts with some documents containing similar methods of dealing with earthquake hazards, and some detailing very different approaches.

To determine how similar district plans are to their respective regional policy statement, categories from policy statements and plans were cross-tabulated and Cramer's V statistical analysis performed to measure the degree of association. For the regions of Hawke's Bay and Waikato, over 70% of district plans had a strong relationship with the regional policy statement and thus contained similar approaches. In contrast, for the Bay of Plenty only one district plan (17%) had a strong association with the regional policy statement showing that districts followed different approaches to those outlined in the policy statement. When figures were calculated for the Wellington Region it was found that 50% of district plans had a strong relationship with the regional policy statement.

These figures indicate that while a selection of regional and district councils do have similar methods in planning for earthquakes there are still a substantial number of district councils whose approach is different from that of the policy statement for their region. Research completed by Berke *et al.* (1999) confirms this finding. They found a gap between regional and district councils with regional and district planning operating independently, weak inter-organisational coordination, variable policy direction, and little, if any, integration. This may be influenced by the fact that while a district plan must not be inconsistent with a regional policy statement, there is no obligation for district councils to address similar issues or follow similar paths in its plan.

In addition, cross-tabulations were performed between individual district plans within the same region and the results indicate that there appears to be a similar gap between some neighbouring district councils. From the Cramer's V statistical analysis, a number of combinations of district council plans were identified to have strong relationships in the Hawke's Bay, Bay of Plenty and Waikato regions. However, many of those that do have a strong association are not located adjacently. These relationships may therefore be coincidental, with the contents of district plans not purposely developed to

Structure of the plan/policy statement	<ul style="list-style-type: none"> No section on natural hazards
Hazard and earthquake definitions	Does the plan/policy statement: <ul style="list-style-type: none"> have the definition of a hazard? list earthquakes as hazards? mention earthquakes as a hazard that could affect the district or region? locate the fault lines in the district or region? describe the earthquake hazard and its effects?
Objectives	Does the plan/policy statement have: <ul style="list-style-type: none"> objectives that are 'all hazard' based? specific objectives for earthquakes? specific objectives for other hazards?
Policies	Does the plan/policy statement have: <ul style="list-style-type: none"> policies that are 'all hazard'? a specific policy or policies on earthquakes? specific policies for hazards other than earthquakes?
Methods	Does the plan/policy statement have: <ul style="list-style-type: none"> methods that are 'all hazard'? methods that mention earthquakes specifically? methods that mention specific hazards but not earthquakes? 'all hazard' rules? rules for earthquakes/ fault lines? specific hazard rules but not for earthquakes/fault lines? monitoring that is all 'all hazard'? monitoring specifically for earthquakes? monitoring of specific hazards but not earthquakes? monitoring only covered elsewhere in plan and does not mention natural hazards?
Assessment criteria	Does the plan/policy statement have: <ul style="list-style-type: none"> general hazard assessment criteria? specific assessment criteria with regards to earthquakes?
Performance standards for earthquakes	<ul style="list-style-type: none"> are there any performance standards for earthquakes?
The Building Act 1991	Does the plan/policy statement refer to: <ul style="list-style-type: none"> the Building Act 1991 regarding earthquakes? the Building Act 1991 regarding hazards in general?
Practicalities of planning for earthquakes	Does the plan/policy statement: <ul style="list-style-type: none"> note the limitations/practicalities of planning for earthquakes? suggest that due to the nature of earthquakes, control is not possible through district plan/regional policy statement?
Earthquake hazard information	Does the plan/policy statement: <ul style="list-style-type: none"> recognise there is a need for the council to update the local seismic hazard information, or acknowledge there is a lack of information available to the district or region? account for new hazard information to come to light?
Environmental outcomes	Does the plan/policy statement have: <ul style="list-style-type: none"> 'all hazards' based environmental outcomes/results? hazard specific environmental outcomes/results?
Hazards on planning maps	<ul style="list-style-type: none"> are local hazards included on planning maps?

Table 1: Categories identified in plans and policy statements.

coordinate with neighbouring councils. Thus it appears that the district councils from the first three regions studied may be operating independently of one another, and are approaching earthquake issues in different ways even where they share the same hazard. Coordination between councils is desirable as it will assist in consistency in planning for earthquakes, and will allow cross boundary issues (such as fault lines dissecting two districts) to be addressed.

Where a gap appears to exist, it is important to note that some differences

in plans may reflect differences in the hazards affecting districts. Berke and French (1994) noted this when comparing how two U.S states (Florida and North Carolina) accounted for coastal hazards in different ways.

When cross-tabulations were performed between district plans from the Wellington Region it was found that six pairs of districts located adjacently had strong relationships. In addition, many of the districts that shared the same fault line and thus potentially were subject to the same earthquake hazard, also had strong

relationships. It appears, therefore, that the districts in Wellington are better coordinated in terms of earthquake content in district plans than the other three districts located further north. It must be noted however that certain elements in the plans did differ. For example, if we look at rules particularly, most of the districts in the Wellington Region that include rules in their plan have differing rules about earthquakes and fault lines. In this case, none of the rules formulated by individual districts coordinate with the neighbouring districts even where they share the same fault line.

Earthquake hazard information

The incorporation of earthquake hazard information into plans and policy statements, and the way that information is utilised varies between the various districts and regions. It was found that in general, plans and policy statements from the Hawke's Bay, Bay of Plenty and Waikato regions contain little information about the nature of earthquakes, the location of fault lines in the area or about the possible effects of earthquakes. This is confirmed by Berke *et al.* (1999) who have identified that most district plans have a limited fact base, no matter what the issue. The quality of the fact base is one of the major factors contributing to a quality plan, so a good plan should ideally contain factual information about earthquakes.

In contrast, the regional policy statement and district plans from the Wellington Region contain more information and facts about earthquakes than their more northerly counterparts. All documents mention that earthquakes are a hazard in the region or district, 89% locate known earthquake fault lines and 89% describe the earthquake hazard and its potential effects.

Objectives, policies and methods of dealing with earthquake hazards

In the Hawke's Bay, Bay of Plenty and Waikato regions, earthquake hazards are mostly dealt with as part of an 'all hazards' framework, and are not specifically singled out for mention in district plans or policy statements (although they may be recorded in a list of hazards that affects the district or region). Most of the objectives, policies, methods and environmental outcomes written in plans or policy statements, are based on the 'all hazards' approach. Only a few district plans that were analysed have actual policies or methods that specifically mention earthquakes or make some attempt to plan for their specific nature. May (1997) suggests that while planning

in an 'all hazards' framework has advantages (e.g. it allows hazards to be incorporated into broader policies) it can also be limiting because appropriate tools vary for different hazards. For example, a warning system could be used for a flood event, but is not feasible in the case of earthquakes.

In contrast in the Wellington regional policy statement and district plans, objectives tend to be 'all hazards' based, but one third have specific policies for earthquakes and over half have methods that specifically mention earthquakes.

Methods-rules

Rules are one method of achieving the objectives and policies of a district plan. A district council may include rules in the plan to prohibit, regulate or allow activities. Likewise, a regional plan may also contain rules, but none of these particular documents were included in the analysis of plans and policy statements.

The majority of district councils in the Hawke's Bay, Bay of Plenty and Waikato regions do not have any specific rules written in their plan for earthquakes, although many districts have rules for other hazards such as flooding, land instability, erosion and coastal hazards. Only two district councils out of these three regions have rules in their plan regarding earthquakes. One is a more general rule that lists earthquakes as one of the hazards to have regard for when considering an activity. The other rule makes any activity located 100m within an identified fault line a discretionary activity.

Wellington region is quite different, with three-quarters of district plans (6 plans in total) containing rules that relate to specific earthquake hazards. Two districts make building in a seismic hazard area a permitted activity, with a few restrictions relating to the type of building allowed to be located there. In terms of earthquake hazard mitigation, it is better to avoid developing in areas subject to earthquake hazards, so to permit building in a seismic hazard area places both the structures and people at great risk. Three district councils make building within identified seismic hazard areas either a discretionary, limited discretionary or a restricted discretionary activity. This type of rule gives councils some discretion over whether to grant a resource consent for a particular activity or not and councils therefore have the power not to allow an activity to go ahead in a seismic hazard area if they consider it too great a risk. One other district council states

under the standards and terms of the rules that 'no building shall be erected within 20 metres of any earthquake fault line shown on planning maps or any other known earthquake fault line'.

Policy adoption after earthquake events

Burby and Dalton (1994) note that hazard mitigation policy studies universally have found that experienced losses stimulate policy adoption. In this study we found that there was no substantial connection between past earthquake events and earthquake policy adoption in the Hawke's Bay, Bay of Plenty and Waikato regions. In Hawke's Bay Region, only one district council has policies for earthquakes in the district plan, despite the region having a history of damaging earthquake events. One such event took place in the Hawke's Bay in 1931 when a magnitude 7.8 earthquake occurred, causing 256 deaths from building collapse and the widespread fires that followed (Johnston and Pearse 1999). Likewise, in the Bay of Plenty only one district council makes reference to earthquakes in its district plan. The 1987 Bay of Plenty earthquake may have had an influence on the addition of this policy, as the area affected during the 1987 event is located within that district. A third district council located in the Waikato Region, has a number of earthquake policies in its district plan, but is located in an area where no large historical earthquakes have occurred.

There may be some connection between earthquake events and earthquake policy adoption in the Wellington Region. It is possible that the 1855 Wairapapa earthquake may have been an influence on the higher rates of policy adoption in this region, although without further research it is impossible to tell if this event has been truly influential. Even if this event has had some influence it is unlikely that it has been the sole determinant of policy adoption. Other factors that are likely to have been influential in this respect include past investment in hazard education, research and policy development, and political support for such programmes, which have led to a high awareness of the hazard in the community and the formation of a significant 'earthquake culture'.

The Building Act

Our findings indicate that while a third of councils from the Hawke's Bay, Bay of Plenty and Waikato regions include a specific paragraph on the Building Act 1991 with regards to earthquakes (and

verify that adhering to the Building Code (as is legally required) is an important way of mitigating against the effects of earthquakes on buildings), few of these councils have backed this up with any other means in plans or policy statements. Only 38% of central North Island councils that make reference to the Building Act have specific earthquake policies in their documents as well. In Wellington Region 44% of councils mention the Building Act in plans and policy statements but only half of those who make mention of the Act also include earthquake policies in their plans and policy statements.

Caution must be exercised when relying on the Building Act and the Building Code alone to avoid or mitigate the effects of earthquakes. It may be possible that if used independently, the Act or the Code may not be totally effective. For example, the Marmara earthquake in Turkey in 1999 saw widespread destruction of buildings despite measures being in place to ensure that buildings were earthquake resistant. Inadequacies in the control mechanisms of local municipalities for checking the work of local building contractors meant that many buildings were not built to standard (Özdemir 1999). The Building Act principally deals with how a building is to be constructed and not where, which means that while a few provisions do exist in the Act with regards to the placement of buildings, it does not allow complete control over building placement. This is especially pertinent with respect to earthquakes, as these are not specifically mentioned in the legislation as a hazard to account for.

After investigations following the Marmara earthquake, Sharpe *et al.* (2000) suggest that in addition to ensuring building standards are adhered to, New Zealand must also improve its efforts in hazard and land use planning. They suggest preventing or restricting new construction on, across, or immediately adjacent to, known active fault traces, and advocate the continued identification of unknown faults.

Conclusions

While more hazard information and policies are incorporated into plans and policy statements than they were pre-RMAct, it appears that there is still not enough being done, with many councils undertaking the bare minimum to meet legislative requirements. The three central North Island regions have very low levels of earthquake information and virtually no earthquake specific policies in plans and policy statements despite

being located in areas identified as being subject to earthquake hazards. Councils from Wellington Region have a greater extent of earthquake hazard information in their policy statement and district plans but still fail to address many of the crucial details such as what development is appropriate for land in seismic hazard areas.

Judging by the lack of attention given to earthquakes in many plans and policy statements, it is evident that councils still require guidance on how to use earthquake information and plan for earthquakes. Nathan and Van Dissen (2001) suggest that to address the lack of national consistency and coordination a national policy statement on natural hazards or national guidelines could be prepared. National guidelines could first be prepared for fault rupture hazard, and followed by further guidelines on other earthquake hazards. A recent report by the Parliamentary Commissioner for the Environment (2001) supports the idea of best practice guidelines for mitigating seismic hazard. Best practice guidelines would provide a basis for councils to plan for hazards but would still allow authorities to devise local solutions for local problems.

One area where best practice guidelines could assist is in the setting of rules. Careful consideration must be given to

the types of rules used in district plans. Currently, while six Wellington districts have rules regarding earthquake hazards only four have any reasonably robust measures for limiting building in seismic hazard areas as the other two councils make building in these areas permitted activities.

The Resource Management Act has provided an approach that allows regional and district councils to deal with local natural hazard issues in their own way. Despite visions of a coordinated approach envisaged at the inception of the Act, in practice there have been a variety of responses from councils, with each following a different path. Results from this study show no strong coordination between councils with few consistent policies and rules between regional and district councils and adjacent district councils, even where they share the same earthquake hazard. When plans and policy statements were cross-tabulated a number of councils did show strong relationships with other local authorities, but this occurrence appeared to be random. In addition some strong relationships were based on councils following similar poor earthquake planning practices as opposed to effective ones. To be successful in planning for earthquakes, councils need to consider a whole range of issues to achieve the best possible

Preliminary announcement



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results. They need to look carefully at the types of policies they are going to incorporate into plans and policy statements, whether they are going to achieve the aims of the district or region and how this will coordinate with other councils so that issues can be integrated across local bodies.

With regards to the Building Act 1991, 33–44% of district plans in all the regions studied make particular reference to this legislation (and the Building Code) to reinforce the fact that buildings in the district must be built to specification in order to perform in an earthquake. However, of those that do specifically mention the Building Act, only 38% in the central North Island and 50% in the Wellington Region have any additional earthquake-specific policies as well. Sole reliance on the Building Act and Building Code to account for any earthquake hazard should not be encouraged as some overseas cases have shown the implementation of a Building Code to be inadequate when an earthquake has occurred. In addition, the Building Act itself has only limited functions to control the development of buildings on geologically unstable land and therefore should not be used independently, but in combination with the Code, RMAct, hazard maps and other relevant documents and measures.

Finally, a review of the relevant sections of the Building Act and Resource Management Act would assist in addressing issues with respect to the interpretation of those Acts. The Department of Internal Affairs is currently undertaking a limited review of the Building Act with a focus on Section 36(2). In addition, there is still uncertainty over the interpretation of 'natural hazards' in the RMAct and the roles and responsibilities of councils in mitigating natural hazards. Some case law does exist on matters (such as the roles of respective councils), but this could be clarified and supplemented by the creation of more detailed hazard guidelines.

Future Research

While this study has been undertaken within a limited geographical area and focuses on only one hazard (earthquakes), future research will involve analysing a wider range of natural hazards in a greater number of plans and policy statements. Surveys and interviews with staff at local and regional councils will also be undertaken, and will enable us to link the information found in district plans and policy statements with the processes that occur in regional and local government. From this, we will be able to identify

barriers to the effective implementation of natural hazard policy and compile a set of 'best practice' guidelines for natural hazards.

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Author's contact details

Ms Julia Becker, Institute of Geological & Nuclear Sciences
Private Bag 2000, Taupo, New Zealand
email: J.Becker@gns.cri.nz
phone: +64 7 374 8211

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