

Guidelines for the use and development of land close to active earthquake faults



NZSEE 2002
Conference

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ABSTRACT: A report into the problems of land-use and development close to and across known fault lines by the Parliamentary Commissioner for the Environment (2001) recommended the development of guidelines for territorial authorities. It is hoped that these would assist in avoiding or mitigating seismic hazard through the District Plan process. This paper is a progress report on the project set up to produce these guidelines.

The issue is a complex mix of planning policy and processes, legal issues and technical considerations. The project involves developing policy for active fault hazard avoidance and mitigation, writing guidelines and illustrating how this can be done, and assisting councils to incorporate these guidelines into their plans. It is agreed that the guidelines should cover both undeveloped land and previously developed urban areas.

It is hoped to first develop an Interim Planning Guideline, highlighting key issues and outlining recommended planning provisions, and to disseminate this as a web-based document on the Quality Planning website (www.qualityplanning.org.nz). Before this is completed, it is intended to hold discussions with interested parties to review draft material.

1. INTRODUCTION AND BACKGROUND

Although earthquakes are devastating and largely unpredictable events, it is possible to mitigate against the worst damage by avoiding obviously hazardous sites as well as by good seismic design supported by good construction practice. In the last two years there has been considerable discussion about the site-specific hazard of building close to or across known active fault lines (e.g. Nathan & Van Dissen 2001), culminating in a Report by the Parliamentary Commissioner for the Environment (2001).

It appears that few territorial authorities have identified seismic hazard in their district plans. The Commissioner's report recommended that the Ministry for the Environment (MfE) work with the Institute of Geological & Nuclear Sciences and other interested organisations to develop best practice guidelines for territorial authorities in avoiding or mitigating seismic hazard through the district plan process.

Both the Geological Society of New Zealand and the New Zealand Society for Earthquake Engineering expressed a willingness to establish a project with MfE to produce a best practice guideline document addressing the specific topic area of the use and development of land close to active earthquake faults. It is anticipated that such a document would form a template for dealing with other seismic hazards.

2. REPORT BY THE PARLIAMENTARY COMMISSIONER FOR THE ENVIRONMENT

At the outset the Parliamentary Commissioner's report clearly identified that addressing earthquake issues to minimise loss of life and damage to property is a national issue. Concern had been expressed about the ability of the Resource Management Act (1991) and the Building Act (1991) to adequately manage the use and development of land close to known fault lines. The terms of reference included identification of problems with the legislation and its implementation by local authorities. Key agencies and organisations were consulted during the preparation of the report, seeking information on gaps and possible improvements to the present system.

Major conclusions reached are that:

- Buildings sited across faults that rupture in an earthquake will typically be more badly damaged than adjacent buildings. For this reason, it is inappropriate to site buildings on or close to active faults.
- Few of the territorial authorities investigated in a recent GNS study identified seismic hazards in their district plans, and even fewer had rules for managing earthquakes.
- The role of territorial authorities and district planning is pivotal as they are responsible for issuing subdivision and land-use consents, and also have responsibility for issuing building consents.
- Practical guidelines are urgently needed to enable councils to discharge their RMA responsibilities for the avoidance and mitigation of earthquake hazards. However, before this can be achieved, ways to incorporate information on seismic hazards and their management into plans and policy statements, and the most appropriate planning options for reducing risk need to be determined.

The report identified several deficiencies in the system for managing the use and development of land on or close to fault lines. Two major recommendations were made:

1. That the Ministry for the Environment, working together with the Institute of Geological & Nuclear Sciences and other interested organisations with structural and geotechnical expertise, develop best practice guidelines for territorial authorities in avoiding or mitigating seismic hazard through the district plan process.
2. That the Department of Internal Affairs addresses in its current review of the Building Act 1991 the difficulties being experienced with the application of s36(2) of the Building Act 1991, and issues concerning the ongoing monitoring, enforcement, compliance, education and guidance under the Building Act 1991.

This paper is concerned with the implementation of recommendation 1, the development of guidelines for the safe use of land across or near to fault lines.

3. KEY PROJECT ELEMENTS

The issue is a complex mix of planning policy and processes, legal issues and technical considerations. The project involves developing policy for active fault hazard avoidance and mitigation, writing guidelines that illustrate how this can be done, and assisting councils in incorporating the guidelines into their plans.

Some of the key project elements include:

Seismological/ geological context

- definition of active faults, different types etc.

Building design aspects

- engineering aspects associated with building near faults
- relationship of the proposed guidelines with the aims of the Building Code?

Planning and legal issues

- development of criteria for fault hazard avoidance and mitigation (*discretionary, non-complying, prohibited*)
- approaches for areas already developed
- method of communication by councils to the public about active fault hazard risk (with reference to RMA & Building Act mechanisms)

Presentation and ongoing management of information

- maps (what scale?)
- recognition that scientific interpretation may change as more information becomes available – how incorporate this?

End user needs

- what things must the guidance material cover to meet the needs of councils?

4. INITIAL PROJECT WORKSHOP

An initial project workshop was held on 6 December 2001 to discuss the key issues from the perspectives of the range of people that have an interest in this subject.

Fourteen people attended this workshop, representing the following sectors:

- Geological
- Seismological
- Building design
- Territorial Authority planners and hazard analysts
- Legal

Representatives of the Ministry for the Environment and the Earthquake Commission were also present.

The purpose of the workshop was to identify the issues for and needs of end-users of the proposed guidelines (mainly City/ District Councils), along with how the resulting guidelines would be applied in practice. From this, the scope and scale of the guidelines were established.

Key points raised during discussion at the workshop were:

- There is a need to consider relative risk rather than just the hazard
 - identifying those features that can give rise to higher or lower level of risk

eg. likely extent and nature of fault rupture

level of occupancy proposed

type of structure proposed/ possible

- There are accuracy limitations with regard to future rupture at the surface
 - should focus on faults with demonstrated repetitive surface ruptures (noting that knowledge dates from mid-1970's only)
 - different expert views as to how close buildings should be located to potential surface rupture and the ability to design the buildings
 - 'zone of uncertainty'/ information is not static
- Data collection: what is the number of locations required, and the accuracy sought at each location?
- Guidance is needed as to the scope/ extent/ objectives/ outputs of site specific investigation required
- Who pays for the process costs?
 - costs to implement and defend plan changes
 - data costs – gathering, formatting, presentation
 - other costs?
- Performance criteria/ objectives for buildings close to faults? (eg. life safety only?). Extent to which current and draft new loadings standards can/ should be applied.
- What is the current liability situation for territorial authorities? What would the future liability under possible rules be?
- What is the nature and form of information to be made available in the public domain?

Principles upon which general consensus was reached were:

- Guidance should cover both undeveloped land and developed urban areas
- The objective is to seek informed and appropriate development and to provide guidance to enable translation of hazard into risk assessment.
- The project will start with fault hazard before tackling other earthquake hazards, acknowledging that this work will hopefully represent a template for the other seismic hazard elements

5. PROPOSED FORM OF GUIDELINE DOCUMENT

The Initial Planning Workshop identified that ideally both a *planning guideline* (eg. 20 page, web-based) and a *technical background document* should be produced given the complexities of this subject. However there is only limited funding available for this project, and there is a relatively tight time frame of completion of the planning guideline before the end of the financial year.. Consequently, the production of a technical document cannot be funded from within the current project budget. Moreover, given the amount of work required and the limited budget, it would not be possible to produce a fully comprehensive 'final' planning guideline with consultation by the end of June.

Accordingly, the project is to aim to produce an '*interim planning guideline*' which highlights and discusses the key issues, and outlines recommended planning provisions. Working from 'top down' will provide a better focus for the technical document, for which a separate project can be set up if considered necessary. It may ultimately draw together the other elements of earthquake hazard.

The Guidelines are intended to take the form of a web-based document to go on the Quality Planning website (www.qualityplanning.org.nz). The purpose of the Quality Planning website is to promote best practice in the development of plans under the Resource Management Act, and it is widely seen by people interested in planning issues.

6. PROJECT ORGANISATION AND NEXT STEPS

A project Steering Committee has been set up, and comprises:

- Peter Webb and Craig Mallett, *Ministry for the Environment*
- Simon Nathan, *Geological Society of NZ & GNS*
- Janine Kerr, *GNS*
- David Brunson, *NZSEE & Spencer Holmes Ltd*

The people who attended the initial project workshop will be utilised as a broader Advisory Committee as work progresses.

A limited amount of funding is likely to be available for this project from the Sustainable Management Fund. GNS have committed an amount of time to this project as part of their Hazards and Society programme, which deals with the application of scientific knowledge to practical hazard mitigation. NZSEE have offered the \$5,000 new project allowance to support this phase of the project.

The technical material prepared for the initial project workshop will be consolidated and developed further, with a focus on fault hazard definitions and risk parameters for development close to an active fault. A discussion group involving interested parties may be held in March to develop ideas further, and a workshop with all of the initial workshop participants will be held in late April to review draft material.

7. SUMMARY

This paper is a progress report on the process being used to develop guidelines for avoidance or mitigation of seismic hazard in land along known fault-lines. It is hoped that this will lead on to the development of similar guidelines for avoidance or mitigation of seismic hazard in more complex areas subject to earthquake-induced landslides and liquefaction.

The project involves developing policy for active fault hazard avoidance and mitigation, writing guidelines that illustrate how this can be done, and assisting councils in incorporating the guidelines into their plans. The issue is a complex mix of planning policy and processes, legal issues and technical considerations, and is thus more complex than a straightforward engineering or scientific solution.

It is intended to initially produce a web-based *Interim Planning Guideline*, and subsequently produce a more detailed technical document.

REFERENCES:

Nathan S.; Van Dissen R. 2001: Avoidance of fault rupture hazard in New Zealand: why we don't and why we should. *Proceedings of New Zealand Society for Earthquake Engineering Conference 2001*, Paper 2.02.01: 1-7

Parliamentary Commissioner for the Environment 2001: Building on the Edge – the use and development of land on or close to fault lines. Office of the Parliamentary Commissioner for the Environment, 30 pp.