Natural Hazard Management Forum

Christchurch May 2001

Report of Proceedings

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NATURAL HAZARD MANAGEMENT FORUM

21 May 2001, Bellamys, Christchurch

Facilitator: Ian McLean

PROGRAMME

9 am - 12.30 pm

Welcome and introductory remarks - Daryl le Grew, Vice Chancellor, University of Canterbury

Sector presentations followed by a plenary discussion facilitated by Ian McLean

Presentations of sectorial perspectives will attempt to answer the following questions:

1 - What does Natural Hazard Management mean in the context of your sector? What are the components? What are the requirements from other sectors?

2 - What are the critical skills needed both inside and external to your sector?

3 - What are the education and research needs of your sector?

Lunch

1.30 pm - 5 pm

Facilitated group discussions/workshops to examine issues arising from the morning session at a cross-sectorial level in respect of the following key risk management processes: Reduction, Readiness, Response, Recovery

The forum will conclude with a report back from each group and a concluding speech by Ian McLean.

5 pm - 6 pm

Drinks and the opportunity to network and socialise

Contributors:

Government	Pat Helm – Prime Ministers Department
	John Norton – Ministry Emergency Management
Local Government	Peter Kingsbury – Environment Canterbury
Lifelines	Dave Brunsdon – Consultant, Spencer Holmes
Infrastructure	Francis Small - Consultant
Insurance and Finance	Chris Ryan – Chief Executive, Insurance Council
Consultants & Engineers	David Hopkins – Consultant Engineer
Research	Robin Falconer - IGNS
Academia	John Mander/ Jim Cole – University of Canterbury

Workshop facilitators:

Bob Kirk – University of Canterbury, David Middleton – EQC,
David Bull – Massey University, Ian McLean – Strategic Advisor.

Outcome:

Identification of key areas for collaborative action and the formation of an industry group tasked with preparing a paper on the viability of a national centre of excellence. Published proceedings will be made available for every attendee at the forum and a web version will be made available for public access on the CAE website.

Natural Hazards Forum

1 INTRODUCTION

Government in 1994 began a series of steps to review and improve civil defence and emergency management mechanisms in New Zealand. Central to this process was the adoption of a comprehensive risk management approach to reduce the vulnerability of NZ communities to the risks arising from natural hazard events.

Under this new environment the expectations of government agencies, business and the community, have needed to be refocused, and responsibility for action reallocated. There is a growing awareness amongst key agencies of the need for integrated risk management that seeks to reduce risk by prevention and pre-emptive measures, mitigation, integrated responses and more effective recovery methods. Government's vision is for a New Zealand community resilient to natural hazards and disasters.

The traditional approach, that to date has defined our responses to natural hazards, has been based upon the vulnerability of this country's physical networks; road, rail, power, telecom facilities and so forth. But the definition is changing quickly to include other infrastructure components that make up the fabric of our communities; hospital systems, school systems, local governance channels, computer and other network systems and, indeed, the communities themselves.

What constitutes natural hazard management is thus open to debate and redefinition. In addition, local government's role is now different from that of the utility and network operator who, in turn, has a different perception of likely risk elements than that of the manufacturer, primary producer or other businesses. Again, the insurance sector brings its particular focus towards risk management as do the engineering profession, research personnel and academia.

The question thus posed is how does one bring these various interests and requirements together into an integrated risk management response. It was this question that inspired the Centre for Advanced Engineering (CAE) to bring together this first national forum on Natural Disaster Management. The objective of the forum was to identify key areas for collaboration so that New Zealand might achieve real improvement in its risk management approaches.

Of course, much has already been done to change the practise of hazards management in this country:

- the Civil Defence Emergency Management legislation now before Parliament will update and redefine the duties of central and local government
- the establishment of the new Ministry of Civil Defence and Emergency Management has created an improved focus towards integrated approaches, and
- individuals from throughout the country and many different institutions (universities, central government agencies such as the Earthquake Commission and Crown Research Institutes, local government and many others in private practice) have combined through Lifeline groups, to institute risk management studies to establish the likely vulnerability of local lifeline assets to natural hazard events.

In particular the lifelines activity has been important in creating a strong network of practitioners active in the field from a technical standpoint. However by developing a better understanding of the issues affecting different sectors, CAE hoped that the forum would allow opportunity to establish critical actions needed to develop a national approach as well as the accompanying priorities for development of critical knowledge and skills to underpin required capability.

The forum thus offered a variety of papers from individuals whose contributions represented a range of sector groupings. Summaries of the papers are included in Appendix 1. Together they offer a wide view on what constitutes natural hazard management and the requirements for an integrated management approach. In this respect, a number of questions can be asked:

- What are the knowledge components for the various sectors, and how can these best be integrated into education and research activities.
- What are the pressures on local government and network organisations to take responsibility for natural hazard planning?

- How good are we at adapting communities and built systems to the likelihood of natural disaster.

Clearly, there are many interconnected issues that are influencing the way organisations and agencies across the whole spectrum of natural hazards management are responding.

As previously hinted, the corporate restructuring of Government at all levels (both national and territorial) has redefined roles and responsibilities. Moreover, amongst our network industries successful organisations are, themselves, continuously restructuring the ways in which they manage and operate New Zealand's infrastructure facilities. Spans of responsibility are continuously changing and technology innovation is also impacting on normal equipment replacement cycles.

There is also the impact of competitive pressure on the insurance market and the increasing interdependence of risk regions. In particular, New Zealand is likely to see increasing variability in weather patterns arising from global warming, which combined with the increasing pressures from urbanisation will result in more communities vulnerable to natural hazard events. Together this all presents new issues for consideration. But, as many at this forum have commented, it only requires one catastrophic event to change the dominant "world-view".

Issues identified at the forum are described in more detail in the section that follows. These were then considered in facilitated group discussion around the four critical disaster management processes; reduction, readiness, response, and recovery (the four R's). In essence these sessions took up the challenge of identifying the research and education needs required to ensure New Zealand has appropriate structures and expertise in place to manage natural hazards at both local and national level.

A consistent national approach is required across all sectors if we are to enhance community awareness of natural hazards, reduce loss from any disaster event, and provide convincing arrangements for response and recovery.

This is the real challenge of natural hazards management; discovering how good we are at adapting built systems for the likelihood of natural disasters, improving the professional practice of natural hazards management throughout New Zealand, raising awareness within our communities of the nature of the risk individuals face in their daily lives, and ensuring an integrated risk management approach rather than relying simply on a hoped-for response capability.

2 THE ISSUES SURROUNDING NATURAL HAZARDS MANAGEMENT

Discussion at the forum was wide-ranging and offered both differing insights as well as practical experience arising from individual involvement in natural disasters in New Zealand and elsewhere.

Within the context of the meeting a strong view expressed was the usefulness and relevance of lessons learnt through involvement of New Zealand engineers, scientists and risk agencies in major catastrophe events elsewhere. New Zealand must expand the occasional practise of having its people practically involved in international co-operative effort and aid in respect of major loss events, for without such learning it becomes more difficult for this country to maintain an effective state of readiness for a major loss event in this country.

However, in the broader context of the forum objectives, issues raised within the discussion of the individual sector presentation are summarised below. For ease of treatment, the various comments and opinions have been brought together under a number of generic headings:

- Hazards knowledge.
- Dealing with the aftermath of a disaster.
- Economic costs.
- Broadening the knowledge base.
- Governance issues.
- Community resilience.
- Insurance.

2.1 Hazards knowledge

"the matters relevant to the field do not always compare favourably with accepted international practice".

- Lifelines approaches require that we ensure natural hazards research enhances and builds upon local community needs.
- Where do social sciences fit?
- A key capability identified from international experience is awareness of communication processes, communicating risk and equipping people to deal with crisis situations.
- Failure to communicate effectively
- Understanding the need for adaptation of human systems.
- Requirement to upgrade critical mass and operational capacity to respond to an event.
- Understanding the systematic approaches that are required and the longer term resource and social issues
- Uncertainty as what natural hazards are relevant to them – public perceptions underestimate the vulnerability of New Zealand to land slips, tsunamis and the probable greater catastrophic loss from a volcanic eruption.
- Shifting building design emphasis from life safety to damage control.

2.2 Dealing with the aftermath of a disaster

"sedimentation flows resulting from the landslide at Mt Adams in October 1999 are still impacting on local farmers livelihood and the ultimate sustainability of the entire valley community".

- How do we deal with the complexity of processes that follow a single event such as a landslide, earthquake or volcanic event.
- There needs to be better recognition that natural phenomena are simply triggers for catastrophic events – natural risks are the intersection of the hazards with the community
- Disaster preparation is about recognising the worst case.

"legislation will not bind people or agencies to becoming capable"

- Restructuring of NZ's infrastructure and network industries has created confused spans of control.
- To what extent can we expect the new Civil Defence and Emergency Management Act to encourage co-operation and sector-based strategies rather than a straight compliance mentality.
- Y2k offers a good case study of people becoming risk assessors. Need is to ensure people are supported and encouraged to do their jobs and assume responsibility for risk assessment.

2.3 Economic costs

"the economic cost is still going on at Kobe. There were businesses that existed in Kobe that are not there any more. It's a very difficult thing to put your finger on…..".

- What value is business continuity.
- How do you take into account longer-term impacts such a depopulation of a region.
- Where are the dynamic models that adequately describe the loss implications at a community level and thus social-economic loss.
- How does one justify financing pre-emptive or preventive measures – who is responsible for paying.
- Implications for local government in funding natural hazard management work.

2.4 Broadening the knowledge base

"getting everybody to do their job "

- How do we maintain the infrastructure required for an increasing urbanised society?
- Need to change existing paradigms – shift from traditional thinking to the new vision of resilient communities.
- Building capability across all stakeholder groups.
- Requires better sharing of research knowledge.
- What is the "acceptable" return periods for decision making and is there a consistent national approach.
- What is the required minimum functionality for critical facilities after an earthquake or loss event.
- What capacity do we need for society to return quickly to a "normal" pattern of functioning.
- What criteria do we apply to performance-based engineering? What are the critical factors? How do we characterise the building code to reflect building purpose and required functionality.

2.5 Community resilience

"until people take responsibility and understand that this is what they are going to have to deal with then they wont change their behaviours"

- Hazard information pertinent to the needs of the community.
- Communities need to be better prepared.
- Do we have communities that actually understand the nature of the risk and the profile of the risks they face.
- Do we have communities who truly understand that it is an individual responsibility (not a government obligation) to minimise loss.
- Involving individuals.
- What role the network companies.

2.6 Local governance

"how to deal with the fragmented nature of hazard management in New Zealand"

- Trend is continuing devolution from central government to local government of responsibility for dealing with longer-term issues and resource allocations.
- Need recognition that effective governance includes both formal and informal planning processes.
- Local Authority Protection Plan (LAPP) is being challenged with local districts withdrawing from the plan. In these circumstance how realistic is the 60% maximum Disaster Recovery Plan.
- Regional and local rating systems do not allow lifecycle management of major facilities or infrastructure – i.e. flood protection or coastal protection works.
- Local resources insufficient to meet major vulnerabilities – how do we encourage sharing of information and pooling of capability.
- Resource Management Act (1991) is limited in its application.

2.7 Insurance

"experience is that the insurance industry is driven a lot from what is happening offshore rather than what is happening in this country"

- How relevant is New Zealand experience to the international/regional insurance market.
- Insurers with New Zealand portfolios need clearer information of the risks they cover in New Zealand so that NZ is differentiated from other regions in their portfolios
- Adoption of risk-based underwriting and capital provision are essential and require open access to information.

3 FACILITATED DISCUSSION SESSION

The purpose of this section of the forum was to consider the views expressed during the morning sessions and identify key areas for collaborative action. Forum participants were divided into four groups based on preferred interests. Each was then tasked to provide a definition of their area and asked to address the question of the day:

" How can New Zealand develop a strategy for better collaboration and integration of effort?"

To help in definition of that question the following questions were asked as guidance to the group task.

1. What are the skills, research needs other institutional requirements.
2. What are the major competencies required.
3. How can we integrate current programmes.
4. What forms of leadership and collaborative structures might best deliver desired outcomes.

Four groups were established: Reduction, Readiness, Response and Recovery and each reporting back session is summarised below.

3.1 Reduction

The first reporter was Professor Bob Kirk, Deputy Vice-Chancellor, University of Canterbury.

Definition

Reduction is about the avoidance and mitigation of hazards.

Gaps

The group identified a number of areas where more work was needed:

- New Zealand has an enormous range of skills related to natural hazards, but they are not coherently organised or focused in regard to hazard reduction. There is thus a need for a more coherent approach to hazard reduction.
- Education in New Zealand about natural hazards tends to focus on the physical aspects of hazards, and rather less on other elements such as societal and economic matters.

Further effort is needed in these areas.

- There is clearly a need for more research on hazards, including regional mapping to provide a clear picture, region by region, and the way they vary throughout the country.
- There is a need to find better ways of translating research on hazards into risk assessment for management purposes.
- Information about hazards needs to be fed into design exercises and design processes for building and infrastructure. Emergency management thinking needs to be part of a design brief for many activities.•
- There is a need for continuing public education.
- There needs to be a broad understanding of the nature of hazards in relation to concepts of risk analysis and risk management. Such education needs to be cross-disciplinary in character.
- There needs to be more consideration given to the use of hazard information in planning and regulatory activities, as well as more attention given to the question of risk and the way it is perceived by the community.
- There is a need for people who can render and translate technical information into a language that is suitable for non-technical decision-makers, and to assist in the public decision-making processes.

- The concept of tolerable risk needs to be better understood. In other words, what levels of risk will society accept for hazards.

Integration needs

In relation to integrating leadership with collaborative structures, it is clear that there needs to be better co-ordination among educational and research institutions, various levels of management in regional and district councils and with industry needs, including the insurance industry.

This group concluded that the Centre for Advanced Engineering could be asked to bring a group of people together who are representative of interest groups and user groups to consider how best to integrate and co-ordinate what is presently a very fragmented situation with respect to hazard reduction in New Zealand.

3.2 Readiness

The reporter for this group was Mr David Middleton, General Manager of the Earthquake Commission

Definition

Readiness is where we are now and what is needed for successful recovery mechanisms to be put in place.

Gaps

- Fragmentation of resources and users is a major problem.
- There are obvious gaps that need to be filled, but it is not certain what is required to fill those gaps and ensure that future needs are met.
- Emergency Management Groups, to be formed under the new emergency management legislation, should be encouraged to develop skills in research and meeting the educational needs.
- The Ministry for Emergency Management's Strategic Plan and Guidelines will show up other areas where skills in research and education are lacking.

Integration Needs

- There are a range of organisations that could promote integration and encourage collaboration and research. The Lifelines groups in New Zealand have become the classic model. Because they are informal and stimulating, organisations continue to belong to and support them. They are persuasive and have no legal or formal framework.
- Other work in progress includes the Geonet Project, which involves collaboration between two Government organisations, EQC and GNS.
- Progress in this area is expected to be research driven. Collaborative research will indicate the areas where skills and education are needed. To get a wider community of interest, a pilot project, possibly led by CAE, could be established.

3.3 Response

Dr David Bull, Director, Graduate School in Public Sector Management, Massey University, reported from the Response group.

Definition

Emergency management response starts with the first formal activity related to an identified or potential emergency This could be declaration of an emergency, but commonly will be a decision to begin close monitoring of a potential emergency. It was agreed that emergency response ends when special surveillance or a declared emergency finishes.

Gaps

The group decided significant gaps in the response stage of emergencies were:

- Controller skills are insufficient (the typical two-day course cannot be adequate),
- Controller support information management systems are insufficient,
- There is not an adequate pool of risk management skills (in the response context there will be many risk management decisions to make).
- Emergency services co-ordination is likely to be poor in large events.
- Absence of people and equipment for urban search and rescue.
- Limited availability of people for second shift.
- There is inadequate connectivity of those with relevant professional skills. (Who are they? How are they contacted? Can they get access? Authorities needed?).
- Contractor access limitations (e.g. same contractor serving adjacent areas).
- Poor linkages to the welfare and voluntary sectors.
- Poor planning at the family level (have parents, schools, children communicated about what they will do?).
- Deficient mechanisms for communicating with the affected public.
- Lack of practical experience of emergencies.

Research priorities

- The group identified the following priorities for research.
- Building a body of knowledge on how New Zealanders should respond in emergencies.
- Gaining understanding of economic sustainability consequences of response priorities.

  (e.g. long-term impact of no power to dairy farms).
- Understanding the community's priorities.
- Developing alternatives to conventional benefit/cost for decisions on rare events.
- Improve prediction (or interpretation) of ongoing events (e.g. flooding).

Integration Needs

Regarding the question of what are the needs for better integration of the emergency sector, it was concluded that:

- While there are good linkages between local government and the engineering profession, and reasonable linkages to emergency services, linkages to the welfare sector are poor. This was illustrated by low representation of the welfare sector at the workshop.
- At present there is not much linking of national and local emergency plans.
- The emergency management sector lacks an independent advocate.
- Leadership is necessary -only the Ministry for Emergency Management is in a position to lead.
- Processes are needed to see the big picture for risk management in New Zealand.
- Incentives to integrate need to be developed.
- An independent advocate for the hazards sector was considered a good idea.

3.4 Recovery

Dr George Hooper, Executive Director, CAE, reported on behalf of the Recovery group.

Definition

Recovery is the process of returning to social and economic normality.

Gaps

The following points were highlighted:

- Matters relating to recovery are imprecise.
- Responsibility is diffused and there is lack of certainty.
- In a serious disaster there will be extreme competition for limited resources. These may include psychologists, wheelbarrows and engineers. The market model has serious limitations in such circumstances and limited resources need to be prioritised.
- What financial models are appropriate in a post-disaster situation? How are limited resources and finances best utilised to bring the community back to normality.
- A major task will be matching society's and community's expectations with what the reality will actually be.
- There is a need to learn more from other activities and other disaster examples. In other words, research what has happened elsewhere.
- There needs to be a centralised repository for information. The economics of recovery raises important issues. It is well known that, post-disaster, some businesses will leave and many people may leave. Business continuance thus becomes an important aspect of scenario studies.
- How can the learning systems that might provide the types of capability required for recovery in the future be created.
- Communication models are important.
- There is a significant gap in the recovery phase in relation to social sciences and economic understanding of the process.
- An education strategy is important. The level of effort at the moment, while small, is mostly occurring within Government groups. The broader business environment needs to become involved with contingency planning and there is a significant need for research in this area.

Integration Needs

The group concluded that, in order to create learning processes, it is necessary to have networks to give proper effect to voluntary effort, and formal education programmes to allow for professional learning and provide information about what is happening in business, the private sector and also in the Government and local authorities.

4 CONCLUDING STATEMENT

The facilitator, Mr Ian McLean, highlighted the following issues arising out of the forum.

- The diminishing role of central government is a significant factor in hazard planning. Government is still involved in funding research and in response and recovery through the uniformed emergency services. It is also still involved in reduction through the Building Act. Generally, central government involvement will be limited in future to only very big impact events.
- It is not certain what organisations will take over from central government.
- There will be increasing responsibilities for local government, civil defence emergency groups, NGOs such as Lifelines groups, as well as community groups like the Red Cross.
- It is clear that the community needs professional people in all of the four Rs (Reduction, Readiness, Response, Recovery).
- It is important for such professionally-trained people to be available and qualified to fill necessary roles when an event occurs.
- Professionals need education and skills. A significant problem in New Zealand is that there has been very little hands-on experience in natural hazard emergency management. Co-operation throughout New Zealand is needed.
- Such knowledge as needed by professional staff starts with a proper understanding of the hazards in the region, and moves on through to risk assessment, design briefs for buildings and to plans for emergency management and public information.
- Conventional methods of benefit-cost analysis may not be appropriate in a natural hazard emergency.
- Funding is a significant issue. Central government will only provide limited funds for emergency management. This is likely to place a significant burden on local government, particularly once the Emergency Management Bill is passed. Other funding agencies such as EQC and ACC will have significant roles.
- Engineers are no longer thinking solely of saving lives. It has now become important to start thinking about not only saving buildings but enabling activity or services provided by that building to continue in a post-disaster situation. The emphasis has moved from reconstruction to recovery.
- New Zealand has a very small population and cannot afford to unnecessarily duplicate resources. A virtual centre based on existing organisation is a good idea. In summary, Ian McLean referred to the forum view follow-up action is paramount. He believes it is important that the initiative taken by CAE is seen as a start to something much more comprehensive. CAE was charged with the task of bringing together a response on behalf of forum participants that sets out the way forward for collaborative action.

5 APPREHENDING THE PROBLEM

The comments of the invited speakers and those who contributed to the subsequent sector discussions covered a broad spectrum. Together these contributions were looking to leverage and lift existing lifeline and hazard activities; identifying the need for and the means of creating hazard resilient communities. Fragmentation of resources and users is a major problem and, thus, a primary purpose will be to create the critical mass required to foster industry-wide involvement and leadership.

The more important points that arose out of the forum are summarised below. These provide essential guidance to the direction and scope of future action.

- There are currently 16 Lifeline groups in New Zealand. These groups have created considerable goodwill in their communities, particularly amongst councils and service providers. This work needs to be built upon and extended.
- Notwithstanding the success of the Lifeline "industry" in New Zealand, public perception of hazard risk remains low, and communities remain less than "ready" to deal with the realities of a major natural hazard disaster.
- Considerable ongoing work is required in New Zealand to take an overview of research efforts and consider what has been achieved in order to identify where the gaps in knowledge lie, and to determine how efforts to begin filling the gaps should be channelled.
- Research capabilities will need to focus, not only on improving the robustness of civil infrastructure but also on understanding the social and economic consequences of disaster
- Identification of gaps in knowledge will highlight education needs at all levels from raising general public awareness through to research at tertiary level, and in CRI's and similar institutions. A national education strategy needs to be advanced. The notion of composite international degree courses is a possibility. Emergency management must be seen as a distinct professional discipline.
- Despite the work of the Lifeline groups in New Zealand, the "hazard industry" remains fragmented. An integrated approach to hazard management is essential to provide, among other things, the necessary linkages among the engineering and science professions, local government, service networks and the community.
- There is a need in New Zealand for a central repository for hazard information. Such are source will be particularly valuable to the new Emergency Management Groups at local authority level.
- New Zealand must develop a greatly improved emergency response capability. While commendable work has been done from time to time at Civil Defence level creating hazard simulation exercises, the fact remains that there is, arguably, no-one of working age in New Zealand that has had hands-on experience in either directing hazard recovery operations or being involved in an actual response/recovery team.
- The "hazard management industry" needs an advocate that acts to improve research use and uptake.
- The prime gap identified was the need to extend current efforts among a wider constituent group that links the social and economic consequences of disaster into an integrated hazards management approach.

Natural Hazard Management Forum

Christchurch May 2001

Summary of Presented Papers

“Reform in Emergency Management”

Patrick Helm
Department of the Prime Minister and Cabinet

ABSTRACT

While the events of recorded history in New Zealand do not suggest that natural hazards present major risks to life and limb, some geophysical hazards have the potential to cause significant and costly disruption to the normal functioning of society, as well as personal tragedy. Moreover, some natural hazards could create serious national impact at energy levels that may not necessarily be of the scale of the “big one” about which people traditionally worry.

In an effort to encourage central and local authorities to better understand and manage risks over which they have responsibility, Government in 1994 began a series of steps to review and improve civil defence and emergency management mechanisms. Central to this process was the notion of comprehensive management in which risks are reduced by preventive and pre-emptive measures, mitigation, integrated responses, and more effective recovery methods.

At this stage the basic elements of the reform are nearly complete: organisational structures are in place; a new culture is emerging among emergency management specialists; a Co-ordinated Incident Management System has been developed; and new legislation will most likely be enacted next month. However, these steps in themselves will not be sufficient to achieve real improvements unless accompanied by better knowledge of hazards, improved analytical methods, and critical new skills that will allow practitioners to make more informed risk judgements.

“The Role of Government in Hazard Management”

John Norton
Ministry of Civil Defence and Emergency Management

1 Ministry Vision and Roles

Vision: Resilient New Zealand
NZ communities resilient to hazards and disasters

Roles:

- develop the frameworks
- put the structures in place
- create the awareness

2 The New Environment

- the 4 r's
  - reduction
  - readiness
  - response
  - recovery
- refocusing expectations and responsibility
- no longer someone else's business
- the domain of policy makers, providers and responders
- achieve through risk management

3 The new Act will:

- establish structures and roles
- create expectations
- influence land use planning
- influence infrastructure management

4 The new Act will require key agencies to:

- be capable
- undertake planning
- be involved in group arrangements

Others are expected to play their part

5 The Risk Framework

- hazard definition and analysis
- vulnerability assessment
- identification of potential consequences
- management and Mitigation options
  - — remove
  - — strengthen
  - — plan to manage
- communicate and optimise risk choices
- monitor and review

6 Community resilience:

The ability of communities to:

- adjust to a disaster and influence its outcomes
- minimise and withstand losses and to recover from adverse impacts of a disaster

7 Why do we want it?

Community resilience:

- is fundamental to our philosophy of emergency management
  - — community self help
  - — everyone playing their part
  - — supported by em arrangements
- is a unifying concept which we wish to institutionalise
- is a strategic goal or outcome

Contributions to Community Resilience to Hazards Comes From:

- individuals and community groups
- community institutions and organisations
- infrastructure and systems
- systems for hazard management
- knowledge and attitudes to risk hazards

8 Community Resilience Derives From:

- community capacity

And the community reaction to

- risk exposure

A model is proposed to address these elements

The proposed model

9 Research Areas

- hazardscape refinement
- risk and decision models for low probility/high impact hazards
- community resilience — definition and evaluation
- social and behaviour responses
  - — to hazard information
  - — during and following a disaster

"Natural Hazards Management and Local Government"

Peter Kingsbury
(Environment Canterbury)

1. Local government's role in the management of natural hazards

Reducing the impact of natural hazard events on communities is a major function of regional and territorial (district and city councils) local authorities. The function spans environmental investigations and monitoring, planning, emergency management/civil defence, warning and protection, and advice and education.

"Natural hazard management" for most local authorities involves three key principles. These are, *avoidance*, *alleviation* or *recovery*. *Avoidance* means keeping people and property away from the natural event. This can be achieved by planning controls, education and public awareness initiatives. *Alleviation* means "controlling" events and/or improving resistance to the effects of those events. Stopbanks, retaining walls, raised floor levels and strengthening of structures are some of the more common techniques used. *Recovery* involves getting life back to normal after damage or disruption has occurred, and may include rescue, insurance and other financial assistance, repairs and new construction.

Regional and territorial local authority responsibilities come mainly from the Resource Management Act 1991 (RMA) and the Building Act 1991. Local authorities have further natural hazard obligations under the Local Government Official Information and Meetings Act 1987, the Civil Defence Act 1983 and the Soil Conservation and Rivers Control Act 1949. The imminent Civil Defence Emergency Management Act will strengthen local authority responsibility particularly in the area of natural hazards planning and response.

The RMA requires local authorities to establish policies for integrated management of the land and natural and physical resources, and to implement rules to avoid or mitigate the effects of natural events. The RMA gives emphasis to identifying and implementing measures that avoid creating hazards through effects-based land use management. Under the RMA local authorities are also required to collect information on natural hazards and make it available to the public. Territorial authorities have further responsibilities to identify and assess land at risk from various hazard events.

2. Skills and training needed for natural hazard management

The skills and training required of individuals and organisations involved with natural hazard management have changed dramatically in the last twenty years. This change can be attributed largely to a shift in natural hazard management philosophy from:

(1) Single agency approach to partnerships with many and varied organisations.

(2) *Reactive* approach to *proactive* approach.

(3) Response management to risk management.

(4) Planning *for* communities to planning *with* communities.

(5) Communicating *to* communities to communicating *with* communities.

(6) Identifying hazards to defining vulnerability.

Today's natural hazard "manager" requires a thorough background in natural hazard science and risk assessment, environmental legislation, and policy development and implementation.

Equally importantly, natural hazard managers must be able to communicate well with a diverse range of interest groups and stakeholders, and be able to consult effectively. Developing and maintaining strategic and effective relationships internally and externally is critical, as is sound decision-making. Determining the hazard facts, evaluating the hazard information, and forming a judgement and deciding on an appropriate course of action are an essential element of the hazard mitigation decision-making process. The ability to develop informal contracts and exchange information and resources is becoming increasingly important.

3. Local government research needs

A prerequisite for successful natural hazard mitigation work is the supply of adequate and reliable scientific and engineering information about hazards and their potential effects. Local authorities, and in particular local authority politicians, require sufficient and accurate information to make logical, justifiable and defendable decisions.

A wide range of technical studies are required to assess the hazard and risk for any particular natural hazard. For example, geological, engineering geological, geophysical, seismological and engineering investigations are needed to assess potential earthquake hazard. For floodplain management planning, geomorphic, flood history, hydrological and hydraulic flood modelling information is required to adequately assess the hazard. The technical studies are needed to define and characterise the physical hazard process, including its source, location, size, likelihood of occurrence, and severity of effect on a site, structure or activity.

Most natural hazard investigations for local authorities are completed under contract and are scoped to meet the needs of the end-user. With a steady increase in the use of hazard information in planning and development, engineering and emergency management, there is however, considerable opportunity to develop more applied natural hazard research programmes through Crown Research Institutes, universities and other organisations.

"A Lifelines Perspective"

David Brunsdon
National Lifelines Co-ordinator

1 What Does Natural Hazards Management Mean in the Lifelines Context?

Lifelines are those essential services which support the life of our community. These are either *utility services* such as water, wastewater, power, gas and telecommunications, or *transportation networks* involving roading, rail, ports and airports.

Asset and risk management considerations require that Lifeline utilities manage the potential impact of natural hazard events. In addition, given the potentially significant impact on the community of the loss of utility services, the new Civil Defence Emergency Management Bill features obligations on Lifeline utilities to be able to function during an emergency.

Over the past decade, Lifelines Projects have played an important role in helping individual utility organisations address mitigation and preparedness for regional scale events. In New Zealand, lifelines engineering was initiated in 1989 by the Centre for Advanced Engineering with their study of lifelines in the Wellington region. There are now 15 Lifelines Projects or Groups underway or planned throughout New Zealand.

2 The Lifelines Process

The focus of lifelines work in New Zealand is on regional scale events that are beyond the ability of individual organisations to respond to and control. The responsibility for taking appropriate mitigation and preparedness steps however remains with the individual organisations.

The process involves getting all utility and transportation network operators together within a region. Inputs are also provided from scientists, emergency managers, insurers and planners. In this way, lifelines groups facilitate and motivate a collective physical risk management process which is essentially the same as that contained in the risk management standard AS/NZ 4360:1999. The process involves the following key steps:

- Identifying the hazards which could affect each lifelines network
- Compiling common GIS inventories of the various networks
- Assessing the vulnerability of the lifeline network to those hazards (potential damage to and consequences of)
- Identifying and implementing practical mitigation measures
- Facilitating the preparation of integrated emergency response plans

3 Overview of the Lifeline Utility Sector – The Current Environment

Lifeline utilities have undergone considerable transformation over the past decade. The restructuring in most sectors has led to a greater commercial focus, particularly for those with revenue directly at risk. This in turn has led to significant advances in financial risk management. However many of the 'newer' utilities have not given the same level of attention to mitigation and preparedness for longer return period hazard events. The same can also be said for some from the category of utilities that do not have revenue directly at risk.

More importantly, co-ordination of the response to major emergencies *within* and *across* utility sectors has not been given due consideration in the absence of effective mechanisms for sector co-ordination. This is despite the efforts of Lifelines Projects to date. It also stands in marked contrast to the community expectation of a rapid, effective and integrated response by our key utilities.

4 What Are The Real Natural Hazard Management Needs for the Utility Sector?

By considering the needs of the utility sector in a broader context, questions relating to critical skills, education and research needs can then be framed in a more appropriate way. Key areas of overall need for the lifeline utility sector are considered by the author to be:

- ***A consistent economic rationale***
  - the development of a consistent framework for justifying investment for mitigation and preparedness for low probability/ high impact natural hazard events
- ***A consistent risk management perspective at governance level across the sector***
  - recognition of the significance of the 'weakest link', and the need for an integrated approach to both mitigation and response
- ***Informed leadership***

- to recognise that in the absence of 'real' events, steps need to be taken to achieve an appropriate level of robustness – otherwise known as the defensible position

- ***A significant natural hazard event!***
  - we don't have damaging earthquakes or volcanoes, do we?

5 The Critical Skills Required

- ***Systems Analysis***
  - the modelling of utility networks to identify the operational and financial implications of natural hazard events
- ***The interpretation of natural hazard information from a utility perspective***
  - being aware of the difference between *hazards affecting a region* and *hazards affecting utility operations*
  - being able to visualise the physical impact of a natural hazard event on a group of utility networks
- ***Risk communication***
  - ability to reach different targets – both the *providers* and the *users* of utility services
  - capability to develop scenarios which can enable people to explore the reality of a major natural hazard event

6 What Are the Education and Research Needs?

- ***Interdisciplinary post-graduate courses***
  - Masters level courses that enable (for example) engineering graduates to study natural hazards in far greater detail, or other related aspects such as emergency management
- ***Systematic monitoring of international research developments***
  - Identifying research that is relevant to NZ, and then either disseminating it directly or updating/ adapting for NZ needs/ environment. While there is a notable absence of NZ research in the utilities and natural hazards areas, the fundamental first step is obtaining a comprehensive understanding of what is being performed overseas

We have and will continue to get good quality natural hazard information, and the related technology (eg. GIS) is increasingly available. The gaps and bottlenecks outlined above relate to the ***application*** and ***communication*** of this information. The pre-requisite however is a ***demand*** for enhanced education and research from the utility sector.

“Impact of Natural Hazards on Infrastructure”

Francis Small
Francis Small Consulting

1 Definition of Infrastructure

- Traditional definition of Infrastructure is Civil based and involves physical networks – road, rail, power, telecoms, utilities
- New definition of Infrastructure is broad banded and based on “Fabric of Society:”
- Leads to broader impact of Natural Hazards on Infrastructure

2 Responsibility for Infrastructure

- Formally devolved to major Govt Dep - MOW, NZR, ECN and Min Civil Defence
- Corporate Restructuring of Government requires redefinition of this role and responisbility
- Risk Management is now a key issue

3 Condition of Infrastructure

- Replacement programme has lagged significantly
- Current condition is variable and maintenance is also lagging
- Improvements in Code Requirements also impacts on maintenance and replacement programme

4 Industry Trends

- What are the pressures on network industries to take responsibility for natural hazard planning?
- How can industry ensure a risk management approach?
- How good are we at adapting built systems to the likelihood of natural disaster?
- Towards improved approaches – did Y2K offer lessons?

5 Infrastructure needs

- Enhancing awareness
- Reducing losses
- Compelling arrangements for response and recovery phases

6 Creating capability

- Utility companies in some instances are contributing through Lifelines Associations
- National utilities will need to operate at local and national level
- Natural Hazards impact assessments
- Quantitative risk assessments

7 Research requirements

- Fragmented programmes
- Strongly entrenched in the physical sciences
- Focus on earthquakes, but little attention to the need for adaptation of human systems
- Business responses

8 Where to from Here

- Implement immediate Crisis Management protocols
- Identify areas of major risk
- Develop longer term plans for upgrading and replacement
- Allocate responsibility for immediate and longer term issues and resource allocation

"Natural Hazards — Insurance"

Chris Ryan
Chief Executive, Insurance Council

1 The Insurance Council - who are we, and what are we doing?

The Insurance Council is a private organisation owned by its 29 general insurance members.

There are effectively two major natural hazards that insurers need to consider in New Zealand. The first is earthquake insurance, and I will elaborate on that further shortly, but the other is the issue of weather-related hazards, and in particular issues of flooding.

2 Counting the cost

In 1998 probable maximum loss from a major earthquake in Wellington was estimated at $12 billion. This would be unlikely to hurt the reinsurance markets overseas, but would no doubt alter the pricing for future earthquake reinsurance in New Zealand. I will be discussing this in detail later.

It is estimated that nearly NZ$2 billion is available to flow into New Zealand from the EQC's reinsurance arrangements. It is estimated that a further $4 billion of reinsurance monies will flow into New Zealand to cover commercial risks.

Exactly how much of this potential NZ$6 billion of cover will flow into New Zealand from any given catastrophe is hard to estimate. Some companies are very conservative in assessing how much cover they wish to buy. Others have a different geographical spread or type of risk. Particularly those companies with predominance in domestic business are insulated against all but the most severe claims by the nature of the EQC's first loss coverage for householders. These factors and the location and type of earthquake will influence the extent to which insurance companies will utilise their catastrophe cover.

Of the $6 billion available to flow into New Zealand from reinsurance companies abroad, it would appear that there is a shortfall from the estimated $12 billion it would cost to fix Wellington after a severe earthquake. The remaining $6 billion would be made up of various methods of managed self-insurance such as private captives / risk pools (for example the EQC has a pool of 4 billion) We must expect a degree of non-insurance / non-risk treatment activities to occur.

Reinsurance monies won't flow into the country all at once, but they will no doubt have an effect on increasing the value of the New Zealand dollar which would be helpful in purchasing foreign made materials, plant and equipment to aid the recovery.

3 Earthquake insurance cover in New Zealand

At present New Zealand is seen to be in a unique position with the pricing of earthquake insurance and the full cover available.

Overseas earthquake risk countries like New Zealand pay significantly more for their earthquake insurance, both commercial and residential, and they do not get full cover. By that I mean the dollar amount of earthquake compensation is limited per risk. Following the

Northridge earthquake, many private homes were left abandoned even though they were insured for earthquake because the owners did not have the capital to pay the earthquake policy deductible, which was as high as US$35,000.

Following the Kobe earthquake it was revealed that most householders did not have earthquake insurance, although they did have fire insurance, because earthquake insurance was disproportionally expensive compared to fire insurance. Of those that were insured, only twenty percent of the earthquake losses were compensated by insurance.

This is not to say that the earthquake insurance markets in North America and Asia are not developed, they are well developed and are huge in comparison to New Zealand.

Reinsurers tell me that earthquake rates in the US are four to five times higher than they are here for the good risks. As an example:

In New Zealand, Domestic (EQC) $120,000 cover costs $60.00 plus GST.

Commercial rates vary between 0.l% and 0.2% for good and bad risks.

In the US they vary from 0.45% to 0.65% for good risks, and anywhere from 0.75% to 2.50% (ie. $2.50 per $100 value sum insured) for the average to below-average risks.

In Japan the costs are even higher. Also remember that you cannot buy full value earthquake cover, and at the same time there are massive deductibles.

The EQC's deductible, for instance, is a minimum of $200 and a maximum of 1% of the claim. Average commercial earthquake deductibles range from $1,000 to $10,000 and you can buy full cover earthquake insurance.

Depending on the risk in California, the maximum earthquake cover appears to be 80% of the building's value, but in some case it is as low as 30%. Deductibles begin in the tens of thousands for homeowners, and hundreds of thousands for commercial properties.

4 Multiple Earthquake events - Aftershocks

Reinsurance is complex. Reinsurers measure their liability on the actual single event occurring giving rise to the insured damage with in a specified time period.
For example the time period may vary from 72 to 144 hours. This is typically referred to as the "Hours Clause" Should another earthquake occur after this period then cover would only be provided if the reinsurance program had been reinstated after the preceding earthquake event. This will require a new premium to be paid to the reinsurer. An earthquake reinsurance catastrophe program ideally needs to contain the provision for insurance cover to be automatically reinstated at least once in any 12-month period. Most reinsurers will not won't to offer any more than one reinstatement.

There can be the potential for much debate on the question "is the aftershock four days later part of the same initial earthquake event"? Much discussion and research is going into answering this question.

5 Pricing for the Future

Many reinsurers firmly believe that as soon as New Zealand experiences its first serious earthquake, commercial insurance rates will suddenly escalate to those of the US rates overnight. Some even predict that covers will not be available on certain types of construction risks and in certain earthquake risk areas in New Zealand. We are not sure how

this would affect the Earthquake Commission as, although they have large amounts of reinsurance, they do have a large pool as well.

Should earthquake rates rise five-fold in the future, then I'm sure many commercial property owners will opt not to insure for earthquake, thus reducing the earthquake insurance pool. This could have a spiral effect of increasing rates further making earthquake insurance a luxury.

The other issue of real concern for insurers, is the issue of weather related hazards. The reality for us in New Zealand is the same as it is the rest of the world, weather related hazards appear to be growing in frequency. This is a result of climate change. They also appear to be growing in the losses that are incurred as a consequence. This is in large part a result of land use increasingly. Cities for example are expanding onto flood plains and as a consequence losses to property and life grow proportionately.

During the past year floods alone were responsible for a quarter of all insured losses and the loss potential was under-estimated. Figures issued recently indicated that in the year 2000 of insured losses of 10.6 billion US dollars, 3 billion were due to man-made disaster and 7.5 billion to natural catastrophes.

Floods accounted for a high proportion of natural catastrophe losses, 2.5 billion US dollars, making the year 2000 the second most expensive year for floods in insurance history. This was after the 1993 floods when losses reached 2.6 billion US dollars. The most expensive insured loss in year 2000 was 990 million US dollars, and that was a result of floods in Japan. The second most expensive of 747 million US dollars was caused in the UK in the wake of the storm Orotea. This is an indication of the often under-estimated loss potential of floods.

The reality of the future is these sorts of losses are not only going to continue, but increase in magnitude. We as an industry need to look at flooding as a potential loss for our societies, economies and of course for insurance companies on a scale far greater than what we have historically.

We come to understand the real question looking forward for the insurance industry and for people who take out insurance, is at what point does the losses, particularly from weather related natural hazards, become too expensive to insure. Or at what point do the insurance companies say enough is enough, we can't sustain these losses and we wont be insuring for certain events.

At the present nobody is suggesting that, but we need to look forward and look at the ways that we can reduce the state of affairs coming to pass. In relation to earthquakes a great deal of work has gone into mitigating earthquake risk by the creation of hazard identification schemes, building construction and education of how people can secure their homes and properties as well as their lives against earthquake loss.

However in the area of weather related hazards, very little work has begun and a significant amount of work needs to be done working together for a start between meteorology and insurance.

I'd like to touch briefly on the three main approaches to this issue. Under hazards study, the industry needs to work with stakeholders to identify a flood typology. Regional scale modelling of the consequences of flooding and modelling rain fall flooding.

Under the area of mitigation we need to look at land use control, evacuation and warning procedures, economic instruments for catchment management. Finally under intervention

strategies, we need to look at a public participation and perception and project appraisal methods.

Finally in speaking about natural hazards we must remember one absolute. The extent of the losses resulting from a catastrophe depends not only on the severity of the natural forces concerned, but also on human factors, like construction methods or the efficiency of disaster protection methods in the affected region.

Where we live, how we live and how we plan will be the determinant in mitigating natural hazards in the future.

6 Conclusion

Is New Zealand's unique earthquake insurance market living on borrowed time?
No doubt it is. I guess earthquake risk mitigation is going to become evermore important in the future, but why wait for the rates to rise?

But let's not consider earthquake as our only big risk. Flooding has so far cost insurers more than earthquake. Floods occur far more regularly than earthquake and some would predict that floods are going to occur more often as global warming influences our weather and economic development forces us to build in flood risk locations.

"Natural Hazard Management Forum"

Presentation by

David C Hopkins
Principal, Sinclair Knight Merz

1 General Observations 1

- Community is more risk conscious

— risk management

— risk aversion

— risk transfer

- Need to focus on world needs
- Explosion of available information
- All hazards considered
- Some hazards interact e.g. wind/fire

2 General Observations 2

- Obligations on decision makers
- Pressure to occupy ever more hazardous sites
- Empirical data/experiences no longer enough
- Perceptions of risk vary widely
- Fiji Workshop
- Philippines bus

3 General Observations 3

- Legislators, code writers must:

— take hazard information into account

— inform those affected

4 What does this mean for Consultants?

- More responsibility
- Broader understanding of issues
- Education and training
- Different work opportunities

5 More Responsibility

- Greater range of issues addressed
- Risk transfer means increased liability
- Higher community/client expectations
- Increasing need to codify

6 Broader Understanding of Issues

— technical issues

— organisational responsibilities

— understand community expectations

7 Education and Training

- Natural hazards effects
- Risk management techniques
- Global perspectives and issues
- Different skill sets

— awareness of natural hazards

— knowledge of fundamental effects

— ability to relate to everyday issues

8 Different Work Opportunities

- Contribution to technical issues
- Risk analysis

— e.g.. Istanbul Seismic Risk

- Risk management advice

9 Natural Hazards Now

- How do we take account of them?
- Refer spreadsheet (overpage)
- Rain/hail/snow
- Wind/Earthquake/Fire/Volcano
- Chemical/toxic/radiation
- Disease/virus

10 Requirements from other Sectors

- Information - distil/disseminate
- Integration/Analysis of interactions

— to help produce practical requirements

- Challenge is to determine

— what to do now

— priorities for practical action

11 Research/Education Needs

- Studies of impacts on communities
- Probabilities of occurrences
- Economic implications
- Information for urban planning
- Monitoring of events and trends

Treatment of Natural Hazards

Notes on current approaches

Hazard	Prime Concern	Direct Effect	Indirect Effects	Current Situation
Rain	Water penetration	Leaks		Building Code
			Scour	Normal practice
			Siltation	Normal practice
			Aggradation	Normal practice
			Flooding	Normal practice
			Pollution	Considered
			Landslip	Normal practice
Hail	Impact	Structural Failure		Not specifically considered - until Sydney
Snow	Weight	Structural Failure		
			thawing/lahar	Sometimes considered - after Tangiwai
			glacier action/siltation	Not significant
Wind	Pressure	Structural failure		
			Wave action	Normal practice
			Water level rise/fall	Normal practice
			Projectiles	Not specifically considered
			Spread of fire	Sometimes considered
Lightning	Heat	Combustion	Fire	Normal practice
	Light			
	Electricity	Elecrocution	Overload	Normal practice
Comets etc	Impact	Destruction	Numerous	Not considered - low probability
Gravity	Weight	Structural failure	Numerous	Normal practice
Volcanic Eruption				
Lava	Heat/Weight			Normal practice - urban planning
Pyroclastic	Heat/Weight/Impact		Lahar etc	Normal practice - urban planning
Toxic gas	Suffocation	Illness/Death		Not considered - low probability
Ash	Suffocation/Weight	Illness/Death/Structural Failure	Lahar etc	Rarely considered
Earthquake				
ground shaking	Structural stability/integrity			
		Landslip		Normal practice
		Seiche		Normal practice
		Tsunami		Normal practice
		Liquefaction		Normal practice
fault movement	Structural stability/integrity/rup	Flooding		Direct effect normal practice - when known
Fire	Personal safety	Injury/Death; Material loss		
Flora	Economic	Disease	Reduction in crops	MAF controls
Fauna				
Wild animals	Threat to life, economy	Mauling/death; deforestation		Incidents prompt reaction; possums, rabbits
vermin	Health	Nuisance	Disease	Normal practice - Health and Safety Regs
insects	Structural integrity	Structural failure		Normal practice - eg timber treatment
Radiation	Health	Cancer		Warnings/precautions given
Chemical Energy	Integrity of materials	Corrosion	Numerous	Corrosion protection is normal practice

"Natural Hazard Management Forum Research Sector"

Robin Falconer, Institute of Geological & Nuclear Sciences Ltd

1. **What does natural hazards management mean in the context of the research sector?**
   - Carrying out the research that is required to enable New Zealand to manage natural hazards
   - so that the society and economy is resilient to the impact of natural hazards.

2. **What does the research sector need from other sectors?**
   - Clear definition of the needs of each sector.
   - Money to pay for the research.
   - Uptake of the research by the other sectors.

3. **What critical skills are needed inside the research sector?**
   - Staff with high analytical skills.
   - Good communication skills.

4. **What critical skills are needed external to the research sector?**
   - Planning skills.
   - Good communication ability.
   - Ability to make decisions
   - Ability to implement.

5. **What are the education needs of the research sector?**
   - Strong university and other tertiary organisations.
   - Excellent students doing high quality research during their education
   - Excellent graduates for future employees.
   - Courses of quality and relevance for ongoing education of staff.

6. **What are the research needs of the research sector?**
   - Identification of the natural hazards of New Zealand.
   - Understanding processes in order to predict impacts.
   - Integration for all risk approach.
   - Benefit/cost analyses, including uncertainties.
   - Translating/transferring research to users.

7. **Towards International excellence in natural hazard management**

   To achieve and be recognised internationally as having world class natural hazard management in New Zealand we need:
   - A network of excellence – this may involve centre(s) of excellence.
   - Collaboration between the research, education and business sectors, and our communities.
   - International collaboration.

A Perspective from Academia

John B Mander
Department of Civil Engineering
University of Canterbury

and

Jim Cole
Director, Natural Hazards Research Centre
University of Canterbury

1 What Does Natural Hazard Management Mean in an Academic Context?

Natural hazards are not really a problem until we have to live with them. Living with natural hazards means we need to deal with the associated risks. Taking an academic stance, one cannot resist resorting to a formal definition. We might define risk from a set of given hazards as:

$$R = \{P_i\}^T \{C_i\} \tag{1}$$

in which R = the risk, $\{P_i\}$ = a vector of probabilities of the risks occurring within a given time frame for each of the i^{th} risks, and $\{C_i\}$ = a vector of corresponding consequences for each (i^{th}) hazard event when it occurs. Consequences may be measured in several ways: the cost to an asset owner and/or society; the number of fatalities or injuries; the time disruption to a business activity, etc.

It is generally not possible to eliminate risk, we are required to live with hazardous events. However, it is desirable from a societal point-of-view to manage the risk by attempting to minimise risk. In equation (1) to minimise R we can attempt to minimise P. This is difficult if we are dealing with natural hazards (as distinct from man-made hazards). At best we can control the hazards (eg, flood control schemes), but often little can be done, other than understand the nature of the hazard from a fundamental scientific point-of-view.

It is thus necessary to develop a deep understanding of all natural hazards in a New Zealand context. Of course much can be learned from overseas experience and research, but it must also be emphasised that the knowledge gleaned may not always be immediately transferable. Therefore we must continue to build up our local knowledge and understanding of New Zealand's natural hazards based on sound fundamental science.

Another way we can minimise risk, is to minimise the effect of the consequences (C in eq. 1). In an effort to alter and avoid undesirable outcomes, this generally requires some sort of human intervention. In order words to alter the consequences we need to apply engineering principles. Once the fundamentals of a natural hazardous phenomena are understood, we can then model (either theoretically or if too difficult by empirical means) the system behaviour and study how, by design, we can obtain improved engineered solutions. This approach goes beyond present prescriptive codes adopted by the engineering fraternity to date, and leads to a new realm of performance based engineering. Performance based engineering codes of practice are really only just emerging. Much

additional research and development work needs to be done to enable practitioners provide their clients or suite of alternative solutions to choose from.

The above remarks pertaining to the consequences and probabilities of natural hazards relate to "Reduction" and "Readiness" and in a University context for the most part are loosely related to engineering and science, respectively. But what about "Response" and "Recovery"? These are areas that have not traditionally been considered academic, in terms of basic science or engineering. Response and Recovery need to be developed as academic disciplines lead by research activity that will eventually filter down to taught course work. Some interesting research in this area has been done jointly between the medical and engineering schools at The Johns Hopkins University in the United States.

2 What are the Critical Skills Needed Within a University for Natural Hazards Management?

Major research universities have two functions:

(i) They are the repositories of existing knowledge and the discoverers of new knowledge; and

(ii) universities take this knowledge and seek to educate citizens with the eventual hope that this will lead to a better quality of life, both for the student and to society as a whole.

Summarising the university has a dual mission: research and education. The major difficulty arises in this enterprise is that there is too much to learn and know. How then, can we make progress? To ensure progress can be made that benefits society a balanced approach is necessary: a balance between academic rigor versus practical relevance, a balance between academic depth and breadth. If the balance does not exist, then we run the risk of knowing a lot about nothing (too much depth) or too little about everything (too much breadth). It is for this reason that academic research is nowadays built upon a team approach, whereby a spectrum of academics can provide breadth each with their own depth. It is necessary for individuals, however, to transcend the traditional boundaries between academic disciplines in order to advance the state-of-the-art. It is also important that academics not be cloistered in their ivory towers, but rather be fully cognizant of societal needs through continued dialogue with practitioners in the public and private sectors. Perhaps the best way to achieve this objective is to make the recipients of the research outcome part of the research team. This also has the desired effect on ensuring university academics are just not mere research providers and contestable commodities, but rather an integral part of the larger solution.

3 What are the Research Needs in Natural Hazard Management?

From the foregoing discussion it is evident that there needs to be a new approach in New Zealand if we are to truly make progress toward a building more hazard resilient community. It is too much to expect undergraduates in either science or engineering to have the foresight to take an appropriate package of course electives that will lead students to rewarding lifelong careers in a relatively narrow discipline. It is therefore necessary for academia to continue with a broad-based undergraduate education based on classic fundamentals in the arts, science and engineering. Additionally, academia needs to provide leadership by providing specialist research degrees that will provide valuable linkages with industry, particularly if the research is problem driven via a sponsored research programme.

Much can be gained by examining successful models of doing collaborative research from abroad.

One example from the authors experience is in the field of earthquake engineering in the United States. In 1986 the US National Science Foundation (NSF) had the foresight to realise more could be achieved with a systems approach to collaborative team research than with the collective efforts of their traditional single-investigator mode of funding grants. To this end the National Center for Earthquake Engineering Research (NCEER) was established at the State University of New York (SUNY) at Buffalo. Based on a nation wide competition NSF initially funded NCEER at $25 million (USD) for 5 years with matching funds being required from the non-Federal government sources. Although hosted by SUNY there were some 10 private and public university partners plus several private sector firms that formed the consortium. Following a successful review round, NCEER obtained a second five-year round of funding in 1992. On the completion of the first 10 years, NSF deemed this experiment a success. Thus in 1998 NCEER was dissolved and three new regional research centres established: MCEER (formerly NCEER) at SUNY Buffalo, MAE at the University of Illinois Urbana, and PEER at the University of California Berkeley. These three reborn research centres have an increased emphasis on collaboration with industry - both the private and public sectors.

Apart from the large body of knowledge that has emerged as a result of this concerted research effort, there has also been a marked increase in capacity as a result of the numerous MS and PhD research graduates. More recent experience is showing that the up take of new research knowledge is heightened with added industrial participation in the research teams. Moreoever, the graduates with advanced degrees have been very successful in obtaining high level positions in industry and academia.

An interesting question in this United States context concerns the role other US Federal and State governmental agencies play in this process. In the United States, fundamental research has generally always been within the domain of the major research universities. National laboratories (such as Lawrence Livermore, Los Alamos and Brookhaven), the military, the Federal Emergency Management Agency (FEMA) as well as government departments such as the United States Geological Survey (USGS) are mission-oriented agencies. They often fund or co-fund research, participate in it, but seldom drive or steer the research. This is left to the research experts–the university academics–but naturally with appropriate fiscal restraints.

This contemporary research model that espouses an empirical - experimental - theoretical union is not new. The roots of organised collaborative research date back some 400 years to the father of modern research as we know it today–Francis Bacon. It was he who saw that the co-ordination of effort was the key to progress. Only in recent years, perhaps since the Manhatten Project, has there been a renaissance of this approach.

4 What are the Education Needs in Natural Hazard Management?

Research and education in academia are intimately connected. Most postgraduate degrees contain a research component, leading to the production of a thesis. Many of the comments already made are therefore equally applicable to education.

New Zealand is a natural laboratory for hazards, and perhaps rather unfortunately for the country, hazards are sufficiently frequent that we get considerable experience in their management. Training of personnel for positions in the broad field of hazard management is therefore important. The other dimension of this is that New Zealand is a good place for overseas students to study Natural Hazards and there is great potential for full-fee paying students to come here to gain experience, which could subsequently help to save lives in their own countries.

Any training has to satisfy the demands of future employers and hence include courses that cover a

range of aspects. It is important that students have a reasonable understanding of background processes while also learning the critical management skills required. Our view is that this is best achieved by through a National Centre, but with IT, it may not be necessary to house this at one location and can be achieved by distance learning.

A good example is the Scarman Centre, University of Leicester (UK), which was set up in 1988 to undertake research, teaching and professional training in the study of public disorder, crime and punishment, policing, crime prevention and security management. Since then the work of the centre has expanded and now embraces the management of community safety, risk, crisis and disaster and health and safety. This centre offers seven campus-based Masters degrees, which may be studied full-time in one year or part-time over two years and are recognised by the UK Economic and Social Research Council for the receipt of studentships. Currently there are nearly 100 Masters' students in the centre. In addition the centre runs seven Masters degrees by distance learning, for which there are currently 450 students enrolled from throughout the world.

Members of staff from within the centre collaborate with other academic specialists and practitioners from Britain and abroad to teach the courses, and guest lectures and seminars are a feature of it. As a result the centre has established an international reputation for its work and has links with universities in the US, China, Hong Kong amongst others.

Currently training related to aspects of Natural Hazard Management in New Zealand is scattered throughout academia. All universities have undergraduate and postgraduate courses in some aspects of earth science, environmental science and resource management, but only Massey and Canterbury Universities currently offer postgraduate courses directly in Natural Hazards.

Massey University offers a Graduate Diploma in Emergency Management Services which contains compulsory papers in Natural Hazards, Coping with Disasters (offered in alternate years), plus a project and special topic in Emergency Management, and optional papers in related subject such as organisational communication, risk management, social psychology etc.

Canterbury offers a range of papers in Science and Engineering Faculties including Geohazard evolution and mitigation, Earthquake and volcanic hazards, Ground failure hazards, Snow and ice processes, Earthquake geotechnical engineering, Risk assessment, Engineering seismology, and Human behaviour in fires. Canterbury also offers geohazard courses to Lincoln University's Natural Resource Engineering degree. Canterbury is hoping to link these courses into a formal Masters or Diploma degree in 'Natural Hazards' from 2003 (with a similar course structure to the current MS/Diploma in Environmental Science).

5 What Type of Research Centre Does New Zealand Need in Natural Hazards?

Due to the complexity and diversity of natural hazards and their management and mitigation, it is contended that no one organisation, neither university nor public or private sector, is capable of providing comprehensive solutions. However, collectively each of these sectors is capable of providing a contribution to not only help solve such problems in New Zealand, but also use this as a knowledge-based expert commodity that has export potential. This notion is an expansion of the Wellington Earthquake Engineering business cluster–it would however be conceivably more far reaching.

It is considered that what is needed is a non-sectorial lead organisation to pull together all the various sectors and provide some cohesion that will lead to a unity of purpose. Such an organisation could be, but not restricted to, the likes of CAE. It could act as research manager, and broker deals between the various funding agencies and stakeholders. This could, of necessity, leave the academics to what they

can best do–research and teaching.

A key factor in establishing a successful Masters course in Natural Hazard Management course is collaboration. It is such a broad subject that it needs a wide range of skills. These are unlikely to all be available in one organization. The University of Canterbury, for example, has staff with a broad range of skills in causes of hazards and their mitigation, in geotechnical engineering, seismology, and fire engineering, but is likely to need outside help in teaching some aspects of emergency management practice and recovery scenarios. If the proposed Masters course is established we would hope guest contributions might be possible from many of the sectors represented at the symposium. A longer term goal might well be a distance-learning option involving more than one organization (perhaps within a common National Centre)

The present Natural Hazard Research Centre has provided a chance for staff within the University to collaborate on research. The next step is to broaden this collaboration to inter-faculty teaching. We are keen to learn from this forum as to perceived needs for training in Natural Hazard Management within New Zealand and how we can contribute to it.