



New Zealand Society for Earthquake Engineering



**The Response of Professional Engineers
to a Major Earthquake:**

***Priority Response Agreements and a Register
of Engineers***

Discussion Paper

February 2002

**NZSEE
PO Box 13 482
Wellington
www.nzsee.org.nz**

The Response of Professional Engineers to a Major Earthquake: *Priority Response Agreements and a Register of Engineers*

Contents

	Page No.
<i>Executive Summary</i>	3
1. Introduction	4
2. After A Major Earthquake: The Context	5
2.1 <i>Characteristics of the Situation</i>	
2.2 <i>Overview of Relevant Emergency Management Processes</i>	
2.3 <i>Immediate Roles/ Tasks for Engineers at a Community Level</i>	
3. Proposed Mechanisms to Enable the Availability of Engineers	7
3.1 <i>Planning Objectives</i>	
3.2 <i>Priority Response Agreements</i>	
3.3 <i>Post-earthquake Register of Engineers</i>	
3.4 <i>Summary of the Anticipated Response of Engineers</i>	
4. Implementation	11
4.1 <i>Promoting Priority Response Agreements</i>	
4.2 <i>Establishing a Post-earthquake Register of Engineers</i>	
5. Concluding Observations	12

References

Appendix A – Key Elements of a Priority Response Agreement

Executive Summary

Immediately following a major earthquake, there will be a period of uncertainty and confusion across the affected region. Telecommunications systems will be significantly overloaded, and access will be difficult. The commonly held view that key organisations will be able to get access to resources such as engineers “on the day” clearly does not stand scrutiny against the realities of this situation.

Appropriate planning is required to ensure that organisations with essential post-disaster functions can get dependable access to engineers and other technical personnel. In this paper, ‘engineer’ is used as shorthand for the wider set of technical personnel who would be called upon to assist. The NZSEE *Working Party on Integrated Planning for Earthquake Response* and the Institution of Professional Engineers New Zealand (IPENZ) are working together to establish robust arrangements to enable key response agencies to have direct access to experienced earthquake engineers and other technical personnel.

The key immediate post-earthquake roles for engineers can be summarised as:

- *Urban Search & Rescue* – technical advice for rescue operations
- *Assisting Critical Facilities* (eg. hospitals) – safety evaluation for immediate re-occupancy
- *Assisting Utility Services/ Transportation Networks* – impact assessment and assistance with restoration of basic operations and access
- *Building Safety Evaluations* – rapid inspections of buildings for Territorial Local Authorities

The first three categories primarily require either specifically designated or trained/ familiarised engineers with experience in earthquake engineering. Building safety evaluations are more general in nature, and architects and building consent officials will have a valuable role to play in this process. As the timeline progresses after a major earthquake, all technical disciplines will quickly be under intense demand.

The primary objective is for critical facilities agencies to have *designated technical personnel with specific response functions allocated*.

The primary mechanism for critical facilities agencies to meet this objective is considered to be a **Priority Response Agreement**. Given that the supply of engineers and technical personnel with expertise in earthquake situations within the affected area will be limited, a **Post-earthquake Register of Engineers** is also proposed. This register will enable Civil Defence Emergency Management to quickly source additional resources from outside the affected area. The two mechanisms are intended to be complementary. They also represent potential templates for similar mechanisms for other emergency events.

This Discussion Paper outlines the concept of Priority Response Agreements, along with their relationship with a Post-earthquake Register of Engineers. The proposed plan for implementing these mechanisms is also described.

Having comprehensive preparations in place to respond after a major earthquake is seen as a prime responsibility of critical facilities agencies, emergency services and key utility organisations. It is an expectation under the Civil Defence and Emergency Management Bill that arrangements such as Priority Response Agreements will be in place with key resources.

1. Introduction

There is always a strong demand for experienced earthquake engineers and related technical personnel to assist at a community level immediately after a significant earthquake. Over the past decade, the New Zealand Society for Earthquake Engineering has been seeking to clarify the role of professional engineers and related technical personnel following such an event affecting an urban area in New Zealand.

While the principal focus of the Society continues to be on *mitigation*, its members will play a key role after a major earthquake, and *preparedness* for this is essential. The strategic direction recently established by the Society for this activity area is to ***promote the need for a higher level of preparation to respond to major New Zealand earthquakes.***

This Discussion Paper has been prepared by the Society's *Working Party on Integrated Planning for Earthquake Response*, working in conjunction with the Institution of Professional Engineers New Zealand (IPENZ).

This paper is aimed at operators of critical facilities such as hospitals and emergency services centres, lifeline utilities and Civil Defence and Emergency Management staff. It is also intended to get engineers and related technical personnel thinking about how they would respond following a major earthquake.

Related technical personnel in this context includes architects, building services engineers, building officials, etc. They will all have key roles following a major earthquake. While this paper focuses on the immediate response role of structural engineers, and mechanisms to enable their availability, it is intended to stimulate further dialogue with other groups to promote similar arrangements, and for other emergency events.

This paper describes the community-oriented roles and tasks that experienced engineers and related technical personnel will be required to undertake following a significant earthquake. The concept of Priority Response Agreements is outlined, along with their relationship with a Post-earthquake Register of Engineers. The proposed plan for implementing these mechanisms is also described.

Having comprehensive preparations in place to respond after a major earthquake is seen as a prime responsibility of critical facilities agencies, emergency services and key utility organisations. It is an expectation under the Civil Defence and Emergency Management Bill that arrangements such as Priority Response Agreements will be in place with key resources.

The scope of this paper does not include recovery operations, which also warrant consideration and preparation, but will extend over a longer period of time.

2. After A Major Earthquake: The Context

2.1 Characteristics of the Situation

The general operational situation in the hours following a major earthquake can be characterised by the following statements:

- There will be uncertainty and confusion amongst the general public and community leaders
- A range of impromptu response activities (such as immediate rescue attempts) will be initiated soon after the event
- Many hours will pass before effective control of the situation is obtained by Civil Defence and Emergency Management agencies, and Emergency Services
- All means of landline and cellular phone communications are likely to be overloaded
- Access both in and out of and within the affected area will be significantly disrupted

The major demand for technical personnel of all backgrounds and disciplines must be set against the background of heavily disrupted infrastructure as indicated above. The commonly held view that key organisations will be able to get access to resources such as engineers “on the day” clearly does not stand scrutiny against the realities of this situation.

2.2 Overview of Relevant Emergency Management Processes

The principal organisational and liaison roles relating to technical tasks that Civil Defence Emergency Management (CDEM) agencies at the local and national levels are responsible for immediately following a major earthquake are summarised below:

- **Locally**, the CDEM Group Controller would be responsible for co-ordinating the local and regional response. Local Controllers, working under the direction of the Group Controller, may be appointed by cities or districts. Principal response activities include the co-ordination of urban search & rescue and organising emergency accommodation.

Territorial Local Authority (TLA) Building Officials would be separately responsible for implementing and managing building safety evaluations.

The CDEM Group Controller would be responsible for identifying the status/ situation of the region and co-ordinating the responses across the affected TLAs, and in particular their requests for resources. They would co-ordinate public information and actively liaise with other CDEM Groups and the Ministry of Civil Defence and Emergency Management (MCDEM). They will facilitate assistance to critical facility agencies if these agencies have specific needs that they cannot meet themselves, provided that resources are available.

- **Between regions**, it is expected that CDEM Groups will provide assistance to each other to enable a sustained response to prolonged events.
- At a **national level** the Ministry would co-ordinate scientific and engineering information on the event, and transmit requests for inputs/ resources from the affected regions to external agencies and other sectors.

These activities would be undertaken within the ODESC(E) framework, where officials from a range of government agencies consider joint approaches to an event.

2.3 Immediate Roles/ Tasks for Engineers at a Community Level

The key initial community-oriented actions that experienced engineers will be needed to perform immediately after a significant earthquake (ie. the first 24 hours) are summarised in Table 1 below.

Table 1: Immediate Post-earthquake Actions to be Undertaken by Engineers

Process or Facility	Key Tasks/ Functions
1. Urban Search and Rescue	Providing technical advice for rescue operations
2. Critical Facilities (eg. Hospitals, Fire, Ambulance and Police Headquarters)	Safety evaluation for immediate re-occupancy
3. Utility Services	Impact assessment and assistance with restoration of basic operations
4. Transportation Networks	Impact assessment and assistance with restoration of essential access
5. Building Safety Evaluations for Territorial Authorities	Rapid inspections of buildings in the affected area
6. Regional impact assessment	The provision of overview/ advisory input to Civil Defence Emergency Management agencies

The first four categories primarily require either specifically designated or trained/ familiarised engineers with experience in earthquake engineering.

Urban Search and Rescue (USAR) requirements are being addressed under a separate project being led by the Ministry of Civil Defence and Emergency Management and the NZ Fire Service. The project objective is to have at least two specifically trained structural engineers formally attached to each of the three national USAR Task Forces planned for Palmerston North, Christchurch and Auckland, plus engineers with general USAR training in each region (refer to the report by the USAR Steering Committee available from www.mcdem.govt.nz).

While training for building safety evaluations is clearly desirable, this process is more general in nature, as initially it involves brief exterior inspections to assess basic habitability and street safety for cordoning, etc. Architects and building officials have a key role to play in this process. Provided that appropriate frameworks are in place (such as the Building Safety Evaluation procedures produced by the Society (NZSEE, 1998)) and the process is led by engineers and architects who are experienced in seismic design, a range of building professionals can be readily deployed. It should however be noted that only a limited number of TLAs have set up the necessary structures and arrangements recommended in the 1998 guideline. NZSEE considers it to be particularly important that real progress is made in this area in the near future.

Associated with the technical function of establishing whether or not essential buildings are safe to be fully or partially re-occupied is assuring the operators (occupants) that the buildings are indeed safe to occupy!

3. Proposed Mechanisms to Enable the Availability of Engineers

3.1 *Planning Objectives*

Appropriate planning is clearly required to ensure that organisations with essential post-disaster functions can get dependable access to engineers and other technical personnel “on the day”. The challenge lies in the fact that in virtually all cases, technical personnel at both trade and professional levels will be external to these organisations.

The primary objective is for critical facilities agencies to have *designated technical personnel with specific response functions allocated*.

The associated functional requirements are that designated technical personnel should:

- Be familiar with emergency response processes generally
- Know what they have to do in their designated role
- Be familiar with the particular facilities (where appropriate)
- Be rapidly available with a high level of dependability

With regard to the latter point, performance objectives must be realistically set. The scale of event being planned for occurs very infrequently, and planning and preparation is set against the backdrop of much more frequent organisational change. However while it is not practical to set specific response times for technical personnel, meeting the basic objective of having *designated technical personnel with specific response functions allocated* will produce a much more effective response at the community level than would currently be the case.

The primary mechanism for critical facilities agencies to meet these objectives is considered to be a **Priority Response Agreement**. There is also a need for a **Register of Engineers** to provide a pool of additional technical resources for regional scale emergencies. While these mechanisms need to be developed for other foreseeable events, this section focuses on post-earthquake arrangements, given the extreme communications and access circumstances involved. These two mechanisms are outlined in more detail in this section.

The focus of these mechanisms is on engineers in order to illustrate the principles involved. The scope of Priority Response Agreements is not intended to be limited to engineers, as many organisations have a need for immediate assistance from other related professions and key trades after a major emergency. Similarly, the Post-earthquake Register of Engineers is seen as a potential prototype for technical resource registers for other emergency events.

3.2 *Priority Response Agreements*

Priority Response Agreements are prior written agreements between critical facilities agencies and (for example) consulting engineers to carry out immediate post-event safety inspections.

There are two principal objectives of such agreements, namely:

- Ensuring the availability of designated engineers and/ or technical personnel who are familiar with those facilities; *and*
- Minimising their response time by defining in advance the specific actions they are to undertake.

There is a range of issues relating to priority response agreements that need to be considered. These issues and the options in terms of the level of commitment and the resulting robustness of the arrangements are summarised in Table 2 below. The level of robustness of an agreement (or urgency of response) depends on the level of commitment made by both the agency and the consulting engineer (with reference to the middle two columns). This will also influence the degree of formality of the agreement.

Table 2: Aspects to be Addressed in a Priority Response Agreement

Aspect	Level of Commitment/ Robustness		Comments
	<i>High</i>	<i>Basic</i>	
1. Nature of required response	Automatic	Make contact first	Triggers must be defined for 'automatic'
2. Numbers of engineers formally committed	>2	2	Measure of redundancy
3. Rendezvous arrangements	Designated location and target time frame	Not specified	
4. Initial Actions	Documented & practised	Documented	
5. Prior familiarisation	Seismic performance assessment undertaken	Prior walk-through	Need to know where construction drawings are located
6. Priority Actions			Agreed with management
<i>Formality of Agreement</i>	<i>Contract</i>	<i>Memo of Understanding</i>	

It is important to have the key elements documented in the form of at least a memorandum of understanding. The key elements and possible structure of a Priority Response Agreement are shown in Appendix A.

Even for a Priority Response Agreement involving only a relatively "basic" level of commitment/robustness, the expectations and duties associated with each of these aspects should be defined. In particular, liability issues need to be understood and documented, along with pre- and post-event remuneration. The process for an annual review of agreements including an update of contact details should also be specified.

For critical facilities such as hospitals, Priority Response Agreements also need to involve building services engineers. Comprehensive agreements should also involve architects.

For territorial local authorities, Priority Response Agreements may need to cover the different units – for example, the emergency management office and the buildings or other asset/ or facilities management aspects.

3.3 *Post-earthquake Register of Engineers*

The reality is that Priority Response Agreements will only make available a minimum of local technical resources, and some essential facilities will be more affected than others. The supply of engineers and technical personnel with experience in earthquake situations within the affected area will be limited. Accordingly, under any scenario (including the current situation where few Priority Response Agreements are in place), CDEM Controllers will need access to additional engineers to 'plug the resource gaps' that may result from severely affected critical facilities agencies, etc. The principal function of a Post-earthquake Register of Engineers is therefore to quickly source additional engineers from *outside* the affected region (including overseas engineers).

As noted earlier, there are a variety of emergency situations in which specialist engineering assistance is rapidly required other than earthquake. IPENZ are currently looking at the broader issue of mechanisms within their database to identify engineering specialists for immediate response duties, and how this can be linked with regional CDEM Groups.

Moreover, as *response* moves towards *recovery* in the days following an earthquake, there will be a considerable demand for a wider range of engineering and technical services. In that situation, the Association of Consulting Engineers NZ (ACENZ) and IPENZ will play key roles in matching supply with demand.

The post-earthquake register as outlined in this document however focuses on the critical first 48 hours when specific tasks need to be undertaken and means of communications are limited. The register will also be valuable into the recovery phase, but is not being designed to cover the wider demands involved, given that market mechanisms will rapidly emerge.

The key operating features of the proposed post-earthquake register of engineers are:

- Voluntary listing of experienced earthquake engineers; not competency based
- Response is on a 'best endeavours' basis (likelihood to be available at short notice is implicit in submitting name for register, but response is not guaranteed)
- Designated *Engineering Co-ordinators* to help match the requests for assistance with available resources (eg. Auckland, Wellington, Christchurch). This assumes two Engineering Co-ordinators are available outside any given affected region.

The two functions of the Engineering Co-ordinator are *firstly* to identify the priority needs, and *secondly* obtain the relevant engineering resources. This concept involves the Engineering Co-ordinator within the affected area working closely with the Civil Defence Emergency Management Group *Controller* to match their needs with available resources. The Engineering Co-ordinators in the other regions would provide assistance in terms of mobilising additional resources.

As the availability of the designated Engineering Co-ordinator cannot be assured in the affected region, this role would initially be taken up by the first structural engineer(s) arriving at the CDEM Group Emergency Operations Centre (EOC). General process familiarity amongst structural engineers will therefore be required, along with Standard Operating Procedures for the register in each EOC.

In creating the Post-earthquake Register, potential conflicts in terms of pre-commitment by engineers need to be recognised. A number already have either formal or informal pre-commitments to commercial clients other than critical facility agencies. Individuals can only commit to a single agreement within a given region.

3.4 *Summary of the Anticipated Response by Engineers*

When the proposed mechanisms of Priority Response Agreements and the Post-earthquake Register are in place, it is anticipated that the initial response of engineers in the affected region following a major earthquake would be along the following lines:

1. Engineers assist in their immediate personal situation. If with family, attend to their immediate needs. If at office, ensure that colleagues are safe and receiving treatment if necessary
2. Engineers with Priority Response Agreements would make their best practical efforts to attend the critical facility or organisation involved
3. Consulting Engineering principals and senior staff would seek to assist major/significant clients.
4. Other engineers and technical resources would help at the community level (eg. Building Safety Evaluations) through Territorial Local Authorities.

The initial engineer(s) arriving at the CDEM Group Emergency Operations Centre could assume the role of Engineering Co-ordinator, undertaking the following:

- Working with the Controller to establish the priority engineering resource needs
- Allocating any available engineers in the affected region (ie. those that have reported in to the EOC)
- Establish contact with the Engineering Co-ordinators outside of the affected region, and request additional engineers with specific or general capabilities (working off the national Register, including international contacts).

By several hours after the event, it can reasonably be assumed that most local engineers will be involved in some form of action. Most therefore will be difficult to contact, given that telephone systems will continue to be overloaded, and as many cellphones will quickly have flat batteries.

Accordingly, engineers who have no immediate designated tasks should attempt where practical to attend the nearest CDEM Emergency Operations Centre and make themselves known as an available technical resource to the Controller or his/ her deputies.

Outside the affected region, engineers (both on the Register and not) who would be able to assist at short order would be encouraged to contact the other designated Engineering Co-ordinators (outside the affected region).

It is envisaged that Engineers requested to assist by Territorial Authorities on specific facilities or for extended periods of time in a declared emergency would be remunerated for their involvement. Default Conditions of Engagement need to be developed for this situation, including clarification of liability and professional and personal insurance issues.

4. Implementation

4.1 *Promotion of Priority Response Agreements*

The Ministry of Civil Defence and Emergency Management have indicated their willingness to assist in the promotion of these agreements with critical facilities agencies, territorial authorities and utilities via the CDEM planning process.

A working group including representation from IPENZ and ACENZ is being established to develop sample Priority Response Agreements.

After an organisation has such an agreement in place, the minimum necessary pre-event preparation is to have the nominated engineers familiar with the facilities and briefed on the organisation's post-earthquake arrangements.

4.2 *Establishment of a Post-earthquake Register of Engineers*

It is proposed that the Post-earthquake Register will be set up and maintained by NZSEE and IPENZ in partnership. As NZSEE now operates its own database directly, tasks can be shared between the two organisations as appropriate. Initial thinking on the mechanisms and various tasks is outlined below.

Creation of the Register

In order to establish the Register of Engineers, it is proposed that NZSEE advertises through its membership for engineers and others who would like to be listed. Registration of interest for engineers who would like to be involved in the Post-earthquake Register of Engineers will be called during 2002.

The database will follow the principle of being a single national database maintained at a central point by one agency. It will be in transportable form that can be read and queried in a universal software package such as MS Excel. An internet version is desirable, provided that it is held in a protected portion of an appropriate website. The structure of the database must allow for local, regional, national and international elements.

Engineering co-ordinators are to be appointed and trained in conjunction with IPENZ, noting their potential to assist in emergencies other than earthquake.

Management and Maintenance of Register

It is proposed that NZSEE will be the lead agency responsible for promoting and maintaining currency of the Register. IPENZ will operate the database, including the distribution of electronic copies to the new CDEM Group Emergency Management Offices. This process is envisaged to operate on the following basis:

- The Register will be updated annually from NZSEE membership updates forwarded to IPENZ
- Listing via electronic files will be provided to CDEM Group Emergency Management Offices and the three Police & Fire Communications Centres by IPENZ
- The Register and Priority Response Agreements would be promoted regularly by the NZSEE Working Party. This would include seeking new members for the register.

5. Concluding Observations

The majority of critical facilities agencies and utility organisations do not have robust post-earthquake arrangements in place with key technical resources. Priority Response Agreements and a Post-earthquake Register of Engineers are seen as essential ingredients in moving towards a minimum level of response preparedness.

Establishing Priority Response Agreements will take time. NZSEE, IPENZ and ACENZ will work with the Ministry of Civil Defence and Emergency Management to promote the concepts involved. The Post-earthquake Register of Engineers will be set up by NZSEE and IPENZ during 2002. Both are needed to be in place – neither will be sufficiently effective on their own for a major earthquake.

In addition to representing good risk management practice, the implementation of Priority Response Agreements by critical facilities agencies is an expectation under the new Civil Defence and Emergency Management Bill. Organisations that should have priority agreements in place include critical facilities (hospitals, police, fire, ambulance), emergency management agencies and utility and transportation network operators.

All engineers and related technical personnel need to consider what their response is likely to be after a major earthquake, once they have assisted in their immediate personal situation. The arrangements outlined in this paper also require much closer relationships between engineers and emergency responders.

More effort also needs to be made by TLAs in setting up the necessary structure and arrangements for post-earthquake building safety evaluations.

Please provide any feedback on the concepts and mechanisms outlined in this discussion paper to NZSEE as follows:

Administrative Secretary
New Zealand Society for Earthquake Engineering
P O Box 13 482
WELLINGTON
Email jacquie@hague.co.nz

References

Post-earthquake Building Safety Evaluation Procedures, New Zealand Society for Earthquake Engineering, January 1998

Appendix A: Key Elements of A Priority Response Agreement

Part 1: General

- Purpose and Objectives
- Scope (building(s), etc)
- Best endeavours basis

Part 2: Preparation/ Familiarisation

- Familiarisation inspection of building undertaken
- Structural drawings accessible (specify location)

Part 3: Maintenance

- Annual meeting between engineer and facility or building manager
- Procedures for change in facility or building manager, or engineering personnel
- Procedures if changes to facility or building

Part 4: Response Expectations and Arrangements

- Activation triggers and notification (*automatic/ make contact first/ await call*)
- Number of engineers formally involved
- Default place of rendezvous

Part 5: Commercial Arrangements

- Name of organisations entering into agreement/ memorandum of understanding
- Permissions of other tenants/ occupiers obtained
- Liability issues (incl. situation where Agreement is with tenant rather than owner)

Appendix: Contact Details