POST-EARTHQUAKE RESPONSE: ISSUES ASSOCIATED WITH COMPILING A REGISTER OF ENGINEERS

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ABSTRACT

The December 1996 issues paper by the Society's *Working Party on Integrated Planning for Earthquake Preparedness* [1] was widely circulated and received positive feedback from various sectors. As one of a number of follow up activities, the Ministry of Civil Defence asked the Society to investigate and report on the issues associated with establishing a register of engineering resources for post-earthquake response.

The investigation involved looking at aspects such as maintenance of the register, training of those involved and mobilisation and co-ordination mechanisms. This process was enhanced with positive input from other interested parties including the Earthquake Commission, the Insurance Council and the Institution of Professional Engineers New Zealand.

The project report as presented to the Ministry of Civil Defence in June 1998 is incorporated in full in this paper.

1. INTRODUCTION

1.1 Background

The Ministry of Civil Defence has been concerned for some time now that they do not have a reliable mechanism for obtaining suitably experienced engineers at short notice following a major earthquake.

The Earthquake Commission and the Insurance Council are also interested parties in terms of seeking access to key technical resources such as engineers after a major earthquake. Both are placing considerable emphasis on the development of disaster response plans, and are aware of the difficulties in ensuring they have access to sufficient numbers of engineers. In November 1996, these organisations co-hosted a seminar entitled '*Finding, Managing and Sharing Scarce Resources*' [2] which looked at some of the related response issues.

Registers of engineers have existed previously in various forms, including versions operated by EQC. These lists typically only recorded names, and did not actively address broader issues such as training and mobilisation.

The New Zealand National Society for Earthquake Engineering (NZNSEE) is also concerned that a number of fundamental planning steps and linkages have yet to be put in place in this area. At a meeting between NZNSEE and Ministry of Civil Defence representatives held in December 1997, the NZNSEE offered to facilitate the compilation of a register of engineers for rapid mobilisation after a significant earthquake. This project to investigate and report on the broader issues associated with establishing a list of engineering resources has resulted.

1.2 Objectives

The objective of this project is to explore the issues associated with creating a register of engineers to assist key agencies after a major earthquake. As well as identifying the most appropriate form and home of such a register, consideration is to be given to aspects including:

- the range of demands that the engineering sector can anticipate
- the maintenance of the register
- the level and frequency of training to be given to those on the register
- how those on the register would be mobilised, and then co-ordinated following an event

The key emphasis is planning to utilise scarce resources in the most effective way possible during the critical initial response phase.

The associated issue of quantifying the number of engineers likely to be involved is outside the scope of this project.

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This report presents the salient points associated with each issue, outlines the options where appropriate and makes recommendations for the Ministry to consider. It is hoped that some of the issues raised in this report will promote debate and assist development in the broader area of integrated planning for earthquake response.

2. POST-EARTHQUAKE DEMANDS ON ENGINEERS

2.1 Sector Demands

Immediately after a damaging earthquake, demands will be placed on engineers from a wide range of sectors or user categories. The needs of each of these sectors will typically fall into the following categories:

Initial Response
- *safety assessment, impact assessment*

- **Recovery Process**
  - *determining in detail the extent of damage, and preparing plans and specifications for the repairs, as well as the processing of Building Consent applications*

The user categories and associated subject/ activity areas, along with an indication of their relative importance and urgency, are outlined in the Table 1.

TABLE 1: Post-earthquake Demands on Engineers

User Category	Subject/Activity Areas	Safety/Community Priority
Ministry of Civil Defence	Urban search and rescue	√
	Situation overview	√
Critical Facilities	Hospitals	√
	Fire Stations	√
	Police Stations	√
	Civil Defence and other government control centres	√
Utility Services	Water supply	√
	Wastewater	√
	Power and gas	√
	Communications	√
Transportation Networks	Road	√
	Port	√
	Airports	√
	Rail	√
Territorial Authorities (regulatory)	Building safety evaluations	√
	Building consent processing	
Insurance	Recovery of operations	
	Claims processing	
Manufacturing and Industrial	Key processes	
Government Sector	Community agencies or key departments as tenants	√
Building Owners	Commercial	
	Residential	

For sectors such as *transportation, utility services* and certain manufacturing and industrial facilities, specific knowledge of the systems and installations would be particularly advantageous for the impact assessment. Not all organisations within those sectors have an in-house engineering capability. As awareness of the need for a planned response widens, it is envisaged that key agencies within these sectors will establish *priority response contracts* with engineers who are familiar with their systems. This is to be strongly encouraged for key community lifelines such as water supply and transportation networks, and for hospitals, emergency services and critical operations centres, as it is understood that few such contracts are in place. The extent of existing priority contracts will however become apparent during the process of establishing a register.

Similarly, it is anticipated that engineers involved in urban search and rescue teams under the leadership of the Ministry of Civil Defence will be specifically identified and given prior training.

The gathering and recording of information via reconnaissance teams is an important and ongoing function,

and while not relating to any specific user category in the preceding table, sits in the context of the "big picture".

2.2 The Time Dimension

The time dimension of demand for engineers also needs to be taken into account, along with the size of the respective tasks. For example, urban search and rescue has a focus on the first three days, whereas comprehensive insurance evaluations are unlikely to be fully underway inside the first week.

A simplistic representation of the time dimension associated with the initial response is given in Figure 1. The shaded rows represent the areas that the sectors involved in this project (ie emergency management and insurance) have the most direct interest in.

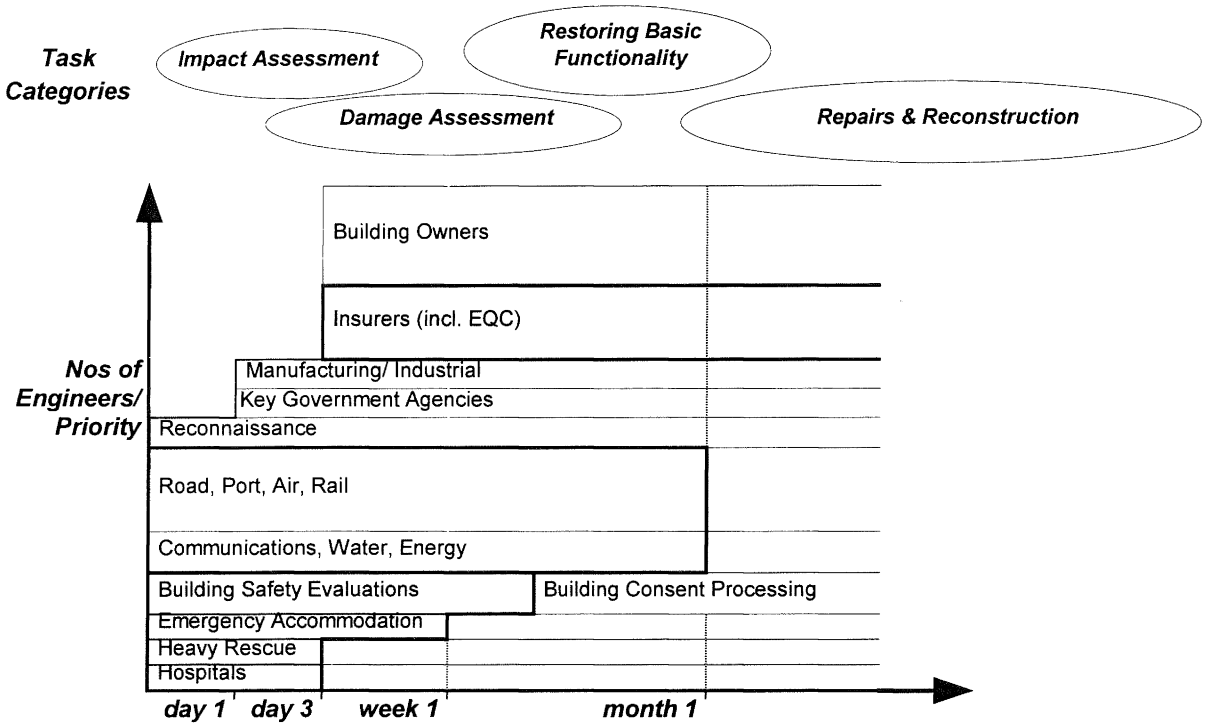

Figure 1: The time dimension associated with the initial response to an earthquake

2.3 NZNSEE Reconnaissance Scheme

The NZNSEE has for some years had a comprehensive Earthquake Reconnaissance Scheme in operation. This scheme has seen multi-disciplinary reconnaissance teams attend a number of major earthquakes within a week or ten days of those events occurring. While the majority of events covered have been overseas, the 1987 Eastern Bay of Plenty earthquake was attended by a full team.

This scheme draws from a list of largely New Zealand-based engineers and scientists that currently numbers approximately 75, of which 25 have experience with earthquake reconnaissance. The scheme is organised for New Zealand-based events in such a way that the NZNSEE reconnaissance team would only draw upon resources outside the affected region. The NZNSEE team would address the important initial gathering and recording of scientific information.

It is important to note that many of the more experienced earthquake engineers in New Zealand are already on the NZNSEE Reconnaissance Team list, and the potential for doubling up with any new register needs to be taken into account in developing mobilisation procedures. Consideration of the different time frames applying suggests for example that some of those involved in the initial response (eg 2-4 days) may then be able to become involved in broader reconnaissance activities for NZNSEE.

3. REVIEW OF A U.S. APPROACH

The US State of California Governor's Office of Emergency Services (OES) has developed a "Post-Disaster Safety

Assessment Plan" [3]. This plan recognises that '*With the continuing threat of disaster, particularly devastating earthquakes, there is a need to plan for augmentation of state and local government engineering capability. One of the most important post-disaster assignments will be to determine the safety and serviceability of key facilities.*'

That original plan was developed in the late 1980's and first applied following the 1989 Loma Prieta earthquake. In light of that experience, a revised 1992 plan has been developed. In total there have been eight activations under the plan including the 1994 Northridge earthquake.

Originally developed for the provision of professional engineering personnel resources with the American Society of Civil Engineers, it currently includes the Structural Engineers Association of California, California Council of American Institution of Architects and California Building Officials 'who have chosen to volunteer their services for such purposes.'

The 'Post-Earthquake Safety Assessment Plan' provides OES with access to engineering and related resources to assess the safety of buildings, structures and lifeline systems and to assess options for their continuing functions. These 'state' resources are then passed onto local government jurisdictions for local emergency uses. A 'regional OES representative', who receives requests from the disaster zone jurisdiction carries out the initial management of engineers' allocations.

The US organisation is similar to that in New Zealand (without the Federal level of Government) in that there are mutual aid agreements between local governments and the reference to central (state) government when local resources are overwhelmed. The State of California is subdivided into regions to facilitate organisation, communication and movement of resources.

Once allocated, the requesting local government manages and completely controls the engineering resources.

Each of the volunteer contributing organisations have pre-allocated primary fields of contribution; e.g. Building official to rapid evaluation of buildings, civil engineers to lifeline structures and facilities, and structural engineers and architects to buildings. There are also secondary allocations to groups of facilities, e.g. schools, health, fire and police, water supply etc. Multiple interest and capabilities of the personnel are recognised, e.g. civil engineers and architects may undertake detailed reviews of buildings less than three storeys or less than 100 square metres.

Standard operating procedures are given for all activities for all participants from requesting assistance through to final debriefing and record keeping. These include the authority to act, responsibilities, co-ordination, identified tasks and procedures for executing those tasks. The inspection process and organisation is spelled out. Potential problem areas, reimbursements and liabilities are addressed.

An important aspect is the management and utilisation of "walk-on volunteers". This is an important issue that if not managed correctly can result in adverse media and political pressures on disaster response activities.

The complete approach is generally adaptable to the New Zealand government structure and the broader working environment. However in making such adaptations, acknowledgement must be made of the different structures that exist in territorial authority and other organisations. The NZNSEE publication *Post-earthquake Building Safety Evaluation Procedures* [4] already takes these aspects into account in addressing local authority preparedness and building safety assessments.

The small human resource pool available in New Zealand for all post-earthquake tasks represents the major difference from the available US models.

4. POSSIBLE FORM AND NATURE OF REGISTER

The most appropriate form of the register of engineers is that of a database, in any of the main proprietary formats currently available. These formats would enable the register to be readily amended or re-organised, and to be sorted across a wide range of information fields. This section outlines the other factors that define the form and nature of the register, and the sub-options associated with these where appropriate.

4.1 Organisations and Individuals

While the register has been thought of largely as involving individuals, the inclusion of engineering practices or other organisations is likely to prove beneficial. Organisations act as a potentially broader resource, enabling the more dependable supply of overall numbers (ie. agencies relying on the register would less vulnerable to the non-availability of individuals due to personal circumstance). This pre-supposes that any such organisation is not over-committed in terms of priority contracts.

The inclusion of organisations can facilitate the formation of teams with a range of skills that may be of greater use than a corresponding collection of individuals. In this way, by association, a wider range of knowledge and skills can be accessed by such a list. Training can also be more easily facilitated and carried out more efficiently.

There are also benefits to the organisations concerned, including the spin-off of training of a group of individuals on company preparedness.

The register should also include offshore resources comprising interested and available individuals or organisations.

4.2 Parent Organisation

The simplest form of the register would be as an "add-on" to an existing engineering membership database such as that held by IPENZ and member technical groups such as NZNSEE, Structural Engineering Society and the Geotechnical Society. A willingness in principle to assist in the establishment and maintenance of such a register has been indicated by IPENZ, subject to the issues involved being worked through in more detail.

Discussions have also been held with RedR (*Register of Engineers for Disaster Relief*), but the view is mutually held that RedR is not set up to respond on the scale envisaged, and within the likely time frames. It is however anticipated that they will be able to add resource to the overall response and recovery efforts.

The next level of enhancement (and hence cost) would involve the development of a purpose-designed database held and maintained by a prime user organisation such as the Ministry of Civil Defence, critical facility owners or the Earthquake Commission.

An alternative form of register would be one that acts as a single list encompassing professional fields such as quantity surveyors and architects as well as engineers. Such a database would be run either by a prime user organisation or as some form of joint venture. While potentially the most comprehensive arrangement, this option would involve the greatest cost.

Irrespective of which of the above options is ultimately chosen, the register must be set up and operated as a 'live' entity; that is to say, resourcing must allow regular updating and provide a facility for interactions with register members and involved organisations.

4.3 Level of Information Sought

The items of information that people wishing to register on the list would be asked to provide could encompass the following:

- address and contact details (24 hours)
- date of birth
- specialist technical field (where applicable)
  - *urban search and rescue; building structures; bridges; water, power, gas, telecommunications systems; port facilities; industrial plant; building services*
- previous experience in reconnaissance, building safety evaluation and/ or reconstruction
- likely response time
  - *6 to 12 hours*
  - *12 to 24 hours*
  - *1 to 2 days*
- likely period of availability
  - *2 days*
  - *2 days to one week*
  - *longer (indication to be given)*
- relevant training attended

The nature of information to be provided by organisations would have a similar emphasis on technical specialities, relevant experience and likely periods of availability. Linkages would be made with entries for individual engineers in the register, with the database being organised to sort by either individual or organisation.

The register is envisaged to be a simple list of engineers who are willing to indicate a likely commitment. It is not considered appropriate to include specific eligibility or selection criteria beyond this self-nomination, thereby avoiding issues such as competency listing. Accordingly, while the NZNSEE may be involved in the establishment of the list, engineers outside the Society's membership would also be encouraged to register. IPENZ have recognised this in expressing their willingness to become involved in this project.

4.4 Nature of Commitment Sought

Post-emergency resource registers can require a range of degrees of commitment by those offering to become involved. This can range from a firm and specific prior commitment to be available, subject only to adverse effects of the event on immediate family, to an offer which may withdrawn when called upon due to the particular circumstances of the individual.

Clearly, the greater the degree of prior commitment sought, the fewer the number of entries on the list that can be anticipated.

It is considered that for the nature of the register envisaged, an indication of a general willingness to commit would be appropriate. For both individual and organisation entries in the register, there is a need to ensure that prior commitments are not doubled up on.

4.5 Financial Recompense

In establishing the parameters for this list it is assumed that the people that will ultimately be called upon to assist will be remunerated for their time as well as receiving recompense for expenses incurred. Amongst other things, this reflects the formal arrangement that such a register represents. As part of the implementation process, forms would be developed including an outline of the contract arrangements that would apply.

While a declared state of emergency exists, those engineers activated under the specific direction of the Ministry of Civil Defence would become a 'national resource', and be remunerated by the Ministry. Engineers or organisations from the register that are mobilised by other users would be subject to direct remuneration from those users.

Priority response contracts for tasks such as the immediate safety evaluation of critical facilities (hospitals, police and fire stations) would contain specific pre-agreed parameters and procedures.

Participation in training is not likely to involve remuneration for other than those responsible for preparing and carrying out the training, as it typically forms part of continuing professional development.

5. MECHANISMS FOR CREATING A REGISTER

Seeking engineers to register for the list by way of a form sent out with professional journals and/ or annual subscription notices is considered to be one of the most

appropriate mechanisms. The form would be initiated by the principal organisation(s) that will administer the list.

This approach has the advantages of:

- reflecting the self-nomination emphasis associated with the register
- enabling Privacy Act issues to be addressed
- minimising the cost associated with gathering this information

The returned forms would then be processed by the parent organisation, and entered into the database. The cost associated with this stage of the process would be limited to the cost of printing the forms, plus any other charges associated with setting up the database and entering of information.

6. MAINTENANCE OF REGISTER

The maintenance of the register is likely to be the responsibility of the parent organisation(s).

The key issue is the frequency of updating - *how, by whom* and *costs*. While a process of annual updates appears appropriate, the actual period would be dictated by the organisation charged with the administration of the list. If it was operated by IPENZ, for example, changes to list entries could be identified readily from annual subscription renewals with only minor customisation. Administration by one or more of the user organisations would see updating as being a specific process, and hence maximising the interval between updates would be in order.

The degree of time input (and hence cost) associated with maintaining the list is a direct function of the numbers registered.

7. INFORMATION AND TRAINING

Notwithstanding the general experience of engineers that are likely to become involved in a register, their response will be improved and better focused if provided with appropriate information and training prior to being called up.

Urban search and rescue is the most obvious example of where specific training will be required. Opportunities to utilise demolition sites as part of this training should be taken. More general training will however be beneficial for those who have not been involved in post-earthquake activities. It should be borne in mind that the majority of the NZNSEE members that have taken part in reconnaissance missions have only experienced the *'Day 7 to Day 21'* period, and that only as observers.

Considerable emphasis in developing information and training packages will need to be placed on *process* and *procedures*. Participants in a register need to be fully informed as to what will be expected of them, and what they can expect. This has been the thrust of the training sessions held to date by the NZNSEE Reconnaissance Scheme team leaders. Emphasis could also be given to areas where additional skills are needed to be developed, such as the forensic aspects of investigations and reporting.

The process of updating information and training will however have an associated expense, and will need to be carefully planned. The following issues arise:

- the frequency of sending out information (and by whom)
- the scope and curriculum for training
- the frequency of holding training sessions, and how long each session should be
- the location of training sessions to achieve appropriate coverage (given that participants are likely to be attending in their own or their organisation's time)

With regard to frequency, it seems that training sessions could be held on a biennial basis. The option of regional sessions or a larger session possibly linked with the NZNSEE annual conference remains.

There is an associated need for engineers to gain a better appreciation of the way the insurance industry operates, and vice versa. Sharing elements of training together would be of benefit to both sectors, and this process should commence as soon as possible.

Possible future linkages with training and exercising by Emergency Management Groups at regional level under the new regime also need to be considered as a means of rationalising organisational effort.

8. POST-EARTHQUAKE MOBILISATION AND CO-ORDINATION

Mobilisation requires a pre-determined mechanism, along with people in or near the affected area to activate the mechanism. Once mobilised, there is a need to meet and brief the engineers, and co-ordinate their deployment and subsequent activities. It appears that there should be a defined linkage with the Regional Controller under the current structures, or with the Emergency Response Co-ordinator under the proposed EMG model.

Appropriate personal identification cards will need to be developed and issued to those on the register as part of the process of establishing the list.

Frontline responders in an affected area will be making urgent requests for a range of resources, as well as engineers. Leadership and co-ordination by engineers that have experience in similar roles from previous earthquakes is clearly desirable. Given the importance of the appropriate allocation of engineering resources in terms of their level of experience, expertise and training, the designation of an *Engineering Co-ordinator* would appear to be of value.

Such a person may be located within or outside the affected region, depending on the magnitude of the event.