Proceedings of the Seminar on the Social and Economic Effects of Earthquake Prediction, 12 October, 1977.

THE ROLE OF LOCAL BODIES

M. Fowler*

SUMMARY

Responsible local authorities throughout New Zealand anticipate a recurrence of earthquakes which experience and historical records have proven. Some have declared themselves bound by the M.C. Act, Clause 301A, which requires earthquake risk buildings demolished or upgraded to at least a minimal acceptable standard. All are bound to require new buildings to conform to present earthquake resistant codes, and most have established a Civil Defence organisation. None are programmed to operate upon the advice of the anticipated time of a predicted earthquake. Yet the application of the science of Earthquake Prediction will require not only the total co-operation of Central Government, but even more importantly that of Local Government to align the population to the worthwhileness of heeding both false and true predictions.

INTRODUCTION

In early September I sent a memorandum to two Wellington City Council officers requesting their opinions for my preparation of this paper. I quote a paragraph from that memorandum:

"If, and I repeat if, the science of earthquake prediction is advancing sufficiently to be of any value whatsoever, and in my ignorance I am totally unaware that this is so (in fact it seems to me to be a field of glorious semantics for under-employed American University sociologists), I will outline what benefit such predictions could be to local bodies."

Subsequently I read a paper by Professor Frank Evison, titled "Precursory Seismic Sequences in New Zealand", and later talked to him to ascertain that the proposed seminar was not just a joke. He convinced me otherwise though it would seem that the application of earthquake prediction in New Zealand, to any tolerable accuracy, may be a decade or two distant.

A major earthquake is predicted for Wellington, and has been for many years, and therefore the Wellington City Council will heed and participate in any exercise which will lead to the avoidance of major loss of life and property through earthquake. One of those exercises is obviously the development of a science to predict the force, location and time of earthquakes.

PRESENT POSITION

In 1968 the Municipal Corportatiors Act was amended by the insertion of Section 301A "Powers of Council with respect to buildings likely to be dangerous in earthquake". This gave local authorities (who had applied to exercise this section of the Act, such as the Wellington City Council) power to require demolition or strengthening of buildings which they considered would be dangerous in earthquake.

The Wellington City Council declared its intention to operate under Section 301A of the M.C. Act in 1970 and carried out a survey of all commercial buildings in Wellington during 1972, 1973 and 1974. It classified buildings into three broad categories:

Class A: Earthquake risks in terms of Section 301A of the M.C. Act

Class B: Those buildings which have a better standard of earthquake resistance than required by the M.C. Act, but a lower standard of resistance than that required by the 1935 code.

Class C: Generally, buildings erected after 1935 and all buildings up to the standard of the 1935 code or better.

The survey of commercial buildings established:

758 Class A buildings
417 Class B buildings
700 Class C buildings

A map of the downtown Wellington area showing the building categories A, B and C in differing colours was prepared. If earthquake prediction becomes a reality in the Wellington region this map will serve a very useful purpose.

It is anticipated that if an earthquake of Richter Magnitude 7 or greater occurred in close proximity to the city, all Class A buildings would be partially or substantially damaged. The Class A buildings are well defined on the classification map.

Notices were sent to the owners of 280 buildings in first priority areas in August 1973 advising of Council's powers in terms of Section 301A of the M.C. Act and requesting information in respect of the

* Architect, Mayor of Wellington.

owners' future proposals for the buildings. Similar notices were sent to the owners of 478 buildings in all other areas.

Council officers are cognizant of the earthquake vulnerability of the city and attend all seminars and conferences related to earthquake risk and resistance aspects. (Overseas attendance has been somewhat limited.) Council engineers frequently attend courses at the Engineering Schools in Auckland and Christchurch, e.g.

1. 1975 South Pacific Conference on Earthquake Engineering.
2. 1974 Seminar on High Earthquake Risk Buildings.
3. 1975 Civil Defence Seminar on Rescue from High Rise Buildings.
4. 1973 Symposium on Tall Buildings.
5. 1970 Geophysical Aspects of Earthquake Engineering.
6. 1976 Seminars on Earthquake Loadings on Buildings.
7. 1975 Symposium on Earthquake Design.

The Council carried out a major programme of work on the strengthening of its M.E.D. building and has prepared design proposals for strengthening of earthquake risk buildings, including the Turnbull Library, Hunter Building, Public Trust, etc. Numerous building owners and their consultants have discussions with Council officers on possible methods of strengthening buildings against earthquake shocks. The Council promoted lectures by Peter Culley of San Francisco, an engineer specialising in the strengthening of existing buildings, to the N.Z.I.E. and N.Z.I.A. in December 1975, and arranged the Civil Defence seminar on Rescue from High Rise Buildings in June, 1975.

The Council is responsible for Civil Defence operations in Wellington and carries out a full programme of training and organisation.

EFFECT OF MAJOR EARTHQUAKE IN WELLINGTON

All those old masonry buildings which are classed as earthquake risks could be expected to suffer partial or substantial damage. Comparatively modern buildings could be expected to suffer non-structural damage, including damage to ceilings, partitions, windows, etc. Non-structural damage is expected to be more substantial in tall buildings having flexible structural frames, while buildings having stiff structural walls may be affected to a lesser degree.

Areas of reclaimed land in the vicinity of the harbour may be subject to substantial slumping and possible liquefaction. Most buildings in these areas have been constructed on piles which will provide protection to some degree. Piles under older buildings, however, will have been subject to decay and may not afford much protection from ground subsidence.

Roading and underground services including water supply, electricity, gas, communication cables, will all be affected by ground movement should it occur.

Possible land mass changes may occur, as were recorded in the area during major earthquakes of the 1850's. Wellington is traversed by a number of geological faults, and a major disturbance may initiate movement on any of these faults which could cause substantial differential ground movement.

It is believed that the land now occupied by Wellington Airport was uplifted in some previous catastrophe. It may well be that in the next major movement it will revert to its original position.

The alluvial plain of the Hutt Valley could suffer substantial movement during a major occurrence.

Road and rail routes out of Wellington pass through tunnels and deep cuttings. Subsidence in tunnels would be certain to cut off rail communication with the city. The main highway routes could be blocked for a time due to land slips in cuttings or due to subsidence of filled areas, particularly along the waterfront.

The main electricity supply will be cut for a considerable period. Transformers and switch gear are prone to damage by earthquake shaking, and transmission lines may be brought down through one cause or another. Electrical supply authorities are aware of this vulnerability and are progressively implementing procedures which will ultimately give greater protection to the supply equipment.

Water supplies will be affected by ground movement, adding difficulty to the fire fighting operations which are likely to be required. Gas mains will rupture, making the situation even more dangerous.

Public health will be at risk with fractured and blocked sewers and the interrupted supply of sterilized drinking water.

ADVANTAGES OF PREDICTION

Persons and valuable materials or items located in those buildings which are classified as earthquake risks would certainly be evacuated. Congregations of people should be prevented, schools, cinemas, places of assembly, should be closed.

If the central city area was totally evacuated during the event, loss of life during a major earthquake could possibly be prevented.

Those owners of buildings which were aware of hazards such as chimneys, parapets or structural weaknesses, may have time to have these removed. Those owners who were planning site redevelopment may update their programmes such that they have evacuated their old buildings and possibly demolished them.

Emergency services may erect temporary or even permanent buildings to cope with the event when it arises. The building industry may well become overburdened with requests to strengthen buildings, remove hazards and for the provision of temporary buildings for emergency use.

Low lying areas, where there is a likelihood of ground subsidence, could be evacuated. Services such as gas and water supplies could be valved off in

such areas.

The general level of activity in areas which may be subject to flooding from tidal wave could be scaled down.

Little precaution could be taken for protection against large mass changes except total evacuation of persons and property. However, the prediction of such changes would be extremely difficult and more general emergency precautions would seem appropriate.

Householders could store supplies of food and water.

Rail transport would have to be completely curtailed at the predicted time of the earthquake, particularly passenger services. Organisations transferring freight might attempt to fill sufficient orders to tide them over the post earthquake period.

Road transport would probably use those routes which were more likely to be unaffected by land slip and earth subsidence.

A substantial conflict could well occur prior to the predicted earthquake with organisations endeavouring to scale down activities such that only a limited number of personnel (if any at all) would be in the affected area, and yet at the same time intensifying their activities in preparation for the event. The survival of Civil Defence personnel and resources would be enhanced, in that warning could allow withdrawal of these for grouping in safe areas while also allowing all, including volunteer units, to come to a state of readiness.

Every major earthquake produces public health problems, and the best way to counter this is to evacuate as many people as possible to an area where there is no risk. Water supply and sewage disposal constitute the two main problems. Water stored in concrete reservoirs may be lost due to earthquake damage, and the only sure way of maintaining a limited supply of sterilized water may be to store it in small metal tanks prior to the earthquake.

Sewage disposal will be difficult to handle on a large scale, but temporary measures such as forming ponds, cesspits or other means could be arranged in preparation for the event. Preparation could also be made for the chemical treatment of sewage.

With electricity and gas supplies temporarily cut, some other form of energy supply, fuel oil, petrol in safe containers, coal, firewood could all be stockpiled to be used until normal supplies of electricity and gas are restored.

CONCLUSION

Finally, Wellington will get its major earthquake, but when? Is the rate of progress in preparing for this earthquake fast enough, and is the cost of preparation and prediction justified?

These questions are not likely to be answered here today.