PRINCIPAL NEW ZEALAND EARTHQUAKES DURING THE YEAR 1973

R. D. Adams*

A wide variety of earthquakes occurred in New Zealand during 1973. Many of the larger shocks originated at considerable depth within the Earth, however, and their effects at the surface were not unduly severe. The year's largest earthquake was a deep shock of magnitude 6.7 (Richter Scale), that took place in the early hours of 6 January 1973. The earthquake was about 170 km deep, and its epicentre was about 20 km to the west of National Park in the centre of the North Island. As is usual for deep earthquakes, it was felt widely, but without undue severity. The felt area covered the North Island south of a line from Whakatane to Kawhia, and extended as far south as Hokitika and Timaru. The highest intensities were experienced in Taihape and Hawke's Bay, where some chimney damage was reported. A grandfather clock in a homestead near Waipukurau was stopped, this being the first stoppage caused by any earthquake since the major Napier earthquake of 1931. The extensive area over which the earthquake was felt resulted in the Earthquake and War Damage Commission receiving more than 2500 claims, mainly for cracked chimneys, minor cracks in foundations and plaster, and for articles falling from shelves. The amount paid for these claims totalled about $180,000.

On the morning of 26 March, two other deep shocks were felt widely on both sides of Cook Strait. In the Wellington area the shocks caused some concern, but only minor damage was reported. The first earthquake had a magnitude of 5.3 and occurred at a depth of 66 km beneath D'Urville Island, and the second, 47 minutes later, had a magnitude of 5.4 and a focus 74 km deep, almost directly beneath Wellington. A further deep earthquake beneath Cook Strait occurred on 13 June at a depth of 100 km. It had a magnitude of 5.1 and was felt from Taranaki to Banks Peninsula. Other significant deep shocks beneath the North Island that were reported felt occurred on 15 January beneath the Rotorua region (magnitude 5.5), on 7 March beneath the central North Island (magnitude 5.3), on 15 April beneath Taranaki (magnitude 5.1), on 30 August off East Cape (magnitude 5.5), and on 27 December in the Bay of Plenty (magnitude 5.8).

The largest shallow earthquake of the year occurred early in the morning of 22 February. Its magnitude was 5.7, and its epicentre in Hawke's Bay, about 10 km southwest of Hastings. It was preceeded by a foreshock of magnitude 4.8, and was followed after 47 minutes by an aftershock of magnitude 5.1. Within the next day four other aftershocks had magnitudes of 4 or greater. The main shock was felt throughout Hawke's Bay, Manawatu and Wairarapa, and about 800 claims for minor damage were received from the Hastings and Napier areas.

Another sequence of shallow earthquakes took place about 35 km southwest of Molesworth Station, in Marlborough, late in April. The largest two occurred on 23 April (magnitude 5.2) and 29 April (magnitude 5.1). Road cracking near the epicentre has been interpreted as minor fault movement on the Clarence Fault. The felt area of the largest shocks extended into northern Canterbury.

In the Fiordland region, the largest shallow earthquake (magnitude 5.0) occurred near Milford Sound on 23 May. A deeper shock, on 29 January, originated 140 km beneath the north end of Lake Te Anau and had a magnitude of 5.3. It was felt widely in the south of the South Island.

A series of small shallow earthquakes occurred near Rotorua on the afternoon of 6 May. The earthquakes were small, the largest being only of magnitude 3.2. The fact that the earthquakes were felt locally may be ascribed to their closeness and shallowness, rather than their size. For similar reasons, a small shallow earthquake (magnitude 2.9) that occurred within 10 km of the centre of Christchurch on 19 June was reported felt there at moderate intensities.

No significant earthquakes were associated with activity of the central North Island volcanoes, but Mt. Ngauruhoe has been more active than in recent years. Activity that started in November 1972 continued as strong ash eruptions on 1 and 2 January, 1973. Other ash eruptions were most active on 8 September, 26 October, and 7 December. During the December eruption a small ash flow reached halfway down the slope of the mountain.

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GENERAL INFORMATION

LETTERS TO THE EDITOR

Microtremor Recording

G. L. EVANS

"The description of microtremor investigation given by Parton and Taylor (Vol. 6 June 1973) is most interesting and the use of this technique could have much wider application in this country for identifying the seismic behaviour of various types of ground strata.

During the measurement of pulse wave velocities to obtain in situ dynamic properties of ground materials some incidental recordings of microtremors were made by the writer using similar detecting equipment, (i.e. Wilmore Seismometer) but a different recording method. In this case the recorder used was a Rapet light beam galvonometer type, using a fast travelling paper chart (100 cm/sec). Visual inspection of the record is quite easy and any dominant period can be seen almost immediately. However, for the more complex vibrations some form of digitising and frequency analysis is needed.

The apparatus was produced for a different purpose, but has been found quite suitable as a cheap and quick way of taking short records of microtremors (over time periods of one third to 1½ seconds).

In tests with Wilmore seismometers it was found that the type of ground coupling methods had some influence on the response of the seismometer to impulse waves through the ground or directly on to the instrument. There was a characteristic strong frequency component between 50 and 110 herz depending on the nature of the material on which the instrument was sitting, e.g. for a firm clay surface the response to an impulse showed a frequency of 68/70 herz and on a concrete floor the frequency was 106/110 her . On an 8" concrete block on medium to firm ground the frequency was about 50 herz.

Various tests were made with the conclusion that the seismometer and ground surface form a coupled system with a characteristic response and the frequency varies with different types of surface conditions. Also there was a small difference between each of two instruments used (as shown by the double figures above).

In the recording of continuous microtremors this particular response characteristic may have little significance but if any microtremors were near the system response frequences it is possible that some amplification of this frequency could occur and give a false impression of the ground behaviour.

The authors of the paper do not mention anything about the influence of instrument or mounting characteristics. It would be interesting to know if any comparative records have been taken using different types of detecting seismometer or geophones and different mounting methods. Only in this way could one assess the relative influence of ground behaviour and instrument behaviour."

I. M. PARTON AND P. W. TAYLOR

"In reply to Mr. G. L. Evan's letter, the Authors agree with the conclusion that the seismometer-ground system must have its own natural frequency. This will be undoubtedly affected by the mass of the instrument and the way in which it is mounted. In the work described in the paper, the seismometer was mounted on a rigid metal plate spiked to the ground. The Authors did not record any resonant frequency which might be attributed to the seismometer-ground system. Mr. Evans mentions frequencies of 50-110 Hz observed by him. Such high frequencies would be eliminated from the record, with the Authors' apparatus, by the high frequency filter which had a cut-off point about 20 Hz.

The Authors wish to thank Mr. Evans for his interesting contribution."

Editorial Comment on Building Services

G. F. RANDS, Building Services Group, N.Z.I.E.

"Engineers are often accused of having a poor public image compared with other professions, and our friends tell us we are sometimes our own worst enemies in the way we publicise our internal professional differences.

I was therefore not unduly surprised to see your editorial of September 1973 inferring that mechanical and electrical services were normally installed by sub-contractors who "... drill, chase, and cut away vital structural parts indiscriminately for their wares". You refer to the "Engineer whose careful aseismic ductile frame analysis has been carried out to a precision of 7 places of decimals". In addition to such academic exercises, one would hope that a practical design engineer would give some thought to the practical needs of the occupants of the building, even the one you quote as "getting dirty water away from a hand basin". The co-ordination of building services with structureal requirements is of prime importance in the design stages of any