



Ground vibration study, Beauty Point Landslip area

B. D. Weldon

The Department of Mines established a line of survey nails along the road in the Beauty Point landslide area in December 1990. These nails were placed at intervals of about 20 m for a total length of approximately 240 metres. There has been movement since that time and this has been located mainly between the nails at 40 m to 160 m on this traverse. The movement ranged from 6 mm at 40 m, 40 mm at 140 m, and 10 mm at 160 metres. This line is surveyed at regular intervals.

It was proposed to undertake vibration studies to assess whether trucks carrying wheat from the port across the landslide were significantly contributing to the further movement in the area.

The vibration study was made on the 18–19 August, 1992 during a transfer of wheat from Beauty Point to Launceston. Two sites were occupied and at each site two orthogonal geophone arrangements were employed. The geophone arrays were located in the table drain on the higher side of the highway. The table drain was wet and the ground close to saturation. This is ideal for transmission of ground vibrations as water is incompressible. The occupied sites were in the area where lateral movement has occurred between 91 Flinders Street and Crozier Street.

The ground vibration equipment operated by the Department of Mines is old and out of calibration, and that calibration is expensive. Nevertheless, the survey was undertaken as relative results should have been useful. It was expected that the level of ground vibration at foundations set back from the roadway would be attenuated, i.e. lower than those recorded in the table drain. However it is possible that ground vibrations may create resonant vibrations in a structure which may behave in such a way as to magnify the ground vibration.

At the first occupied site, the ground vibration ranged from 1.8–6.8 mm/second peak particle velocity, and at the second site, from 1.2–8.6 mm/second peak particle velocity. These peak particle velocities are not the instantaneous particle velocities but the velocity of a particle should the worst recorded vibration recorded by each channel of the geophone occur

simultaneously. In other words, they tend to overstate the actual ground vibration. Background noise recorded with no vehicles on the roadway, but at the high amplifications used during the survey, was 1.0 mm/second at both occupied sites. The highest reading, which was for a laden wheat truck followed by three passenger vehicles, thus represents an eight to nine-fold increase in vibration from the background noise.

The levels of vibration detected were below that at which it is usually accepted that structural damage will occur. According to work undertaken in Germany, they were below, but approaching, the level at which architectural damage (such as hairline cracks in plaster) is considered possible from occasional sources of vibration. The German limits are regarded by many as too harsh and restrictive, but are mentioned here because they consider a range of building types, as well as the duration of the event causing the vibration.

On most records, two channels of the geophone closest to the portable 240 volt power supply generator recorded vibrations at 47–48 Hz. It is suspected that this is electrical noise which has not been excluded from the calculations reported above. In this event the ground vibrations will have been over-estimated.

Humans are excellent detectors of ground vibration and good use of this is made to help seismologists determine earthquake intensities. The human body is generally able to clearly perceive ground vibrations in excess of 1 mm/second. The officer conducting the testing was unable to personally detect either the measured background vibration or that from passing laden wheat trucks. This suggests that the results of the survey over-estimate the actual ground vibrations, perhaps because of the electrical noise mentioned above.

It was suggested that the presence of the survey had appeared to reduce the speed of the trucks to the local legal limit, although it was noted that as the day progressed, the speed of the trucks appeared to increase. The condition of the highway over the

landslip area was excellent. There are no pot holes, a notorious source of ground vibrations, but a hump is developing in the road surface at the northern end of the active area.

Provided the condition of the road is maintained in an excellent state, the hump does not become exaggerated to the point where it induces bouncing of the road users, and the speed limits are observed, it is

considered that vibrations from the cartage of wheat are within acceptable limits. It is probable that the higher vibrations recorded could be detectable by occupants of housing adjacent the roadway. As the vibrations are only occasional, it is considered they are unlikely to have a deleterious effect on the active landslide area.

[2 October 1992]