The Education of Engineers; Submission to the Royal Commission

1. It has for some decades been evident that New Zealand is a country with exceptionally dynamic geology and land-surface processes (e.g. Davies, 1982). The recent Canterbury earthquakes, rockfalls and liquefaction, Manawatu Gorge landslides and Nelson floods, and the 2005 Matata debris flow, demonstrate the substantial effects that geodynamic processes can have on structures and infrastructure. **The education of engineers in New Zealand needs to acknowledge that this dynamism is a crucial factor in the selection of sites and designs. Presently it does not.**

2. The training of (particularly civil and natural resources) engineers in New Zealand must in future be underpinned by adequate knowledge and understanding of the geological and geomorphological process at work in and beneath the New Zealand landscape.

3. Given the unpredictable nature of the larger and less frequent geological (e.g. earthquakes) and geomorphological (e.g. floods, landslides, debris flows) events, engineering education must also include adequate treatment of risk assessment, analysis and management.

4. While geotechnical engineering maintains a strong presence in engineering curricula, the need for increased geology and geomorphology is counter to recent trends that have replaced these inputs with engineering subject matter. Geotechnical engineering deals very well with soils, but lack of understanding of geodynamics renders designs vulnerable to phenomena initiated below the soil and off-site.

5. Risk assessment, analysis and management are not included in undergraduate engineering curricula in New Zealand.

6. We contend that unless it is based on an adequate foundation of geology and geomorphology, and understanding of the nature of risk, engineering practice will neither realise the potential benefits from more advanced technologies nor prevent disasters from increasing as population and investment grow. Recent experiences in New Zealand, Chile and Japan demonstrate the relatively low precision of information available on geodynamics, and this constitutes a serious obstacle to realising the potential benefits of high-precision engineering. By contrast, adequate understanding of how NZ landscapes and geology behave, and of the nature and management of risks, would allow geodynamic risks to be avoided or managed by corresponding site selection and engineering design.

7. **We recommend that curricula in Civil and Natural Resources Engineering incorporate adequate learning around engineering geology, geomorphology and risk management so that graduate engineers appreciate the dynamic nature of New Zealand and the implications for engineering practice, and are equipped to deal with these implications.**

Reference:

Davies, T.R.H. (1982). Engineering in the Dynamic Landscape. In: *Engineering and Society*, Ed. R. B. Keey. University of Canterbury Press, 158p.