



**Canterbury Earthquakes Royal Commission**  
**Te Komihana Rūwhenua a te Karauna**

**UNDER THE COMMISSIONS OF INQUIRY ACT 1908**

**IN THE MATTER OF CANTERBURY EARTHQUAKES ROYAL COMMISSION**

Before: The Honourable Justice M Cooper  
Judge of the High Court of New Zealand

Sir Ron Carter  
Commissioner

Associate Professor Richard Fenwick  
Commissioner

Appearances: S Mills QC, M Zarifeh and M Elliott as Counsel Assisting, U Jagose  
for the Department of Building and Housing, N Hampton QC for  
Mr Alec Cvetanov

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**OPENING ADDRESS OF S MILLS QC**

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This is the first of 11 hearings which are scheduled through March of next year and just to give the list and the order of them, the first one is the hearing on seismicity which of course is the one that commences today. That is followed by a hearing on soil and ground conditions, then what is referred to as unreinforced masonry and other earthquake prone buildings, then the PGC building followed by the Hotel Grand Chancellor and the Forsyth Barr Building.

The inquiry then turns to other buildings that failed causing loss of life, some of which are in the CBD area, some just outside it, then the Commission will hear from experts on new building technologies. That is followed by a hearing on the training of engineers and issues around the engineering profession generally, and then the CTV building, and as the Commissioners are aware no specific date has been set for that yet, although it is expected and hoped that it will be in March of next year, the delay having been caused and the ability to schedule, having been caused by the fact that the report the Department of Building and Housing is preparing, which is a pre-cursor to the hearing on that by the Commission is still not in final form and has not been released yet to the Commission.

That is then followed by the issue of the post-earthquake building assessments, probably generally known to the public of Christchurch as the green, orange and red stickers and the assessments that occurred, and then finally building codes and the design rules related to structural engineering. It is possible that further issues might emerge during the course of the inquiry for which hearings will be needed, but that is for the moment the list that's been settled on.

Hearings of course form only one part of the inquiry process that the Royal Commission is engaged in. Much of the work of the inquiry has been outside of the hearings and has involved the commissioning of reports from experts and investigative work that has been carried out by counsel assisting the Commission, and by the Commission itself. The hearings are for the purposes of enabling a wider engagement with the principal issues that the

Royal Commission is addressing, to ensure contestability of the advice that the Royal Commission is receiving and evidence that might be put forward, and in some cases because considerations of fairness require that individuals and organisations who might be the subject of adverse comment have the opportunity to be heard.

Hearings also serve the important purpose of enabling the public of Christchurch and New Zealand to gain a better understanding of the often complex issues that the Royal Commission is addressing so there can be more informed engagement with the public policy choices and trade-offs that are involved in deciding what is an acceptable level of risk in the construction of buildings.

In advance of each hearing the Royal Commission will have commissioned and received reports from leading experts in the field of inquiry, both from New Zealand and overseas, and in most cases these reports will have been peer reviewed by leading international experts. Both those initial reports and the reports from the peer reviewers will have been posted on the Commission's website to enable further comment and submission.

At the hearings most of the authors of these reports will be called to speak to their reports and to be available for questions from the Royal Commission and from counsel assisting, and with leave, from other organisations and individuals who have lodged expressions of interest with the Royal Commission.

I turn now to outline the hearing that is about to commence on seismicity. This is probably to most of us one of the more difficult of the hearing topics because of the technical nature of it. It's concerned with seismicity and the seismic hazard models that predict the probabilities of ground shaking from future earthquakes. GNS Science, which is the leading Crown organisation in New Zealand that deals with these issues, was commissioned by the Royal Commission to prepare a paper on what's referred to as the Canterbury

Earthquake sequence and its implications for seismic design levels for buildings. The paper is dated July 2011 and it is on the Royal Commission's website.

5 On my count any rate, there are 21 authors who contributed to that paper and by agreement these issues that are dealt with in that paper will be presented at this hearing by three witnesses. They are Dr Terry Webb, Professor Jarg Pettinga and Dr Graeme McVerry. Dr Webb is the general manager of what's called the Natural Hazards group at GNS Science where  
10 he is responsible for directing the research and other activities of more than 120 staff who assess natural hazard risk and develop mitigation strategies to improve community resilience for natural disasters.

The Natural Hazards group also includes what's referred to as the Geonet  
15 project which provides real time earthquake and volcanic monitoring and data collection for New Zealand. He holds a PhD from the University of Canterbury and has worked in Australia, the United States, Canada and Vietnam. He has published extensively in national and international journals on a range of earthquake related topics.

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Professor Pettinga is a professor of structural and engineering geology and head of the Department of Geological Sciences at the University of Canterbury. He is a member of the Geological Society of New Zealand, the Geological Society of America, the American Geophysical Union, the  
25 European Geosciences Union and the New Zealand Society for Earthquake Engineering. His principal areas of research include earthquake hazard assessment and since 1998 he has been the leader of what's referred to as the Active Tectonics and Earthquake Hazards Research programme. The work from this programme over the past 25 years has generated the data  
30 base that now underpins the Earthquake Hazard assessment for much of the northern and central South Island. He holds a PhD from the University of Auckland.

Dr McVerry holds a Master of Engineering degree with first class honours from the University of Auckland. He is what's referred to as the principal scientist for the GNS Hazards Group. He has over 35 years of engagement with engineering seismology research including advising on the specification of design motions for buildings and other structures. He has reviewed seismic design motions for many major projects in New Zealand and overseas and has served on earthquake code committees as a specialist in seismic hazard assessment. He is a principal contributor to the current National Seismic Hazard Platform and its implementation in the earthquake design codes. He developed the Seismic Hazard Spectra in the current New Zealand standards that deal with earthquake issues.

The order in which the three witnesses will give their evidence is as follows and it does involve some of them giving evidence more than once to try and maintain an order that seemed to be the most helpful for the Commission and to the public. Dr Webb will be the first witness on the topic of the Canterbury earthquake sequence. He will be followed by Profession Pettinga who will deal with active faults and historical earthquakes in the Canterbury region. Dr Webb will then give evidence again on the likely future rates of seismicity in Christchurch. He will be followed by Dr McVerry who will deal with the implications of building design motions and finally Dr Webb will close this off by talking about the national implications and the conclusions to be drawn from the Canterbury earthquake sequence.

For the Commissioners and anyone else who may wish to cross-reference that evidence to the GNS report itself it's on the website, it is – Dr Webb will be addressing sections 3 and 5 of that report that's on the website except for section 5.2. He is also dealing with section 6 which is the concluding remarks in that paper. Profession Pettinga is dealing with section 2 and Dr McVerry is dealing with sections 4 and 5.2 and appendix 5.

Now I do note, and it's an important aspect of the way in which the Royal Commission has gone about its work, that the GNS paper has been peer

reviewed by two leading international experts. They are Professor Ralph Archuleta who is the professor of Seismology Earth Science at the university of California, Santa Barbara, and Dr Norman Abrahamson who is the adjunct profession of Geo Engineering in the Department of Civil and Environmental Engineering at the University of California, Berkley. Their peer review papers are also on the Royal Commission website.

Professor Archuleta is a fellow of the American Geophysical Society. In 2009 he was awarded the Seismological Society of America's top honour, the Harry Fielding Reid medal. He is the former deputy director of the Southern California Earthquake Centre and a former president of the Seismological Society of America.

Dr Abrahamson has had extensive experience in the practical application of seismology to the development of deterministic and probabilistic seismic criteria for engineering design. He has developed design ground motions for hundreds of projects according to his CV including dams, bridges, nuclear power plants, hospitals, office buildings and other essential facilities such as gas and water pipelines.

Arrangements have been made, I'm happy to say, for Dr Abrahamson to present his paper via a video conference link from California and that will be first thing on Wednesday morning at 9.30 when the Commission first sits on that day. Following this Dr Abrahamson and the three GNS witnesses, plus Kelvin Berryman from GNS, will be available to engage in an expert panel discussion during which they will be able to be questioned by the Royal Commission and any questions that counsel may have as well.

So that's the expert component of the hearing on seismicity. In addition, the Commission is expected to hear from Ms Rachael Ford. Now Ms Ford filed an expression of interest and made a joint submission with a Mr Ed Radley and she's requested that she be allowed to ask a series of questions of the GNS witnesses which arise out of the joint submission from Ford and Radley

and a video link has been arranged for that as I understand it at 4 o'clock on Tuesday afternoon, so those, from the point of view of managing the hearing process, are the two fixed points really, 9.30 Wednesday morning, 4 o'clock Tuesday afternoon because of those other arrangements and if we have to fit  
5 other things around that that can I think quite readily be done.

So if there's no questions about any of that I will call Dr Webb.