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Hon Justice Mark Cooper
Canterbury Earthquakes
Royal Commission

11th November 2011

HERA Submission to the October 2011 Interim Report

Dear Hon Justice Cooper

The Heavy Engineering Research Association is a not-for-profit research organisation, which is the leading independent provider of design guidance and disseminator of best practice to the steel construction sector since its inception in 1978. It is well known internationally, and serves on many national and international Standards committees.

Among its achievements, HERA has been the lead organisation responsible for the development of the New Zealand seismic design provisions for structural steel in buildings. Principal of these is HERA Report R4-76 *Seismic Design Procedures for Steel Structures* and the ongoing maintenance and development of the Steel Structures Standard, NZS 3404 which covers general design of steel and composite construction, design for earthquake and design for severe fires.

On the back of our work and substantial industry commitment, including from the design profession, the market share of steel construction in multi-storey buildings has risen from virtually 0% in 1983 to over 50% today; the most significant increase worldwide. Not only has this benefited the steel industry but also New Zealand as a whole, through providing increased competition in this sector that accounts for some 3 to 5 % of New Zealand's annual GDP.

In our opinion, the Royal Commission Interim Report covers the aspect of seismicity and geotechnical consideration well; however, it fails to deliver on the Terms of Reference in respect to establish "why certain buildings failed severely while others failed less severely or there was no readily perceptible failure". Also, in our view, the document does not cover adequately seismic design guidance offered by the different building systems in the request "to inform decision-making on rebuilding and repair work" and under the terms "inquiry into legal and best-practice requirements" does not indicate sufficient coverage of the best-practice requirement for the design, construction and maintenance of buildings in central business districts.

As we understand that the Commission is only part way through the inquiry process we expect our concerns, which are as follows, to be addressed in the final report:

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- Including the seismic performance of structural steel buildings (which was generally very good in the Christchurch earthquake series) in the section entitled description of overall building performance
- Covering not only Recommended Changes to Design Practice but also what building systems worked well and are cost effective and can be recommended for the rebuild practice
- Review the section on New Building Technologies which appears to be biased towards the PRESSS technology and lacks the inclusion of standard structural steel seismic resisting systems such as Eccentrically Braced Frames (EBF) and advanced damage avoidance technology such as Sliding Hinges Joints (SHJ) and rocking systems. All these systems allow, with little extra cost, excellent performance under design level severe earthquake loading, leaving buildings fit for service after earthquakes. Some solutions such as the EBF's and SHJ's have been extensively used in recent years by the design profession under the guidance of HERA Report R4-76 - Seismic Design Procedures for Steel Structures, which was first published in 1994 with an update in 2001. It should be specifically noted this document is standard design practice and is available now to provide low damage, cost-effective buildings.
- HERA strongly requests that under the section entitled "New Building Technology" or preferably under its own section heading "Future Research and Innovation" the Commission could be direction-setting by covering aspects of the development of sustainable and safe buildings and infrastructure and demonstrating that the industry and government are indeed learning from the experience of the Canterbury earthquakes. In HERA's view the current R&D focus of government funded research appears to be centre upon seismicity and geotechnical consideration. We would recommend that R&D levels on building systems be increased such as the development of damage avoidance technology for new buildings. Widespread adoption of this technology would not only protect lives but offers the most economic solution in a whole of life assessment approach through avoiding massive removal and rebuilding costs which Christchurch now requires.
- HERA has developed a specific research proposal for its industry sector on the development of sustainable damage avoiding technology which includes the development of a rating system for seismic performance similar to the Green Star Rating System. HERA considers that major benefits would derive for the NZ economy and society if the development and implementation of such world leading seismic rating systems would indeed happen and developers, building owners and users and the associated industries such as insurers would obtain an adequate assessment of the seismic risk associated to a building. Should the Commission be interested to cover future focused R&D, HERA is willing to make representation to the Commission through its Structural Systems Division Manager Dr Stephen Hicks on new technology development and the mentioned seismic rating proposals with a big picture view independent of the building material used.
- We understand it is the prerogative of the Commission to call on experts, however we would like to confirm that e.g. Auckland University's Associate Professor of Civil Engineering and former HERA Senior Structural Engineer Charles Clifton is available to act as expert covering structural steel systems. We also can recommend a number of practicing design engineers with expertise in advanced damage avoidance technology, such as Sean Gledhill from Aurecon who designed the Te Puni student accommodation building in Wellington using HERA developed sliding hinge joints and novel rocking systems for energy dissipation. This development was the winner of Structural Engineers International 2009 Award for Engineering Excellence with the judges comment "A worthy project bringing true

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innovation in the field of seismic design and economy to what could have otherwise been a very expensive building.”

HERA trusts that the above considerations are useful to the commission and hopes that the Final Report does full justice to the Terms of Reference and indeed sets the scene for a safer, cost effective and sustainable rebuild of Christchurch and the future development of the entire building sector of New Zealand.

We would be grateful if you would be kind enough to acknowledge the receipt of this submission.

Yours sincerely



Dr Wolfgang Scholz
Director