Project E6471

Project Title

Low cycle fracture assessment and earthquake life of structural steel elements

Research Team

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Project Description

After a structure has experienced damage due to yielding, a decision needs to be made as whether or not the structure can remain as it is, whether it should be totally replaced, or whether it should be repaired. As a key part of this it is important to understand how many more natural hazard events the structure can sustain – i.e. remaining event life. Currently engineers have almost no information about this and guidelines are required for post-event evaluation. This is also consistent with Royal Commission recommendations after the Canterbury Earthquakes for methods of assessment.

Issues considered at the scatter in results as well as the means of considering cycles of different magnitude as the high cycle fatigue approach has been shown to be inappropriate. Also, tests to evaluate the change in materials, from effects such as strain ageing and material toughness, will be further developed. A start has been made with eccentrically braced frames but there are many key questions still arising from the research to date.

Up to now, no S-N curve (or similar procedure) for different element connection details and materials has yet been developed to make low cycle fatigue. Our research concentrate on experimental/analytical studies to assess low cycle fatigue of typical structural steel elements. According to the experimental tests results on steel elements with different detailing and material properties, the key parameters of cyclic behavior of steel components, considering low cyclic fatigues, will be obtained. Utilizing these parameters as an input for initial modelling, a numerical model will be developed that can predict the behavior of components reliably. The numerical modelling will be calibrated with experimental results. After finalization of model, some experimental tests can be conducted to validate the numerical model.