Seismic response of underground utilities following the Canterbury earthquakes

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ABSTRACT

This paper reports the initial findings of a new research project funded by the Ministry of Business, Innovation and Employment (MBIE). The research, in collaboration with the Geological Nuclear Sciences (GNS), will provide enhanced understanding of the performance and resilience of underground utilities under seismic loading.

Information exists in various formats on the damage to underground utilities following the Canterbury earthquakes. This information will be compiled and analysed to evaluate the applicability of current models of seismic response. Data from ground deformation, geology and seismic loading will also be assessed together with the damage data. Areas of interest identified in the analysis stage – unexpected or previously unreported forms of damage, for example - will be further studied through finite element analysis backed with selected full scale testing.

Initial findings from the first year of the project work will be presented. This will include the aspects identified from the analysis of the damage data, and the initial findings from the full scale testing and numerical analysis, together with initial recommendations for current design practises and guidelines.

A key goal of the project is to help develop robust, evidence-based national recommendations and guidelines to help reduce the impact of future seismic events and to improve the resilience of communities after a seismic event in a cost effective manner. Risk management and damage prediction will also be enhanced providing greater reliability for insurers and incident managers.

1 INTRODUCTION

The recent earthquakes in the Canterbury region resulted in numerous fatalities, caused severe social disruption and caused damage estimated in 2012 at $3 billion. Utility owners and providers face the huge task of preparing qualitative assessments, quantifying the damage, and restoring service.

The Ministry of Business, Innovation and Employment (MBIE) is funding research to better understand how underground utilities behave in seismic events. The research's main objectives are to use information on the actual performance of underground systems to help advance our