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HORIZONTAL SOIL MIXED BEAM GROUND IMPROVEMENT AS A LIQUEFACTION MITIGATION METHOD BENEATH EXISTING HOUSES

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Ishihara (1985) recognised that a thick non-liquefying crust overlying liquefying soils would reduce the consequences of liquefaction (i.e., sand boils, loss of bearing capacity and differential settlement). In Christchurch, in the aftermath of the 2010-2011 Canterbury Earthquake Sequence (CES), detailed engineering assessments of nearly 60,000 single-family houses, combined with a comprehensive regional scale geotechnical investigation, clearly showed that less structural damage occurred in liquefaction-prone areas containing an intact, relatively stiff non-liquefying crust with minimum thickness of approximately 3 m. To increase the resilience of the Christchurch residential housing portfolio an extensive in-situ test programme, which included dynamic shake testing and blast-induced liquefaction testing, was carried out on various ground improvement methods. One of the ground improvement test methods developed in the test programme was Horizontal Soil Mixed (HSM) beams, which can be constructed beneath existing buildings. This paper presents the results from the blast-induced liquefaction testing of ground with HSM beam improved crust soils to examine the reduction in ground surface differential settlement compared to natural (unimproved) soils. The testing results are supplemented by three dimensional (3D) numerical modelling of the foundation/crust/liquefied soil response. The blast-induced liquefaction testing of the HSM beam improved crust, as well as the 3D numerical modelling, demonstrated that HSM ground improvement resulted in reduction in differential ground surface settlement caused by liquefaction of the underlying soil layers, thereby reducing the potential for future liquefaction-induced structural damage of existing buildings.