

# Ferrymead Bridge – Temporary seismic restraint system

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**ABSTRACT:** Christchurch's Ferrymead Bridge on Ferry Road was damaged by the 2011 Christchurch earthquakes during construction to widen and seismically strengthen the bridge. Liquefaction and associated lateral spreading caused extensive damage to the pre-existing abutments and piers, as well as to the new abutment piles under construction. A decision was made to demolish the existing bridge and replace it with a new two-span bridge, which is currently under construction.

A high probability exists for an earthquake aftershock, capable of inducing liquefaction, to occur at the bridge site during the 18 month construction period for the bridge substructure. Therefore, in order to avoid the likelihood of irreparable damages to the substructure during their construction and prior of being restrained by the superstructure, risk mitigation measures were developed. This included carefully planning the construction sequence considering the vulnerability of different sections of the substructure to lateral spreading. For example, the bridge components that are least susceptible to lateral spreading were programmed to be constructed first and the most vulnerable bridge components were phased to be constructed last. Also, in order to avoid the risk of excessive permanent pile displacements due to a significant earthquake during their construction, a Temporary Seismic Restraint (TSR) system was designed and detailed for the substructure. 3-D finite element models of the bridge substructure with the TSR system were developed and subjected to the assessed lateral spread loading. This showed that the presence of TSR was both essential and very effective in restricting the likely permanent pile displacements to be within tolerable displacement limits at different stages of construction.