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Bi-directional testing of precast panels with both grouted and dowel type panel-to-foundation connections

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Precast concrete wall panels are a popular construction form in New Zealand and are used extensively in both low rise industrial and multi-storey residential or commercial buildings. Following the Canterbury earthquakes, concerns were raised about the lack of robustness of the panel to foundation connections typically adopted for this construction type. Subsequent experimental studies of the two most common connection methods, being grouted metal ducts or doweled starter bars, confirmed the sub-standard behaviour of these connection types with rapid strength degradation even when the panels were subjected to moderate drift levels. Several alternative connection details were also investigated and were found to perform adequately. However, concerns still existed regarding the behaviour of these connections when subjected to bi-directional loading, and if load carrying capacity degraded more quickly. To investigate the bi-directional behaviour of these connections, four specimens representing full-scale wall detailing were tested in the state-of-the-art, six degrees of freedom Multi-Axis Substructure Testing (MAST) facility at Swinburne University of Technology. Two specimens utilizing grouted metal duct connections and two specimens using dowel starter bar connections were tested. Each pair of foundation connections included one specimen detailed using current practice and one specimen using alternative detailing. The response of the specimens was compared to results from previous uni-directional tests on the same connection details to determine the effect of bi-directional loading on seismic performance. The outcomes of this testing are being used to inform design guidelines and recommendations on appropriate connection detailing for different precast wall panels will be provided.