

# MAKE IT THEN BREAK IT

## Experimental tests on concrete wall-steel beam connections

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### 1. WHAT'S THE DEAL?



Buildings that combine concrete walls and steel frames have recently become popular in New Zealand. However, one concern with these buildings is the seismic performance of the connections, particularly between concrete walls and steel beams.



Unfortunately, not many studies have been conducted on such connections. Furthermore, current design standards do not explicitly address design procedures for concrete wall-steel beam connections.



To address these gaps, experimental tests were conducted on concrete wall-steel beam connections at The University of Auckland Structures Test Laboratory with funding from Te Hiranga Rū QuakeCoRE: NZ Centre for Earthquake Resilience.



The aim is to assess the seismic performance of existing connection details and to validate potential failure modes. (i.e. How will the connection break?)

### 2. WHAT DID WE DO?

- Based on a review of 50 existing New Zealand buildings, a typical connection detailing was developed.
- Four (4) full-scale specimens were constructed, consisting of:
  - » a steel beam (length: 3.5m)
  - » a precast concrete wall portion (2.4m x 2.4m x 200mm)
  - » a precast floor slab portion (width: 1.3m x length: 2.4m)
- The test setup is shown below. To assess the seismic performance of the connection, earthquake load was simulated by repeatedly pushing and pulling the end of the beam with a hydraulic actuator.



### 3. WHAT HAPPENED THEN?

Although the connections were designed to fail in a slow and controlled manner, all four specimens failed suddenly and dramatically, which is undesirable during earthquakes.



Want to see something cool?  
Scan this QR code  
to watch a video of the  
specimen failure:



### 4. WHAT COMES NEXT?

- An improved design procedure will be developed to ensure that concrete wall-steel beam connections will perform as intended by design, thus enhancing the safety of New Zealand buildings during earthquakes.
- The results of the experimental tests will also be used to calibrate a numerical model of an entire building, which can be used to investigate a wider range of variables.

#### References:

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