ILEE-QuakeCoRE Shake Table Test on a Low-Damage Concrete Wall Building

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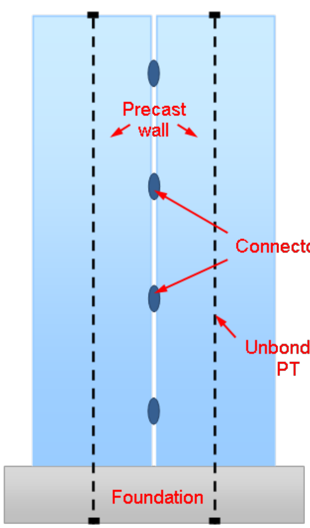
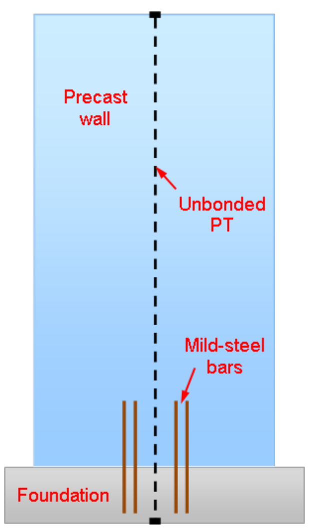
1. Background

PT walls

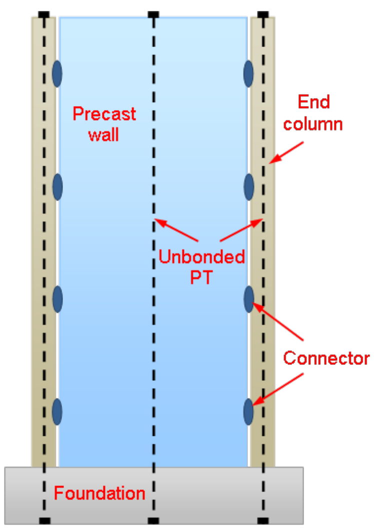
- Extensively investigated experimentally and numerically
- Easy to incorporate dampers
- Dependable behaviour and minimal structural damage
- Implemented in a number of buildings



Jointed



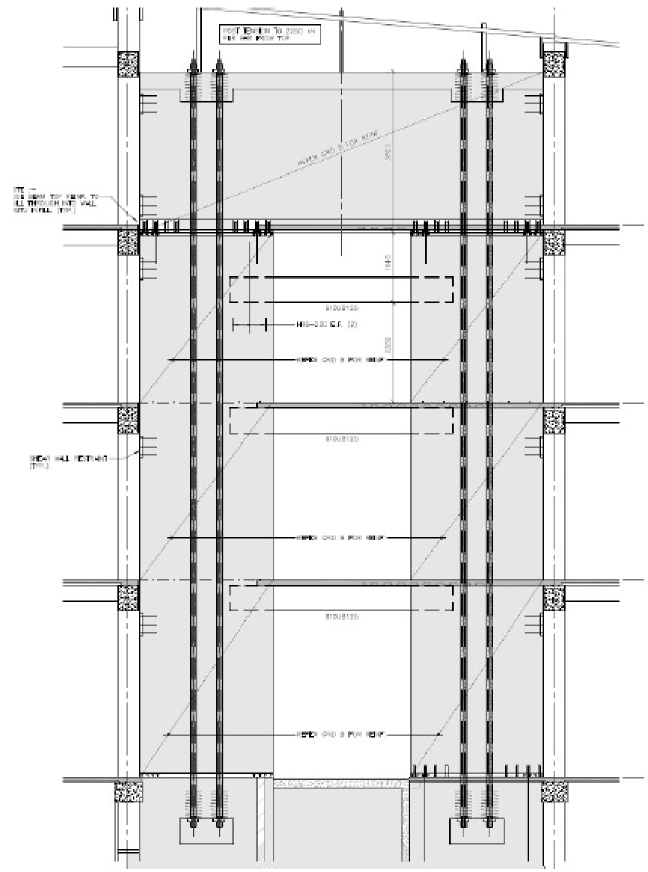
Hybrid

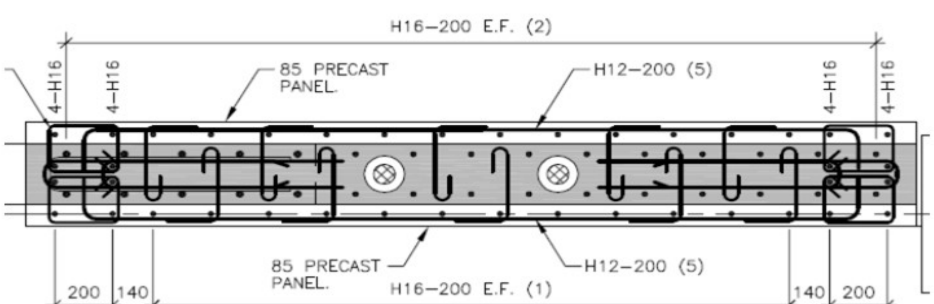


PreWEC

1. Background

Allan MacDiarmid Building: Wellington





1. Background

Southern Cross Hospital: Christchurch

- 3 storey
- PT rocking coupled walls & frames

UFP dissipater

1. Background

- Walls with different types of dampers
- External dampers rather than internal reo
- Detailing are different
- Different with tested walls in the lab

1. Background

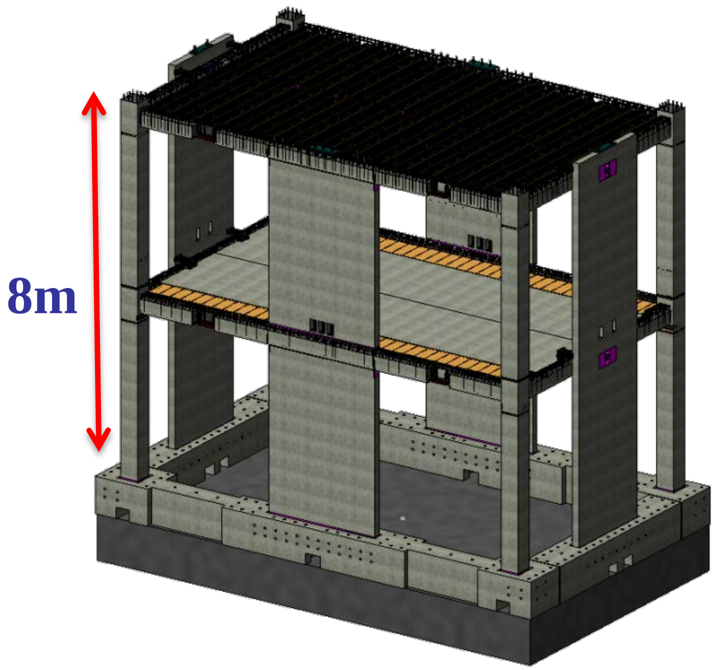
Research gaps

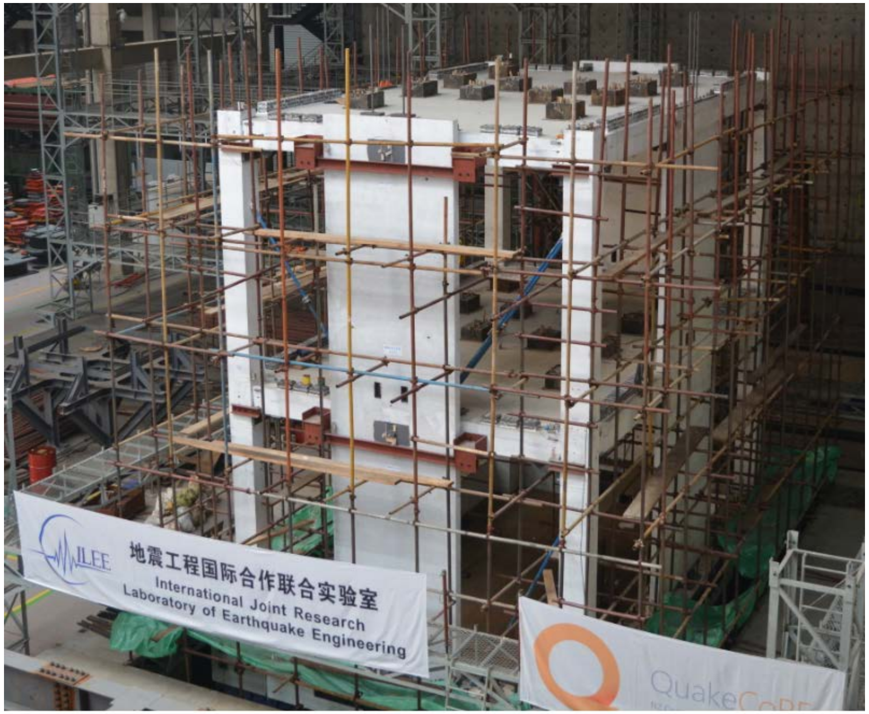
- Component behaviour well understood
- Interaction of components in building system needs further development and verification
- Practical construction details also need to be verified and guidelines published

2. Objectives

- Verify seismic response of low-damage concrete wall building implementing state-of-art concepts
- Verify practical construction details used in low-damage buildings
- Investigate interaction of the structural components
- Sub objectives:
    1. Compare alternative wall-to-floor connection details
    2. Compare alternative dissipating devices
    3. Torsional / bi-directional response
    4. Diaphragm design / load paths

3. Test building





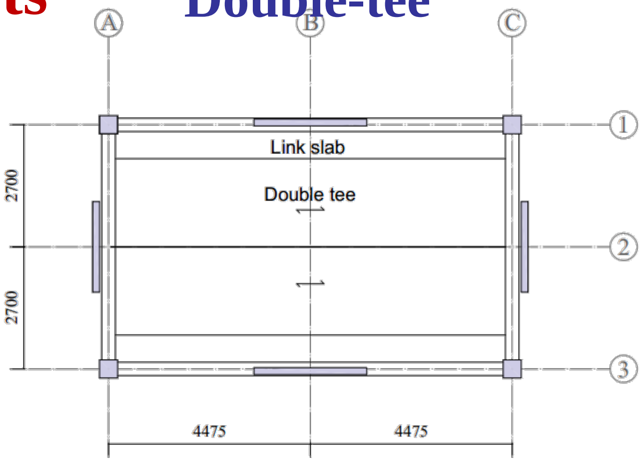
- 2 storeys (@ full scale)
- Fit onto 2 tables joined (10 × 6m)
- Post-tensioned concrete walls
- Gravity frames
- Interchangeable energy dissipating devices

Member	Size (mm)
Columns (all levels)	400 × 400
Beams (all levels)	300 × 400
Walls at long-span direction	150 × 2500
Walls at short-span direction	150 × 2000
Double-Tee floor	300TT 80 mm topping
Composite floor	ComFlor60 130 mm

3. Test building

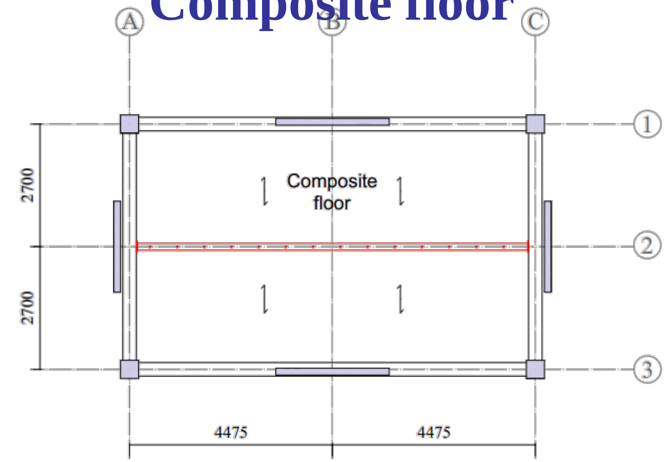
Plan layouts

Double-tee



(a) Level 1

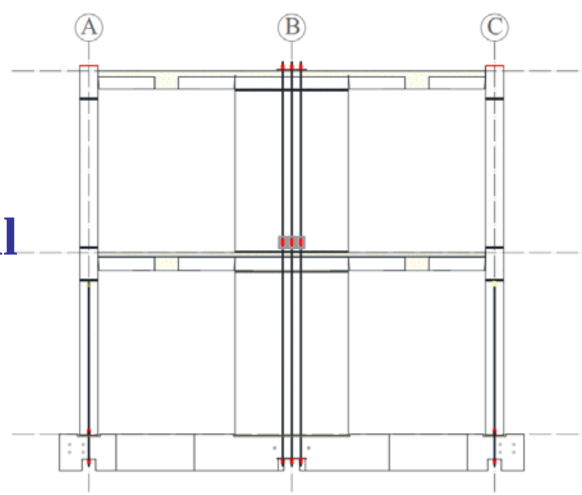
Composite floor



(b) Level 2

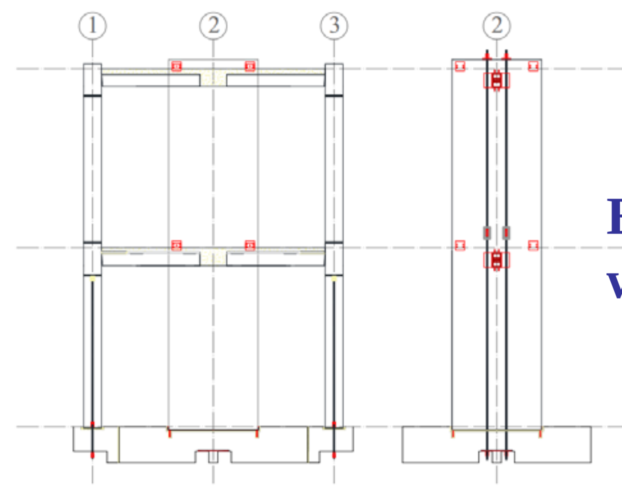
Elevations

Integral wall



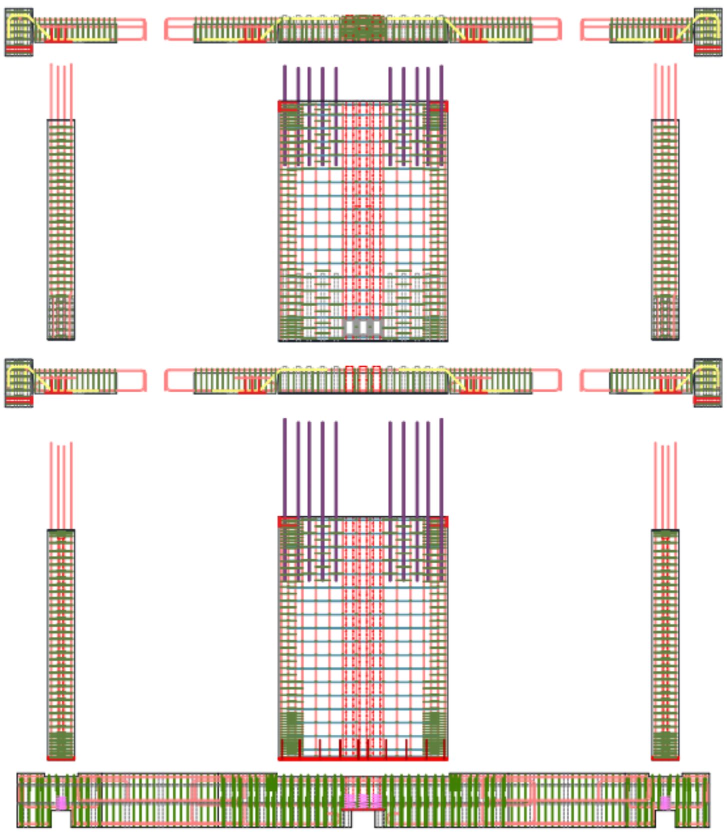
(a) Long span direction (Grids 1 & 3)

External wall



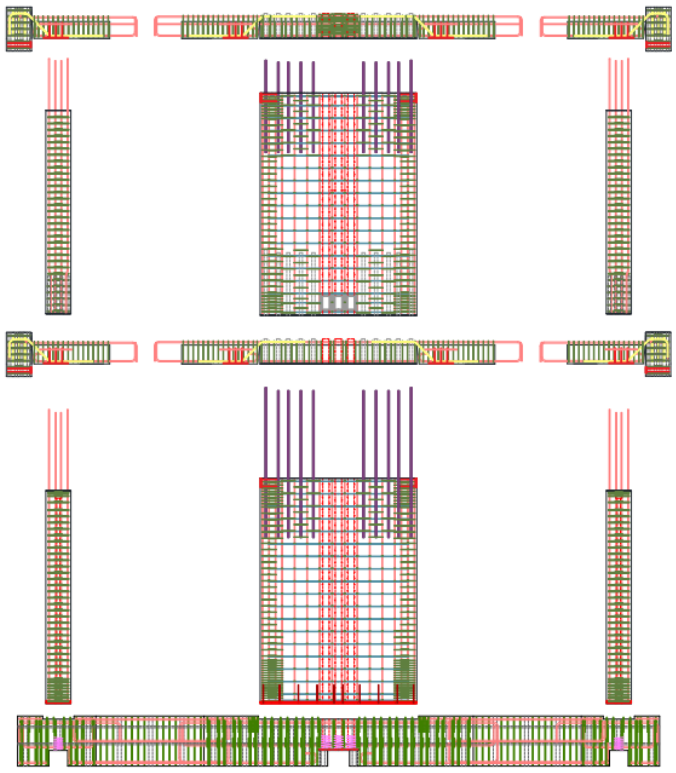
(b) Short span direction (Grids A & C) – Wall panel shown separately

6. Assembly plan



7. Construction

Precast construction: Citi-Raise Construction Group

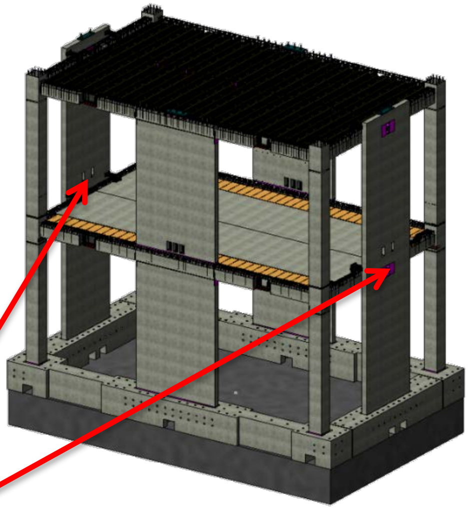


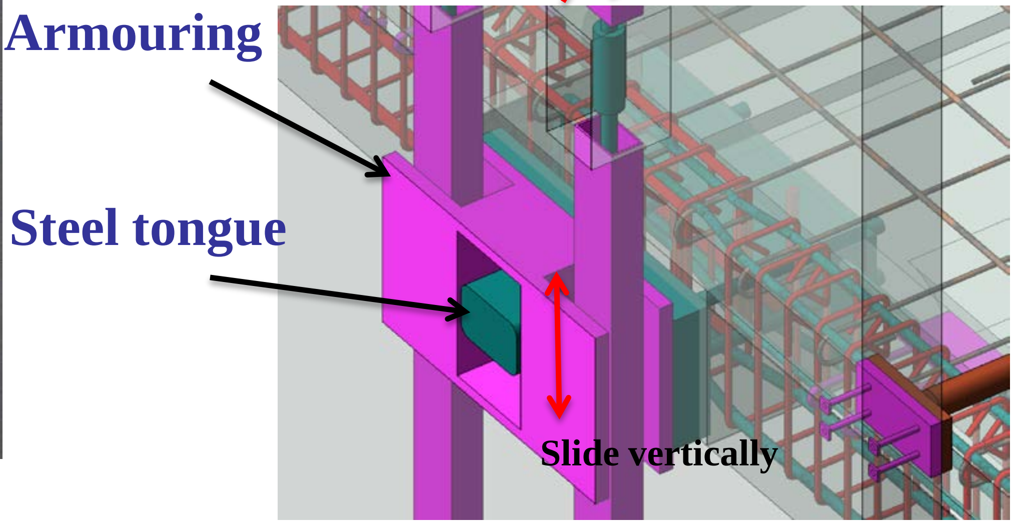
- Precast components have been constructed

4. Detailing

Isolated wall-to-floor connection

- Transfer of horizontal forces in bearing
- Free to slide vertically to eliminate dis. incompatibility

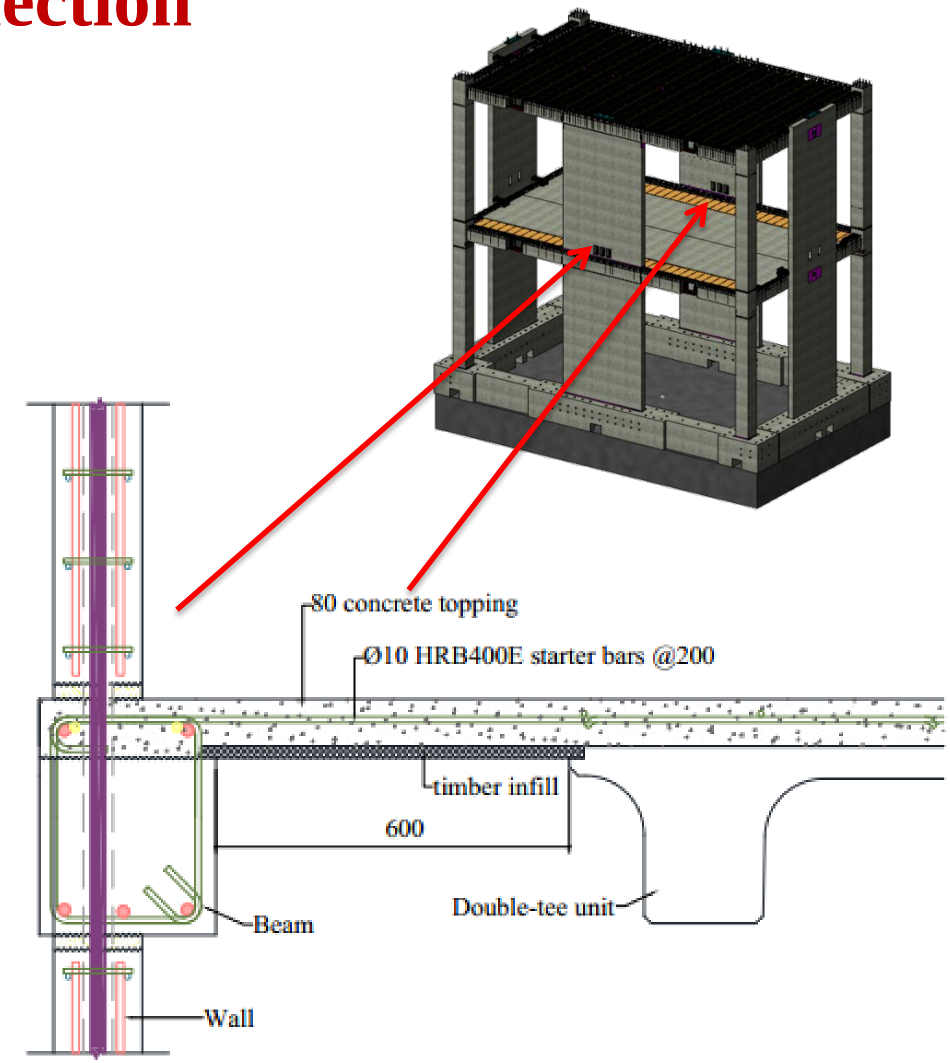




4. Detailing

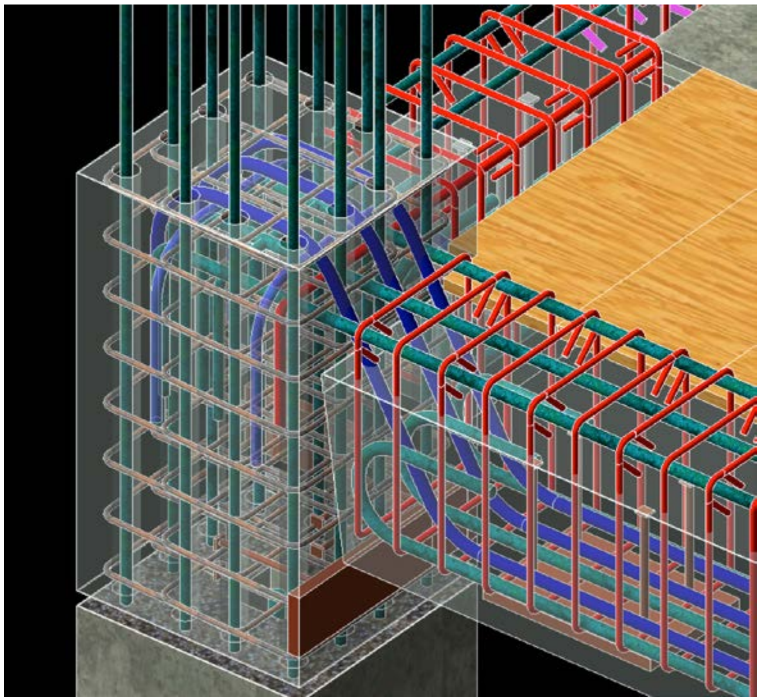
Flexible wall-to-floor connection

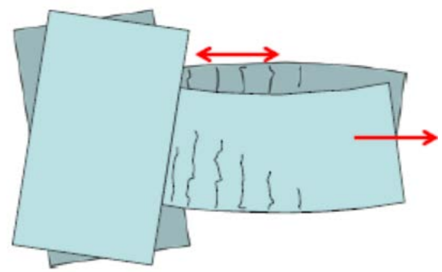
- Stiff to transfer horizontal forces through diaphragm
- Flexible out-of-plane to accommodate wall uplift and rotation

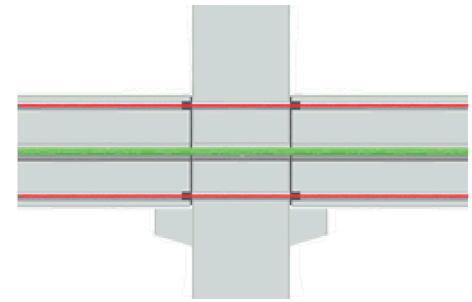


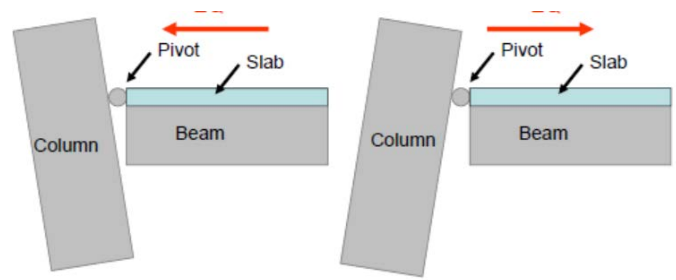
4. Detailing

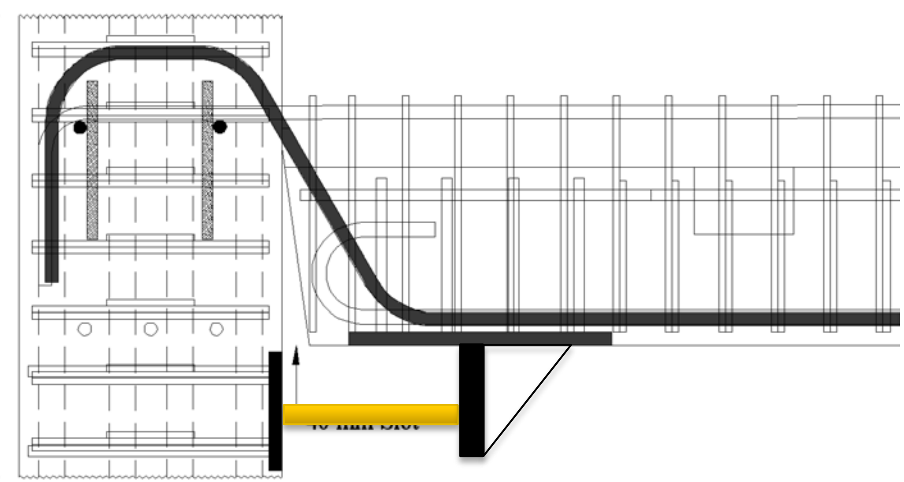
Slotted beam



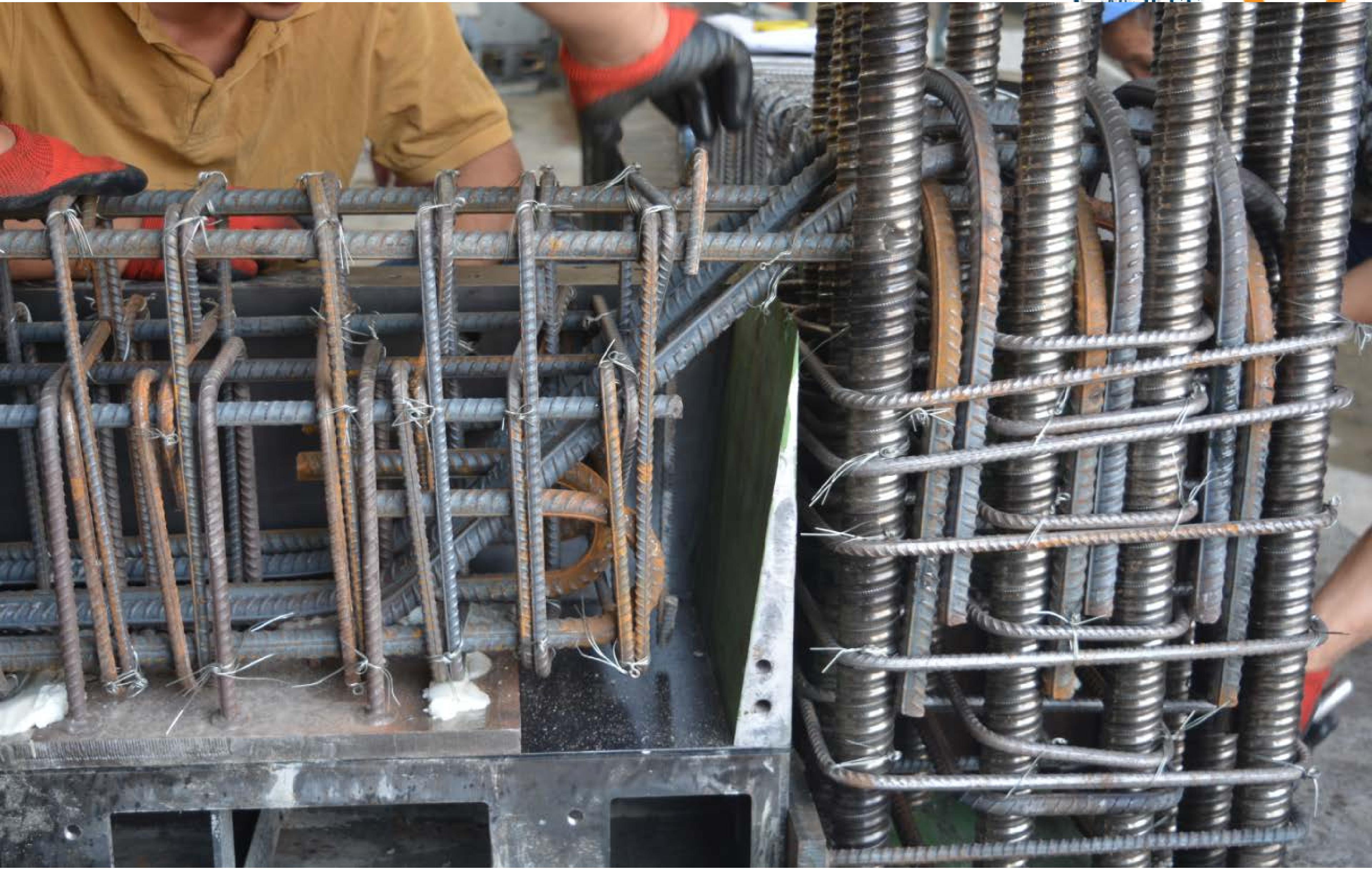








- Pin connection
- Minimise elongations
- Could install dampers

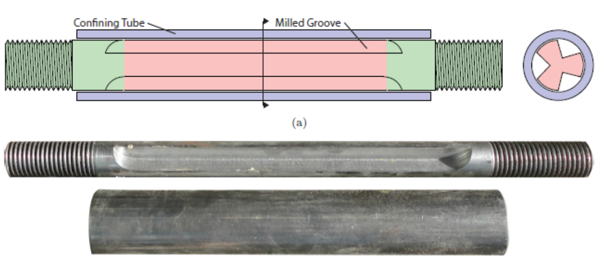


5. Test variations

Energy dissipation device variations

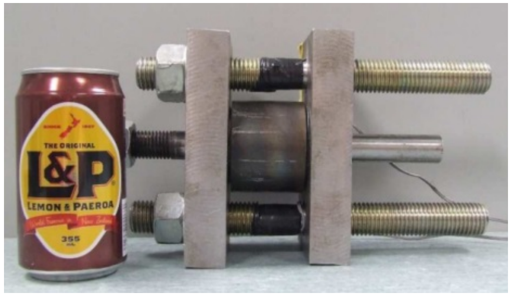
Design case	Variation	Beam-column joints	Wall base
Design 2 (2% drift)		None	Steel fuse
Design 1 (1% drift)	A	Steel fuse	Steel fuse
	B	Steel fuse	Viscous energy dissipating device
	C	HF2V	Steel fuse

Delibrate torsional load cases



Steel fuses

Viscous damper



Lead-extrusion (HF2V)

8. Blind modelling opportunity

- Provide blind modelling opportunity
- Schedule
  - Aug 2018: Release building design
  - Nov 2018: Testing
  - Dec 2018: Release actual ground motions
  - Jan 2019: Collect modelling results
  - Apr 2019: Workshop on blind modelling comparison

Thank you

Questions!