Designing Repairable Buildings

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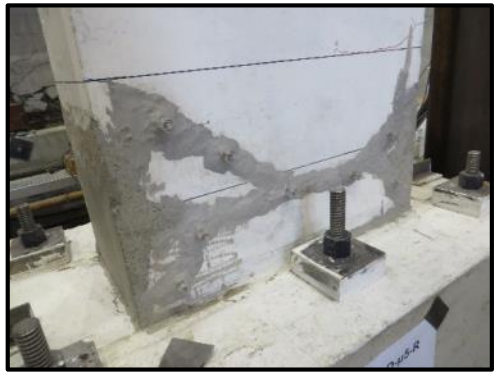
ENGINEERING

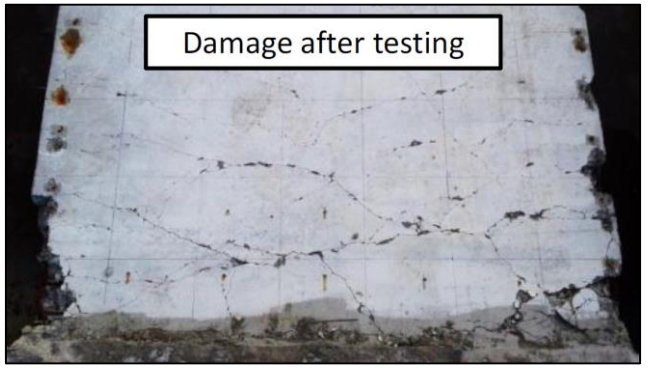
2010/2011 Canterbury

- Repairability of (concrete) buildings

Conventional RC Components

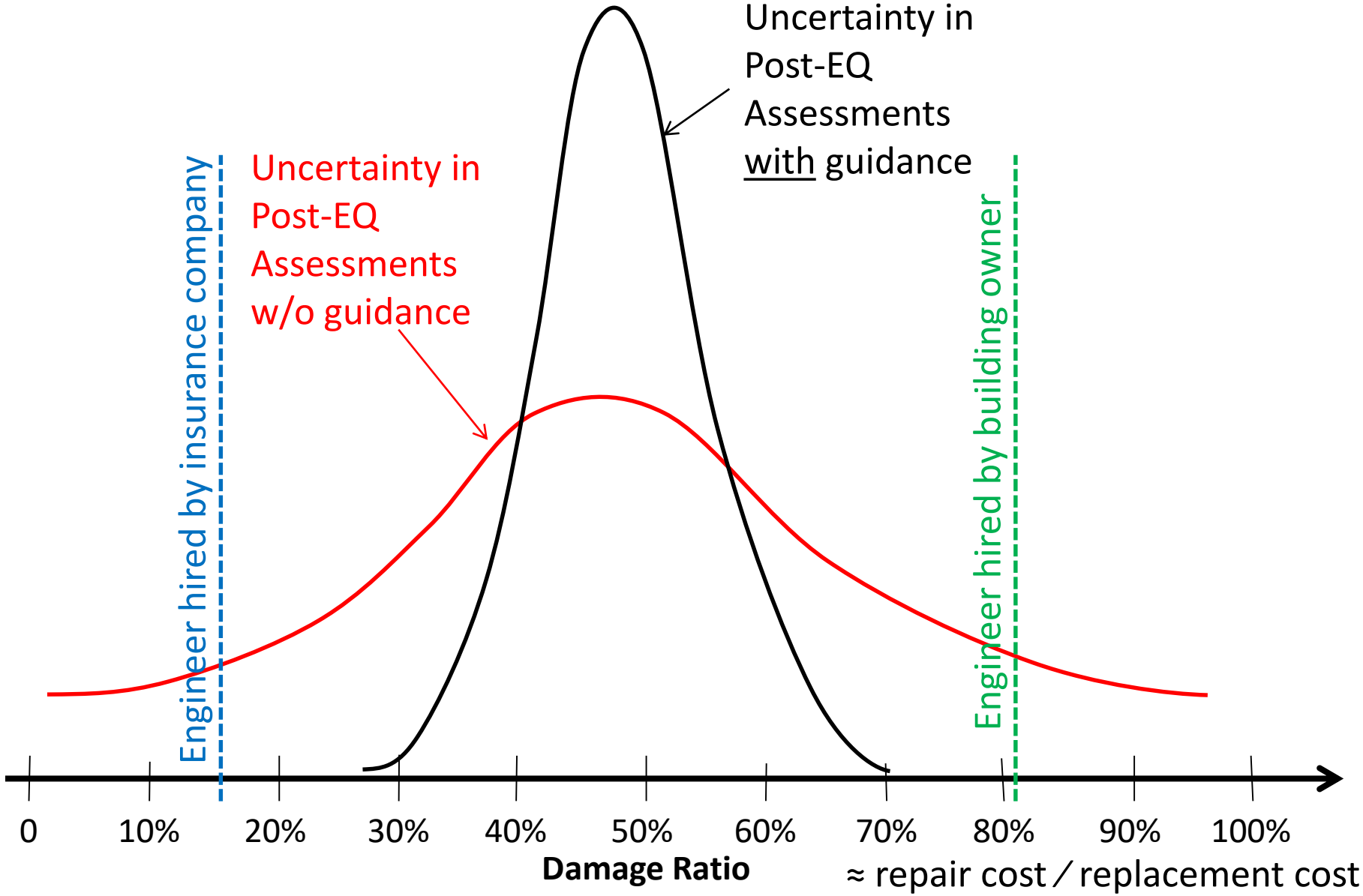
- Improving guidance on residual capacity and repair
- Damaged beams & walls can be repaired (structural perspective)





Elwood et al.

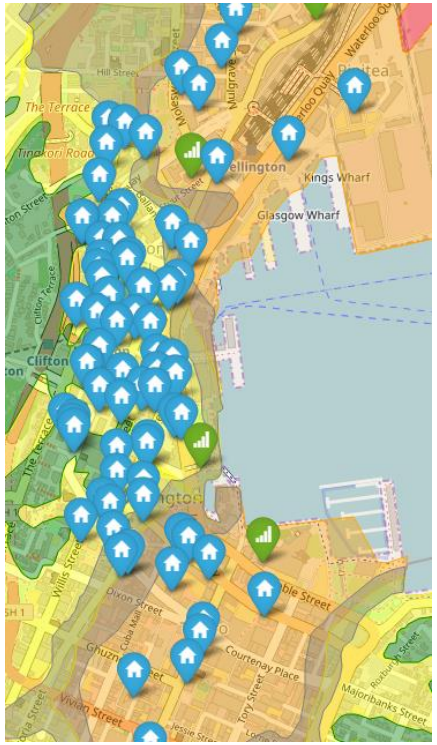
Uncertainty in Post-EQ Assessments

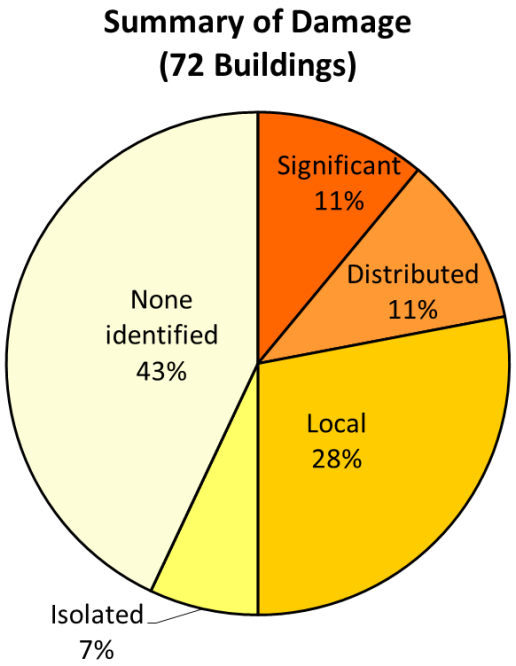


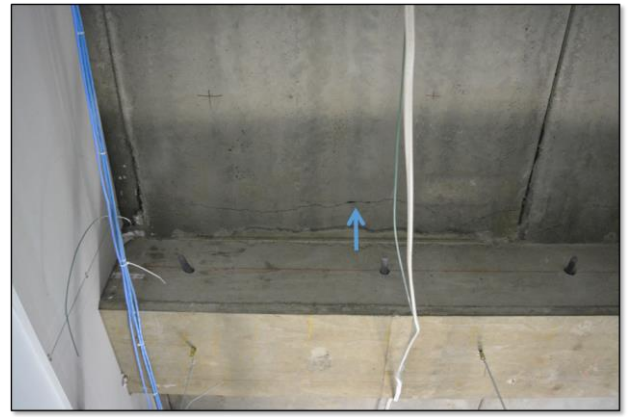
Elwood et al.

2016 Kaikōura

- Disruption caused by damage to precast floors (esp. hollowcore)

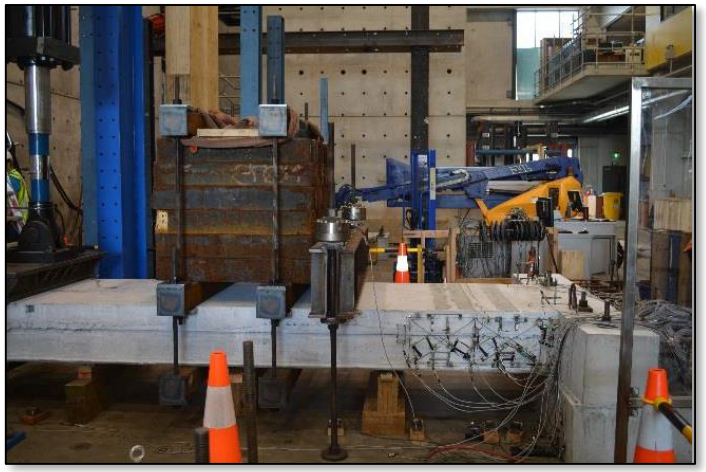


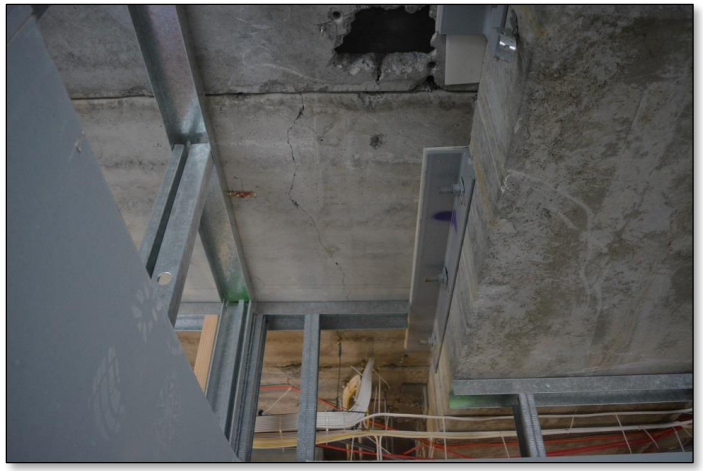




Precast Floor Research

- Improve assessment guidance
- Validate retrofit methods
- Focus on life-safety,
  can’t eliminate damage





Resilient or Repairable Buildings

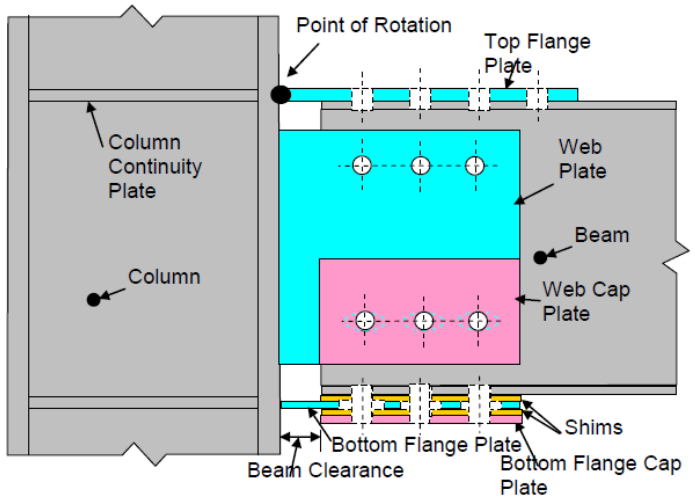
1. Structural components
2. Structural systems (more than components)
3. Entire buildings (more than structural system)
4. Clusters of buildings (more than 1 building)
5. Cities and communities (more than buildings)

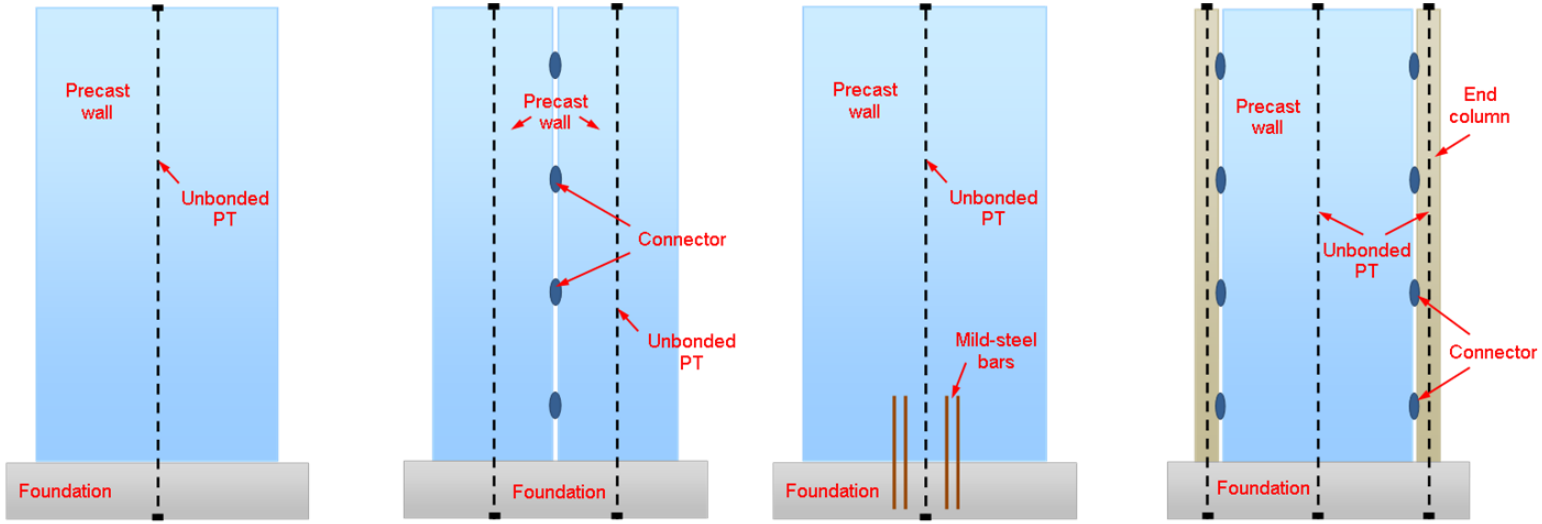
What about reducing damage?

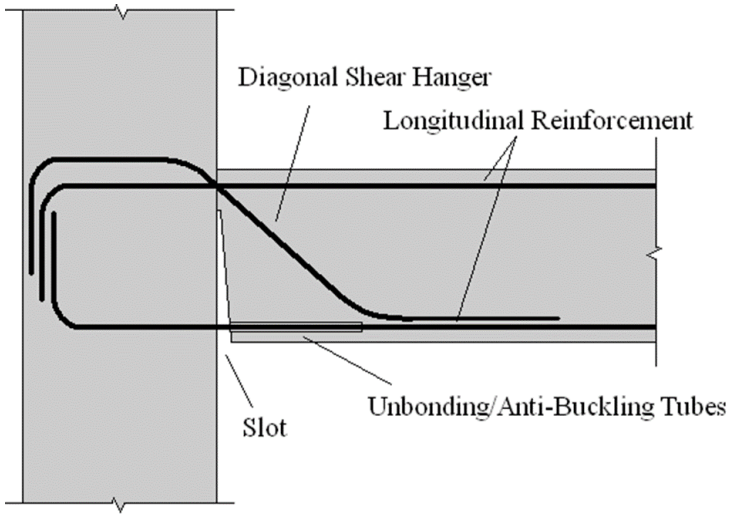
Base Isolation

- Can protect the building from (most) damage
- Not likely to be implemented in all buildings

Low-Damage Components







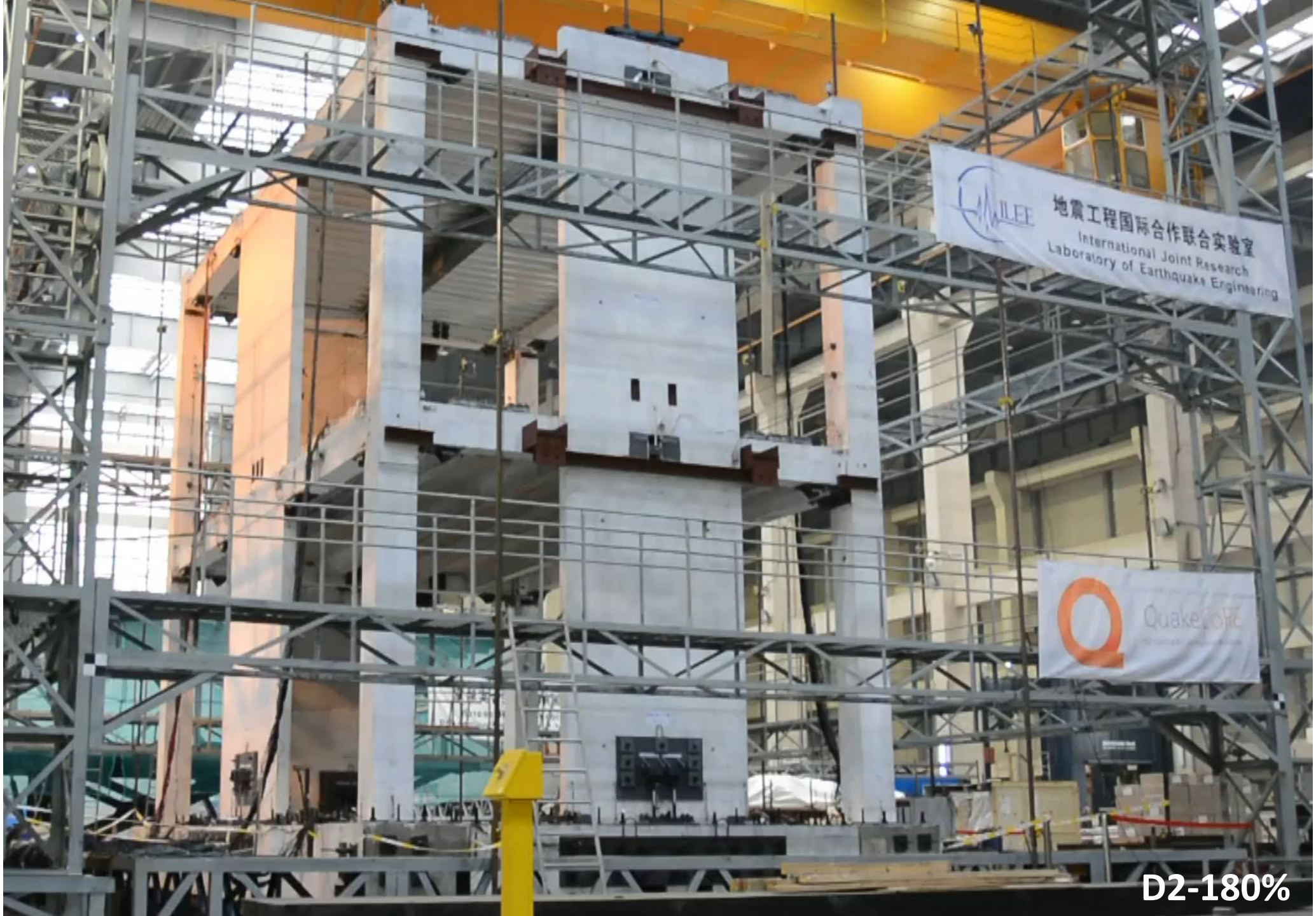
Low-Damage Buildings

- Have the innovative low-damage solutions currently being implemented sufficiently tested?






- 2 storeys (@ full scale)
- Post-tensioned walls
- Frames with slotted beams
- Interchangeable energy dissipating devices
- Several designs/config:
  - 1% & 2% design drift
  - Torsional
  - No dampers


地震工程国际合作联合实验室
International Joint Research
Laboratory of Earthquake Engineering
D2-180%

Wall Base

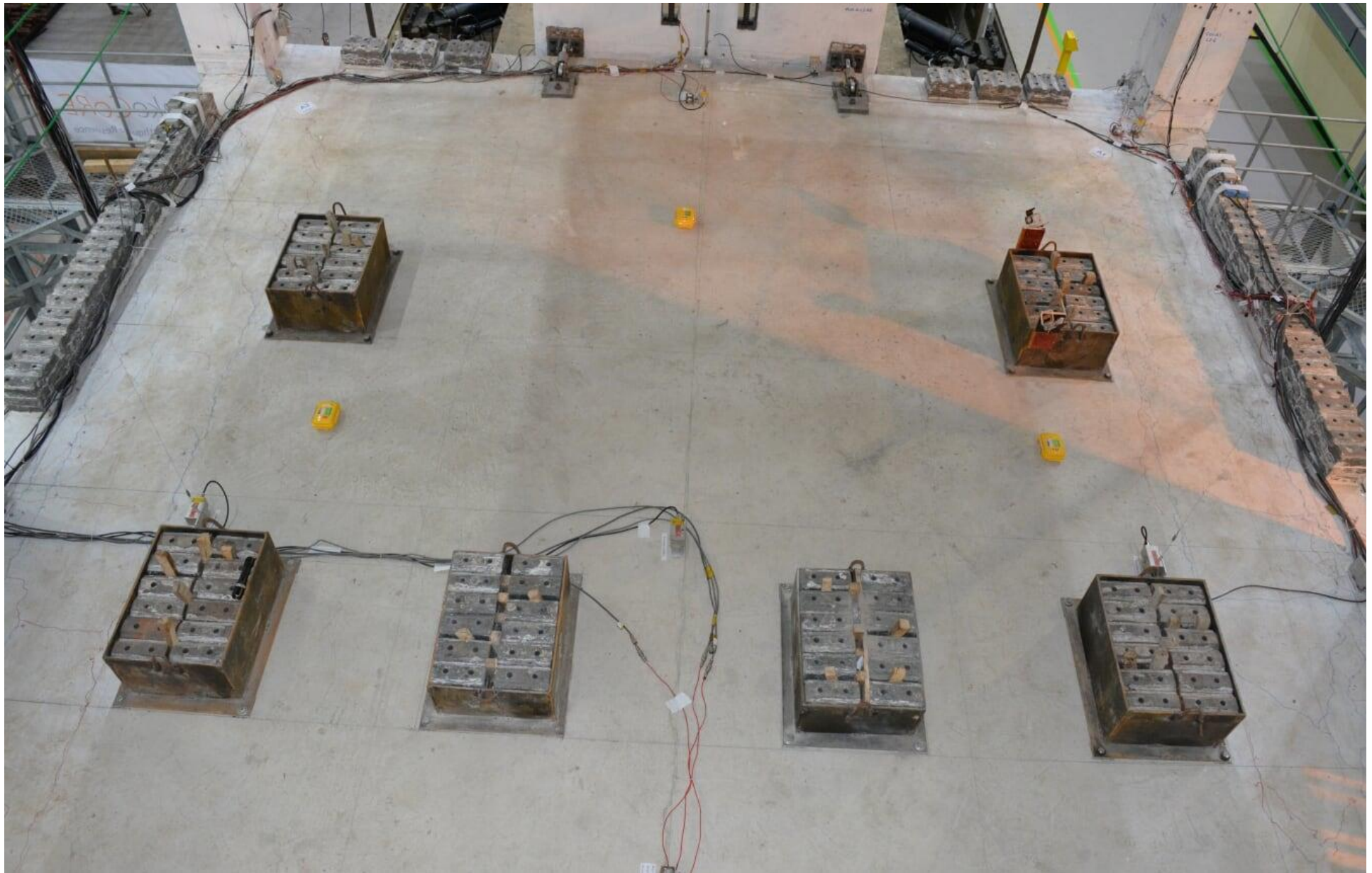
ULS EQ (1% design)

ULS EQ (2% design)

MCE EQ

Slotted Beam Joints

Floor Slab



Link Slab Cracking

Summary

- Conventional RC components are repairable from a structural perspective
- Hollowcore floor damage difficult to repair
- Repairability needs to be achieved for entire building
- Low-damage systems offer a range of alternatives but need to be properly validated

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Thank you

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BUILDING PERFORMANCE

ILEE
International Joint Research Laboratory of Earthquake Engineering

QuakeCoRE
NZ Centre for Earthquake Resilience