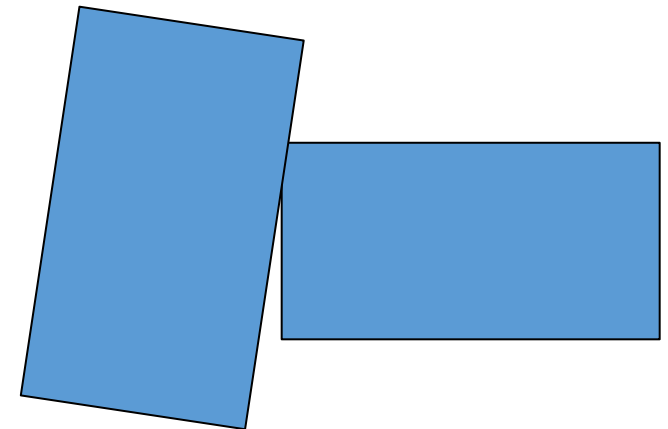
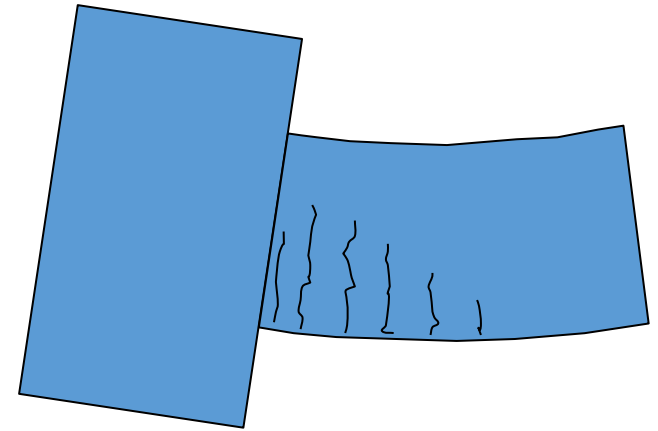


State-of-art research and guidelines: Rocking systems



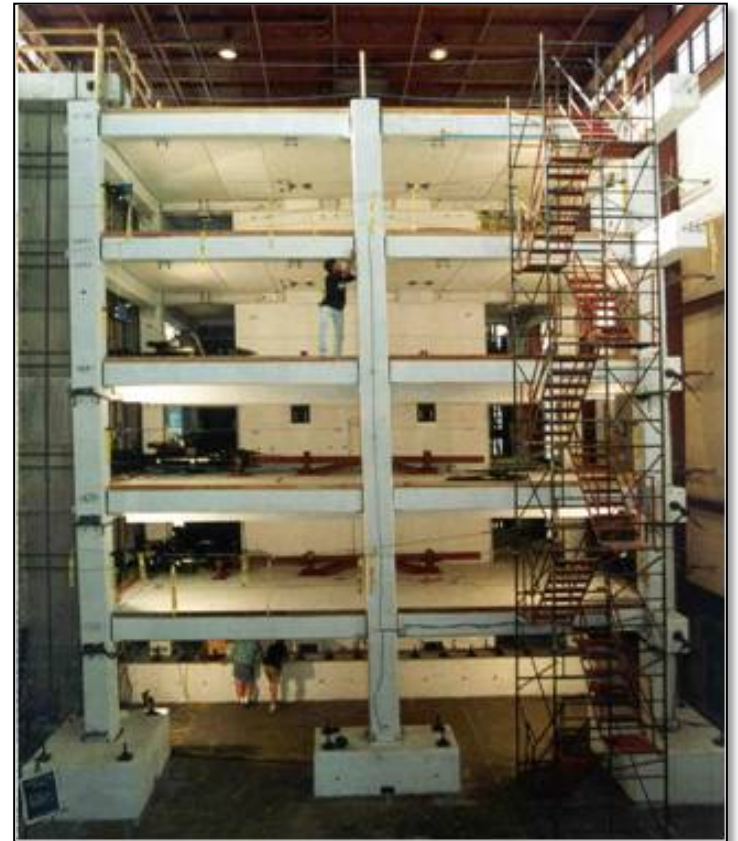
Precast Concrete Structures

- Cast-in-place emulation
 - Strong connections
 - Ductility in member
- Jointed / gapping / rocking
 - Ductility in joint
 - Undamaged member



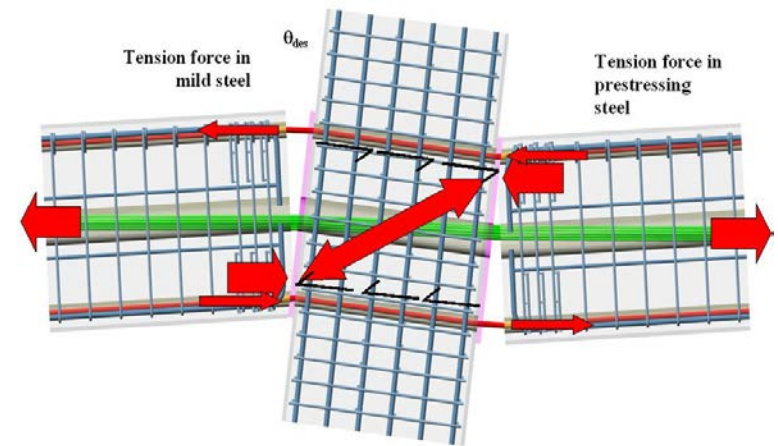
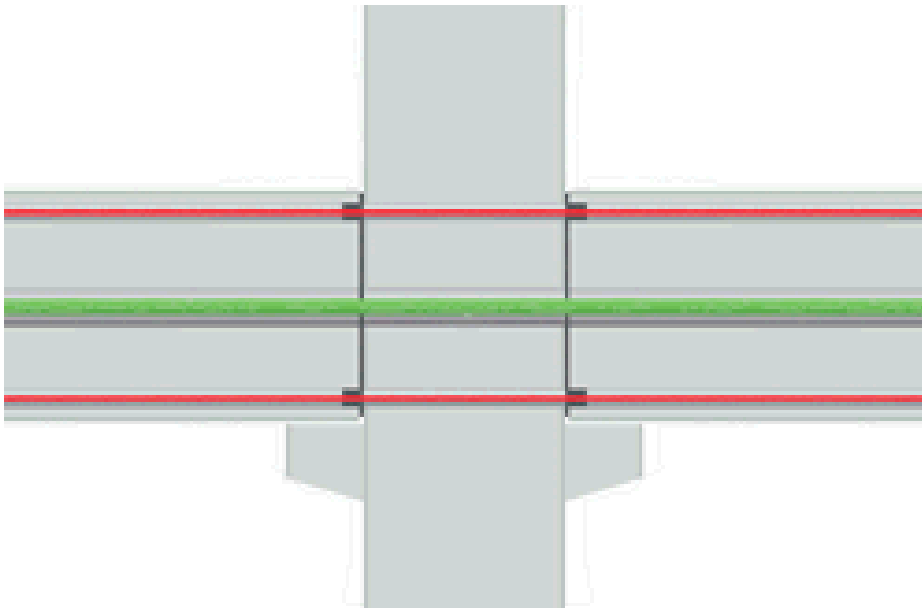
PRESSS Program (US-Japan)

- PREcast Structural Seismic Systems
- Component development
- PRESSS test building
- Focus on jointed design with unbonded PT



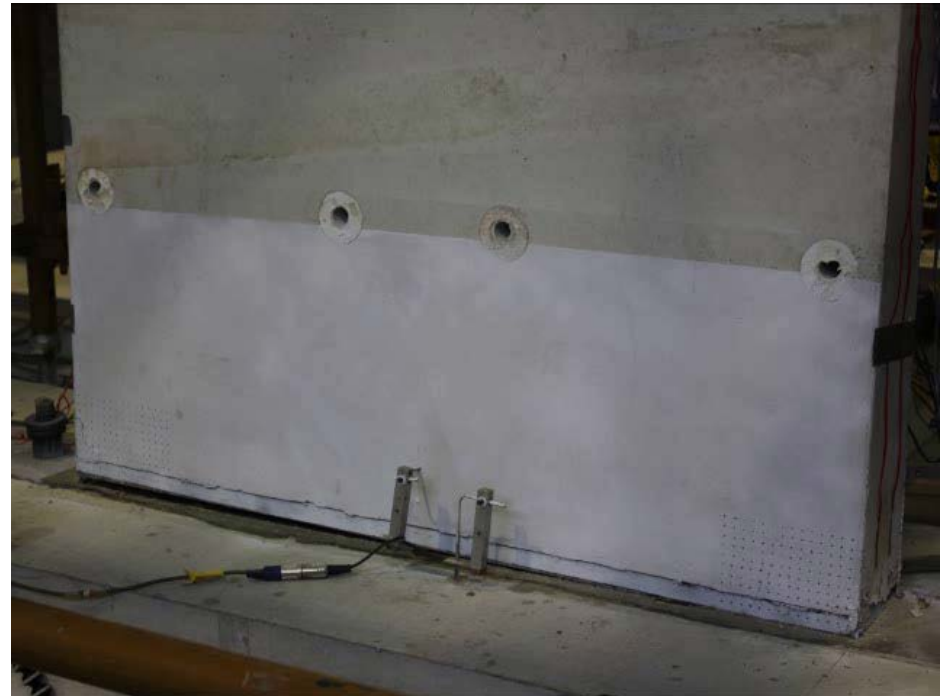
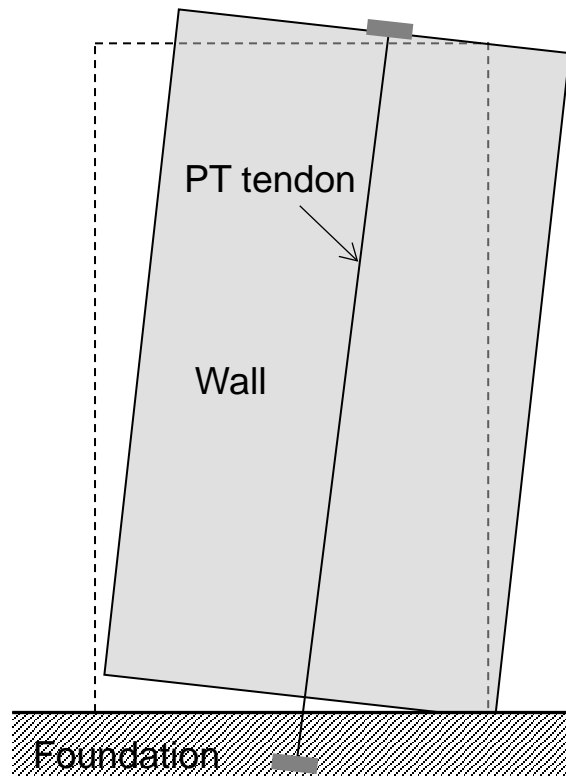
Frame Systems

- PT + mild-steel bars
- Challenges with floor diaphragms



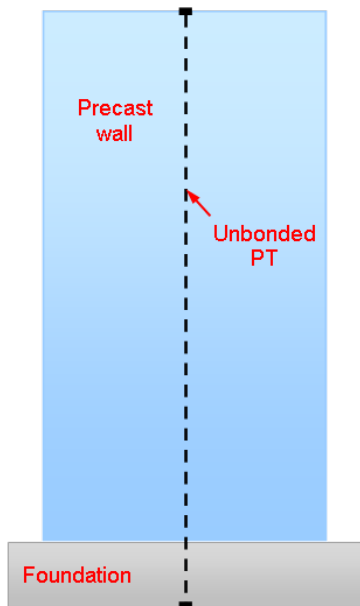
Post-tensioned Walls

- Overcome many design challenges with RC walls
- Minimal damage post-earthquake

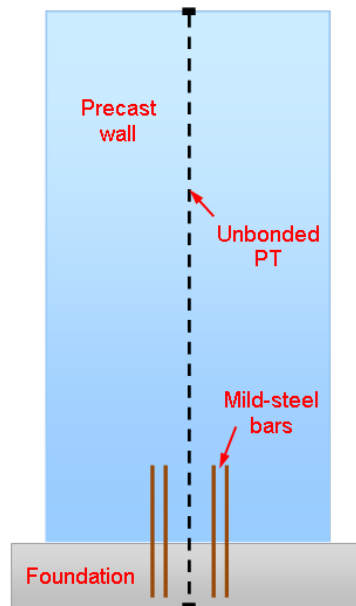


Wall Systems

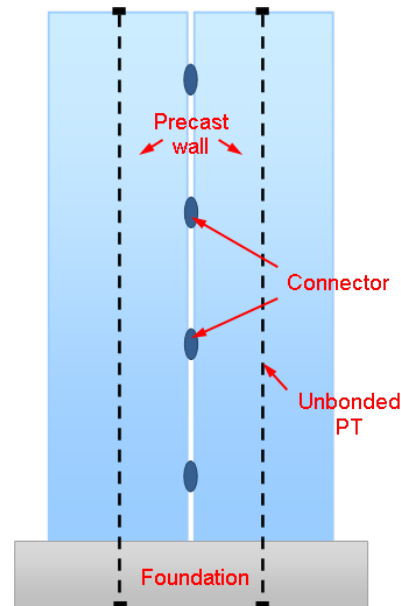
- Extensive research (testing and modelling)
- Many alternative energy dissipating elements



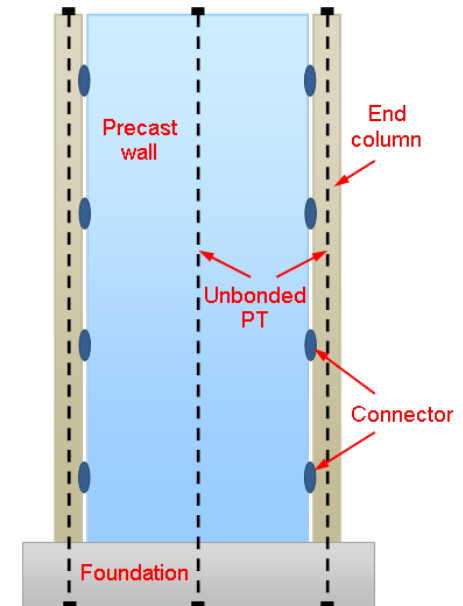
SRW



Hybrid



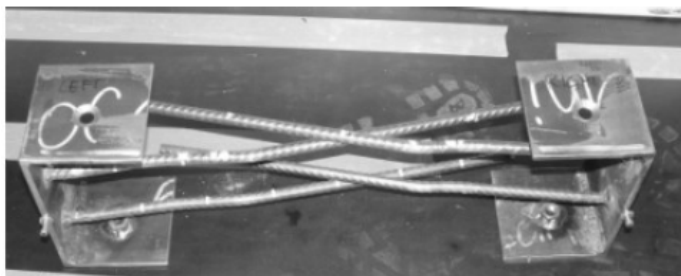
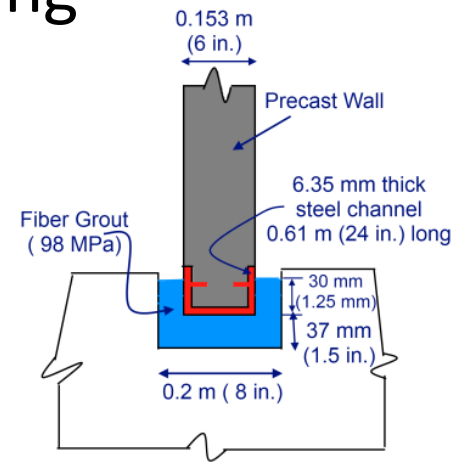
Jointed



PreWEC

Detailing

- Post-tensioning anchorages
- Confinement and armouring
- Grout interface



Dynamic Testing

- Shake-table tests of walls
 - Verification of wall systems
 - Improvements to modelling and design methods



UC



UoA



Reno

System Level Tests

- Many component tests
- Few system tests



PreSSS

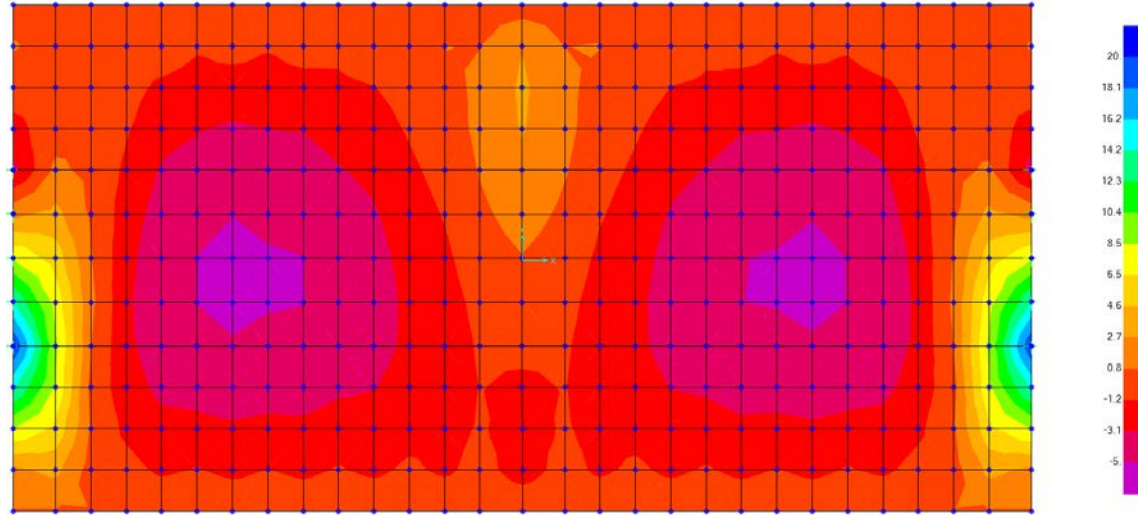
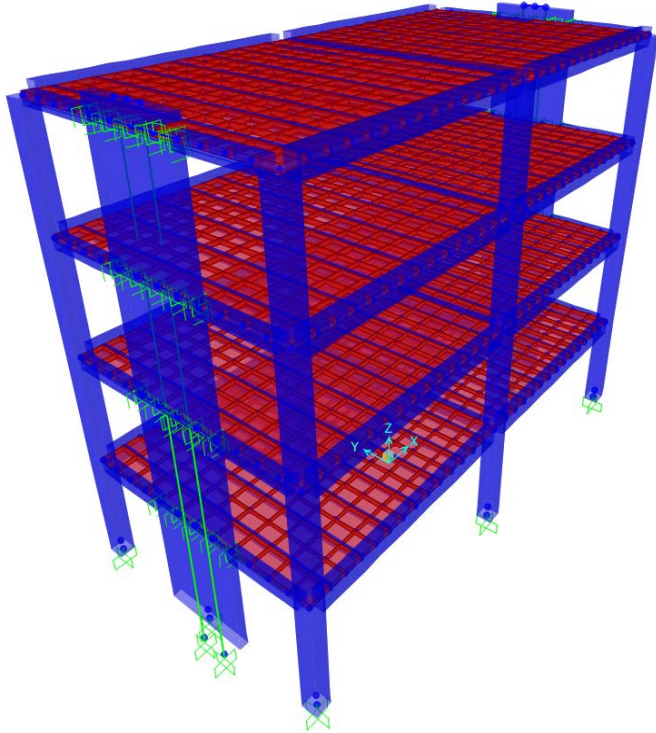


USCD

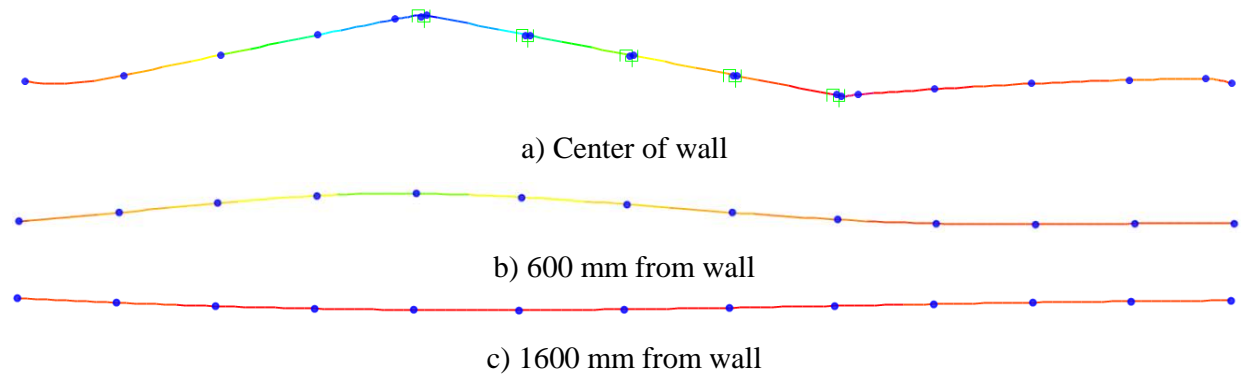
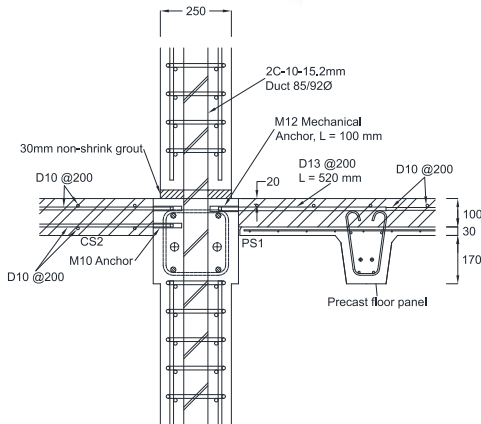


E-defence

Building Model



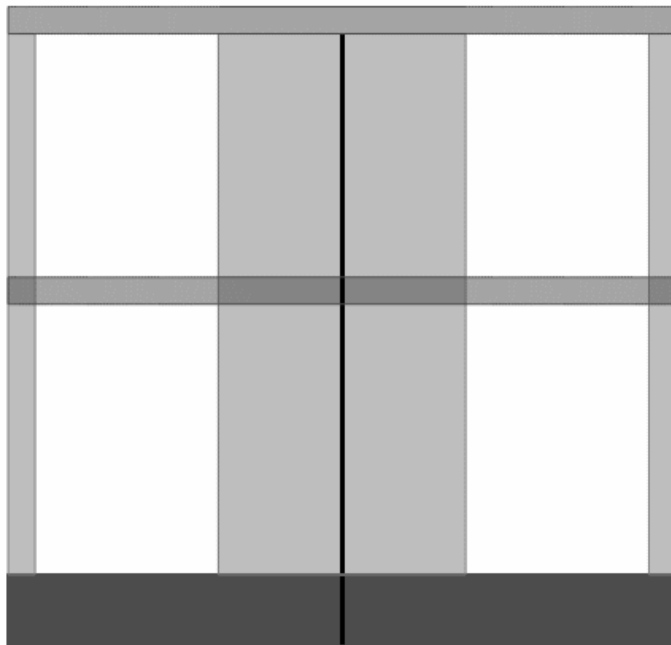
Vertical deformation of floor



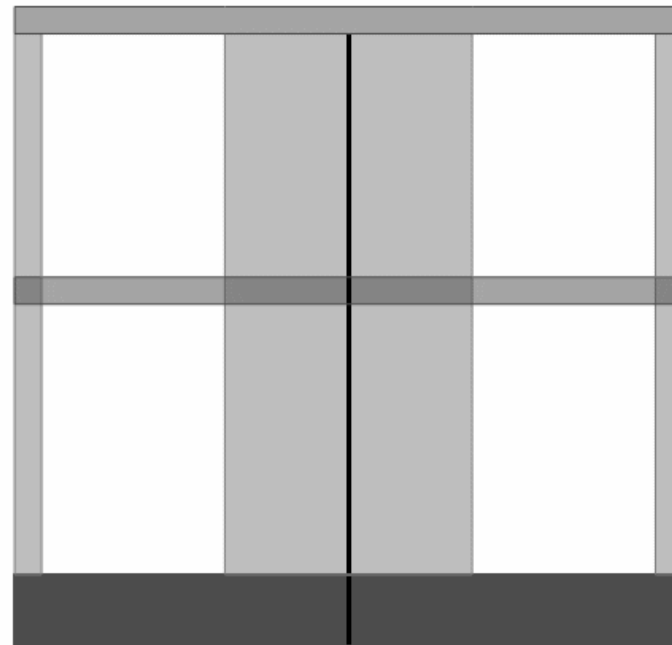


Wall-to-Floor Connection

- Connector to isolate vertical deformation

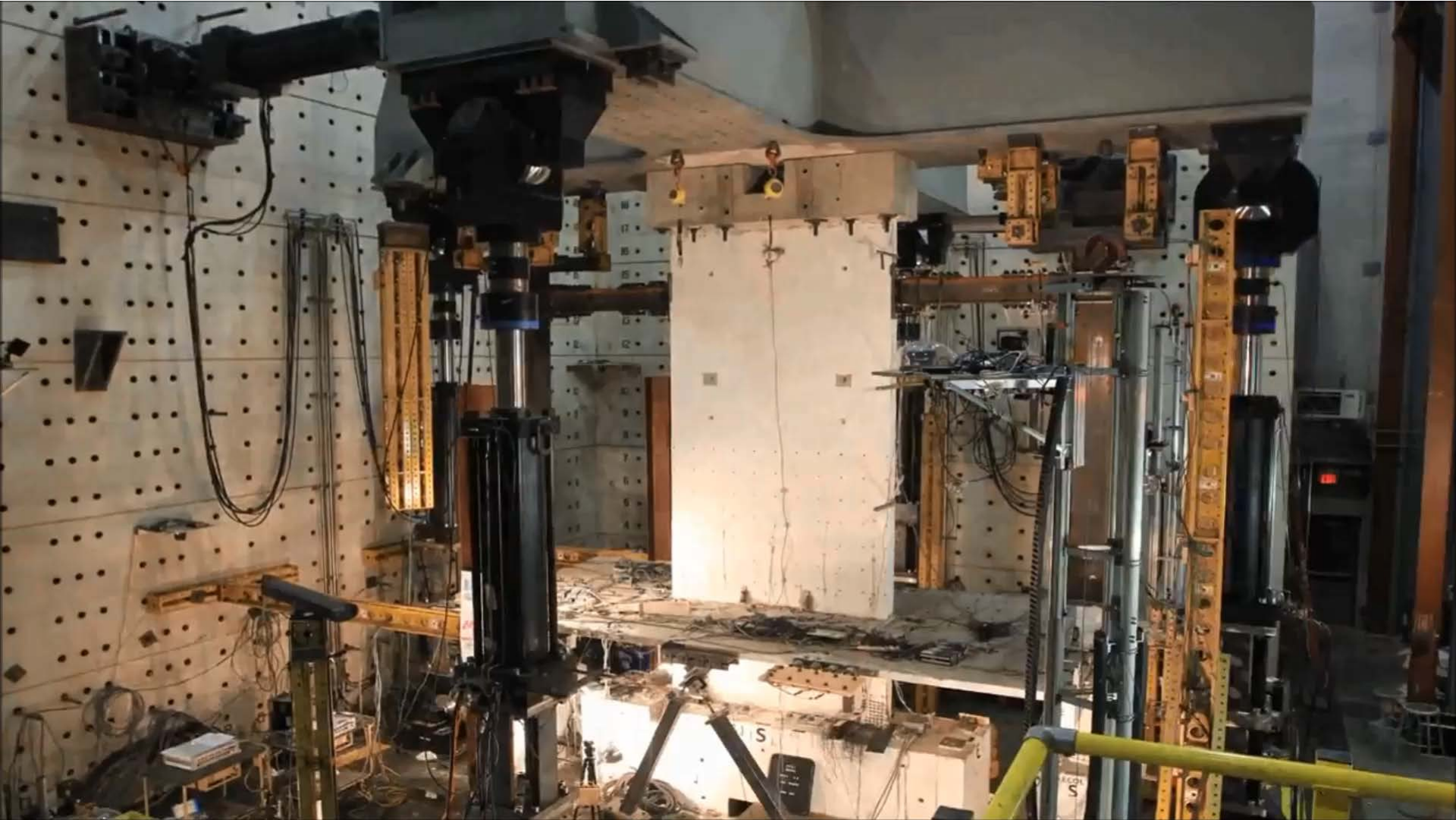


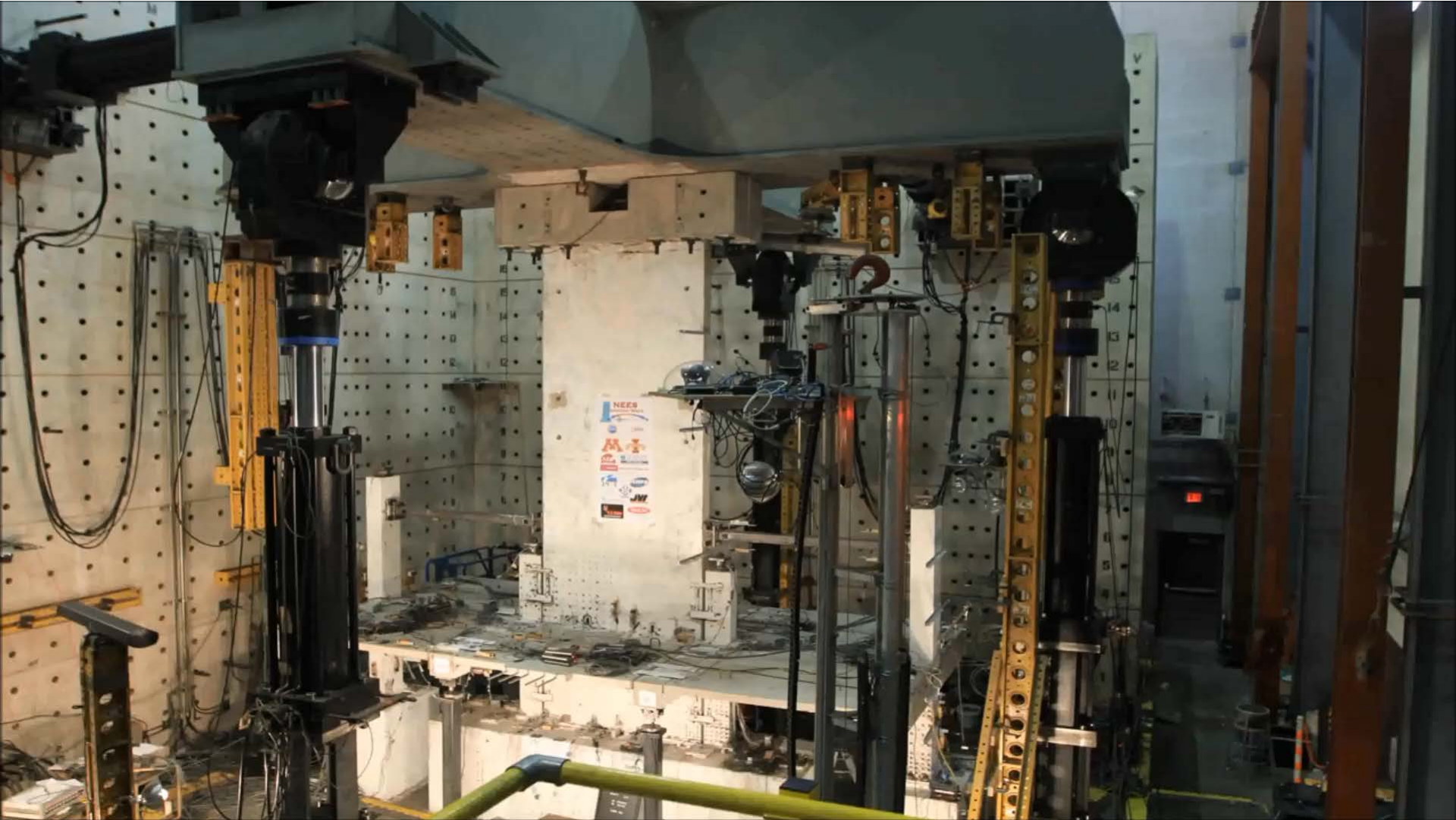
Rigid Floor



Isolated Floor

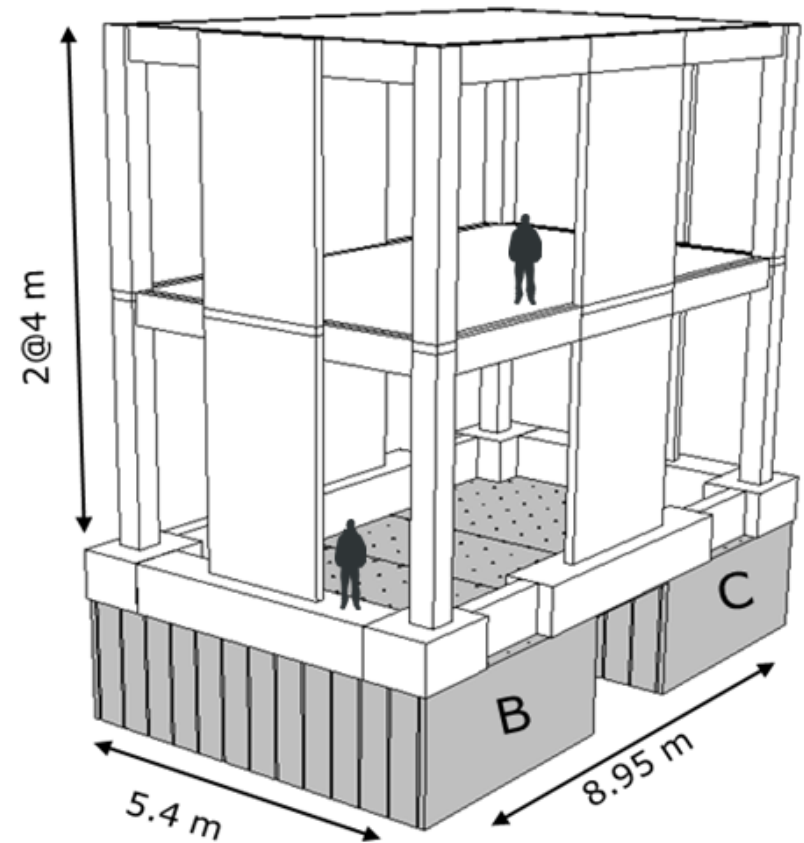






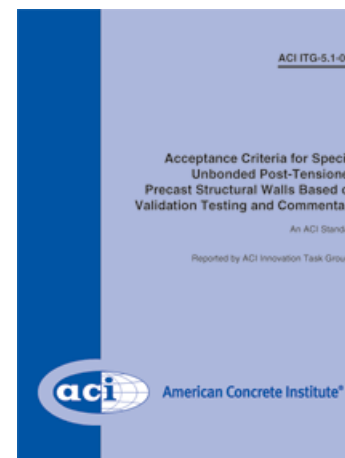
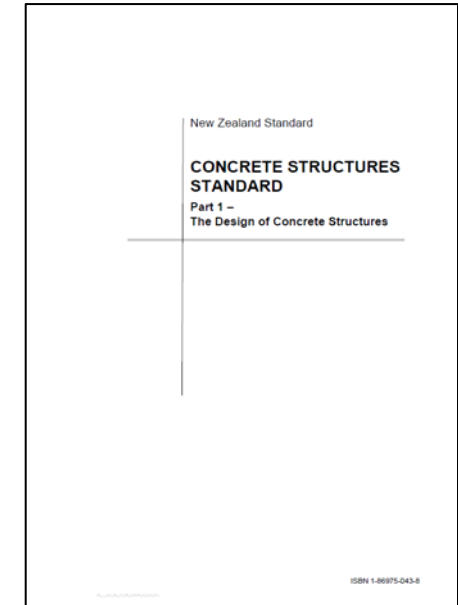
What's Next?

- ILEE-QuakeCoRE shake table test



Standards + Guidance

- NZS 3101:2006 Appendix B
- PRESSS Design Handbook
- ACI ITG 5.1 and 5.2



Summary

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



Panel session: Rocking systems

Questions #1

- When considering detailing and system behaviour:
 - What worked well?
 - What didn't work well (time-consuming, expensive, lack of guidance, poor EQ performance)?
 - What would you do differently on the next building?

Questions #2

- Wall base detailing:
 - Pocket vs. no pocket
 - Armouring (none, light, heavy)
 - Grouting
- Wall-to-floor connections:
 - Flexible / conventional (minor damage) vs. isolated / device (no damage)
- Non-structural components:
 - Drift and acceleration sensitive components

Questions #3

- What modelling or analysis did you use for the design?
 - Challenges?

Questions #4

- What areas require would benefit from further research or guidance development?
- Were there any directions from the client regarding performance objective and/or preferred systems?