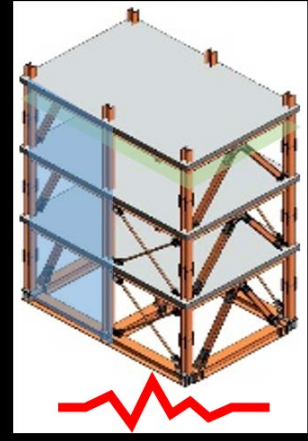


**RoBuSt**

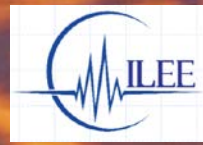


# QuakeCoRE-NZSEE Conference Workshop #3 – Large Scale Testing

University of Canterbury  
Christchurch  
13 April 2021, 9:30am



## Robust Building System (RoBuSt) Project



Gregory MacRae  
(UC Civil) (TU Civil)

Liang-Jiu JIA  
(UA Civil)

Charles Clifton  
(UC Civil)

Rajesh Dhakal  
(AUT Civil)



Geoff Rodgers  
(UC Mech)

Pierre Quenneville  
(UA Civil)

Ping XIANG  
(TU Civil)

Shahab Ramhormozian  
(AUT Civil)



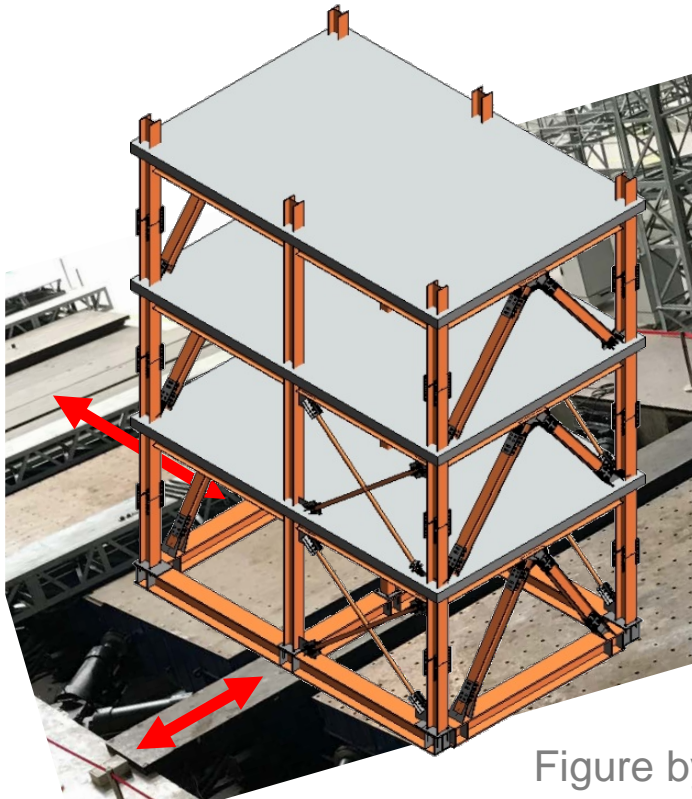
+ Hilti Corporation, Forman Building Systems, Gripple,  
Lanyon & LeCompte Construction Ltd., and Alutech Doors & Windows Ltd.

**NZ-China Collaborative Research Programme**

# ROBUST OVERVIEW

## TESTING TYPE

### Shaking Table Testing (Jiading, Shanghai)



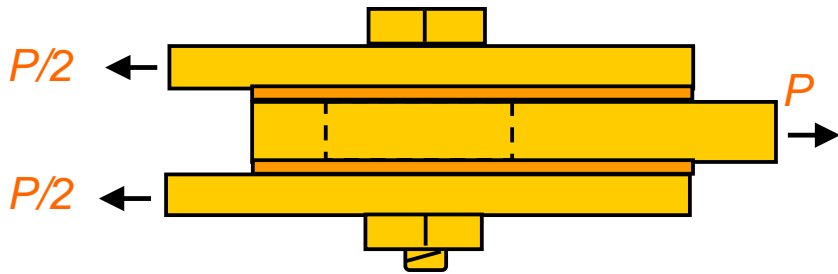
- BUILDING SYSTEM
  - Whole (Main Skeleton + NSE)
  - Full Scale
- RANGE OF CONFIGURABLE
  - STRUCTURAL SYSTEMS
    - MRF, CBF, Rocking, Gravity
  - FRICTION DEVICES
    - SFC, AFC, RSFJ, GnG
- SYSTEM ADVANTAGES
  - New Concepts
  - ROBUST (Resilient)
  - Cheap
  - Modular
  - Reparable
- SHAKING
  - Dynamic
  - Bi-directional

Figure by Hamed Bagheri

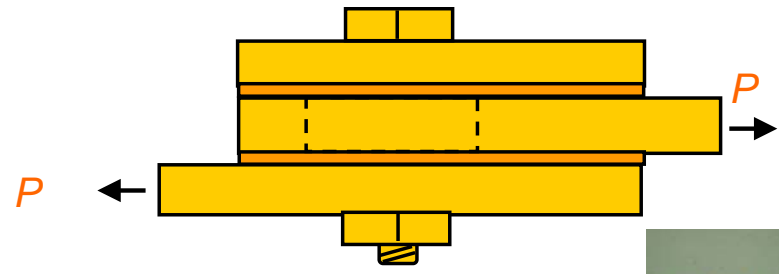
# ROBUST OVERVIEW

## Energy Dissipation with Friction Connections

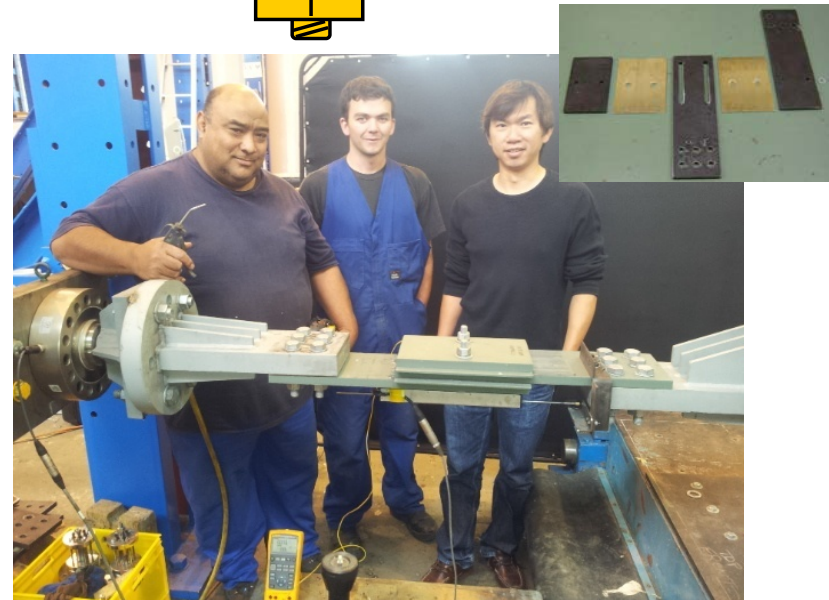
### Symmetrical Friction Connections (SFC)



### Asymmetrical Friction Connections (AFC)

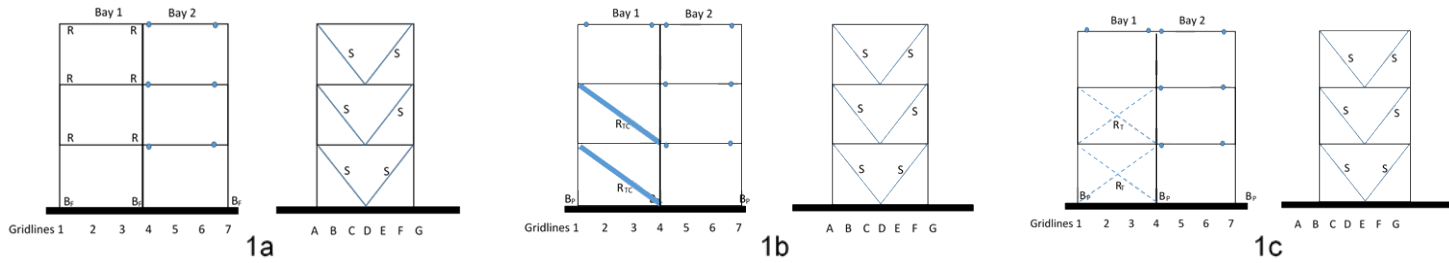


### RSFJ Connections

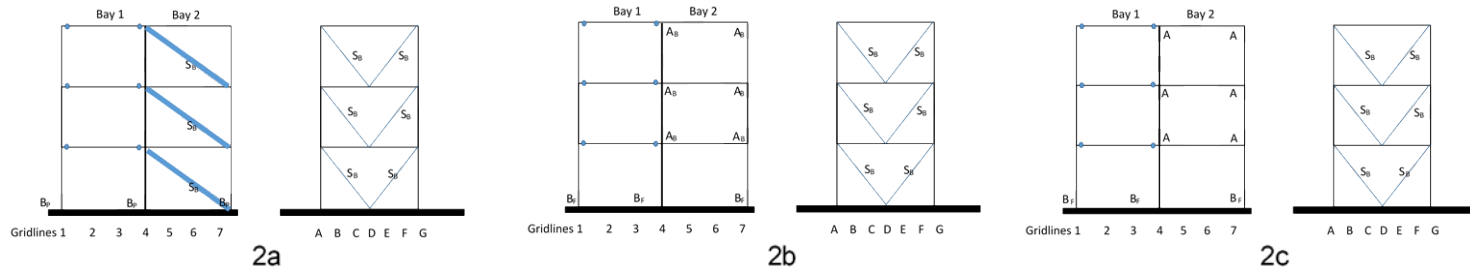


Previous work: Pall and Marsh (1980s), Popov (1990s), Clifton et al. (1995), MacRae et al. (2010), Chanchi (2015), Quenneville (2016)

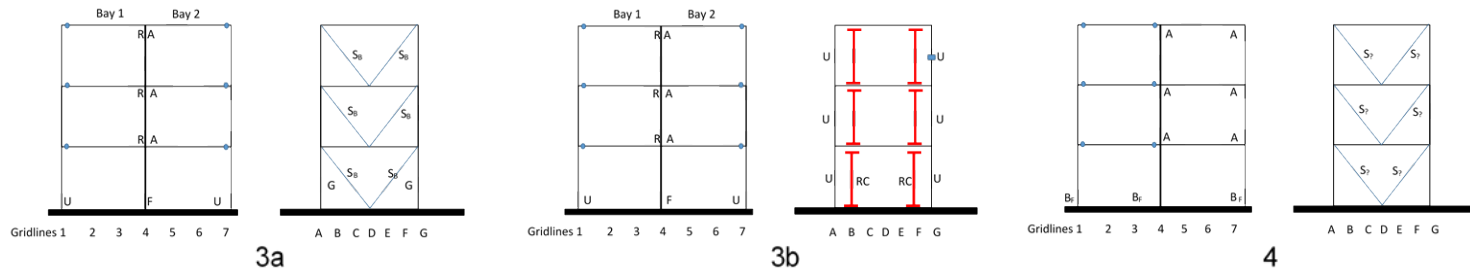
## RSFJ (X – long direction), SFC CBF (Y)



MRF                      Compression-Tension Brace                      Tension-Brace  
 AFC MRF & SFC CBFs (X), SFC CBF BeS (Y)



CBF SFC (CSW)                      MRF (No CSW)                      MRF (CSW)  
 MRF (X), Rocking Structures & MRF w/- NSE (Y)



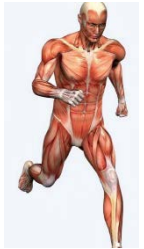
Rocking Frame w/- GnG                      Rocking Column                      MRFs + CBF + NSE



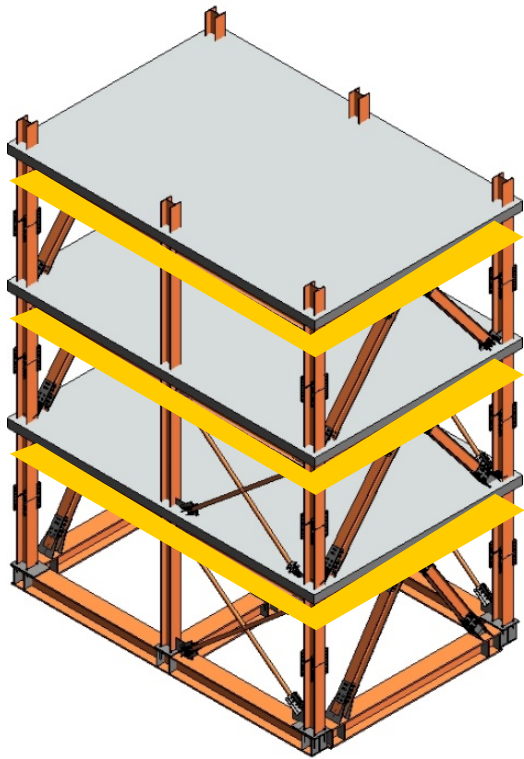
# TEST PLAN



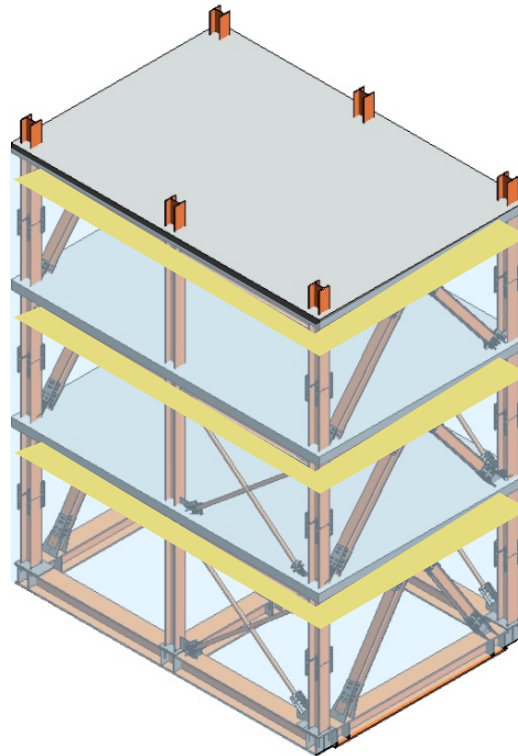
## Non-Skeletal Elements (NSE)



E.g. Ceilings



Cladding (e.g. GCW and PCP)

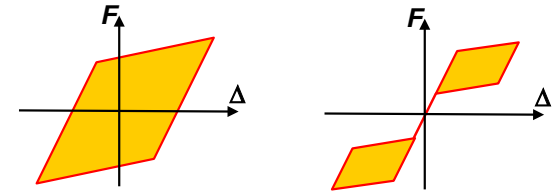


plus

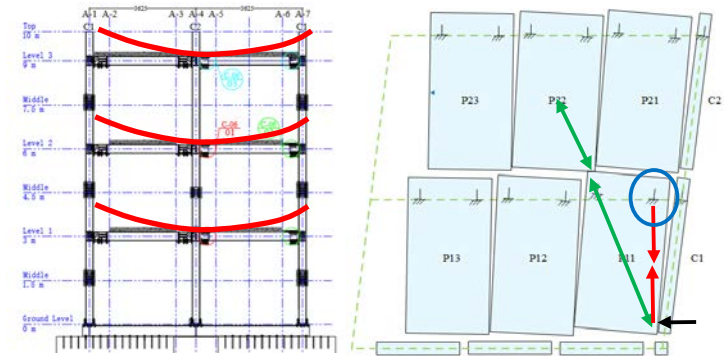
- Sprinklers
- Partitions
- Contents  
(e.g. furniture)

# FINDINGS - PRETEST

i) Need better displacement prediction



ii) Configuration effectiveness

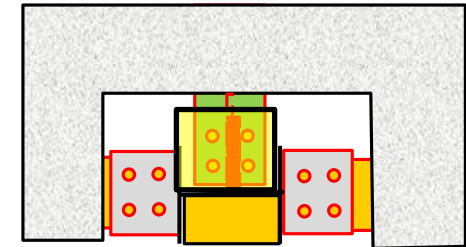


iii) Repair / replace decision tools

iv) Column twisting

v) Fundamental friction behaviour

vi) Base connections



vii) Transfer of forces through slab

viii) Access panels



ix) Novel instrumentation

Data Reduction

# Thank you







# TEAM

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