**INTRODUCTION**

As part of QuakeCoRE research into the rebarability of structures, the ROBUST (ROBust Building System) project is ongoing. The two main focus areas for the project are: (a) traditional buildings; and (b) new construction. The research is being conducted at the International Joint Research Laboratory on Earthquake Engineering (IIEE) facilities, Brussels, Belgium. The project is an example of industry-driven research that involves collaboration between the industry and Indian researchers. The project is funded through a grant from the New Zealand Ministry of Business, Innovation & Employment (MBIE). The project aims to develop new building systems that are resilient to earthquakes and can be used in regions prone to seismic activity.

**NEEDS**

Severe earthquakes worldwide have emphasised the need for building resilience. Some design procedures developed minimize the undesirable effects of the earthquakes by using friction for energy dissipation. Detailed experimental investigations and friction connections at component level have been undertaken, but no experimental testing has been undertaken on complete building systems using friction. Hence, there is a need to develop a full-scale steel structural building system, comprising both structural and non-structural components, that can be tested with significant earthquake shaking without significant damage.

**SCOPE**

This study is referred to as the Robust (ROBust Building System) project. The project is ongoing and is being conducted at the International Joint Research Laboratory on Earthquake Engineering (IIEE) facilities, Brussels, Belgium. The project is an example of industry-driven research that involves collaboration between the industry and Indian researchers. The project is funded through a grant from the New Zealand Ministry of Business, Innovation & Employment (MBIE). The project aims to develop new building systems that are resilient to earthquakes and can be used in regions prone to seismic activity.

**OBJECTIVE**

This paper presents the methodology and results of the testing of a prototype building system consisting of an asymmetric friction connection, with the aim of demonstrating the effectiveness of a range of specifications in terms of energy dissipation and structural performance.

- **Type of FRAMES**
  - Depending upon different types of frame systems, various configurations will be considered in the future. They are shown in Fig. 2: a. Moment resisting frame (MRF) b. Braced frame (BF) system c. Braced frame (BF) system

- **Type of CONNECTIONS**
  - Significant development of a number of connection types have been developed in New Zealand since 1995. The basic friction connection type is the Symmetric Friction Connection (SFC).

- **Friction connection connection types**
  - In the SFC, there is a low damage alternative for traditional seismic MRI systems (see Fig 8). Belleville springs (BS) may be used with the bolts. Connections are initially rigid then rotate at higher moments. A high-strength bolt prevents them from moving further. Placing them on the beam bottom flange minimises slab damage. A rotational link at brace end (Fig. 9) is also used.

- **Framing FRANCE structure dissipation**
  - Rocking wall tension only dissipation such as GFRG/GRG systems are used in this condition. The rocking action is transferred through the connections to the column bases.

- **NON STRUCTURAL SYSTEMS**
  - This aspect is of great interest to NZ sponsors who wish to ensure a robust system. NZ structures include a variety of components (parapets, chimneys, parapets, ceilings, claddings, facades, doors, windows, HVAC (heating, ventilation and air conditioning) systems, fire protection, water piping etc. In this test, the non-structural system (building) (see Figs 2 and 4) is tested to be equipped with:
    1. Suspended Ceilings comprising of composite tiles and aluminium grids with two different support systems (perimeter fixed and fully floating with damping layer around the perimeter).
    2. Sprinkler systems comprising of rigid and flexible drop pipes with different bracing configurations.
    3. Partition drywalls with linear, right angle and T shaped configurations with traditional and low damage details.
    4. Precast masonry claddings and glazing using traditional and low-damage connections to the structure.

- **Testing EQUIPMENT**
  - The shake table used in this project is shown in Fig. 16. Two multi-functional shake table, Tables B and C, each 6 m x 4 m will be used for this project. These two shake tables will work together (see Fig 16).

- **DESIGN CONSIDERATIONS**
  - The shake table used in this project is shown in Fig. 16. Two multi-functional shake table, Tables B and C, each 6 m x 4 m will be used for this project. These two shake tables will work together (see Fig 16).

- **Testing ORGANISATION**
  - The project has gained support from a number of groups in New Zealand and promises to provide interesting insight into the performance of emerging technologies and design strategies. The primary investigators are the New Zealand Earthquake Research Commission (NZEROC) and the QuakeCoRE as well as NZ consultants.

- **CONCLUSION**
  - This is the first test of a multi-storey building system at this scale including multiple drift and acceleration sensitive NZ systems.

### Tables

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### Figures

1. **Figure 1.** Concept of asymmetric friction connection (AFC).
2. **Figure 2.** Plan layout of the shake table.
3. **Figure 3.** Test frame plan.
4. **Figure 4.** Symmetric friction connection (SFC)
5. **Figure 5.** Asymmetric friction Connection (AFC)
6. **Figure 6.** Resilient Slip Joint (RSFJ)
7. **Figure 7.** Friction connection locations
8. **Figure 8.** Resilient Slip Joint (RSFJ)
9. **Figure 9.** Rocking frame dissipator (MFRF)
10. **Figure 10.** Rocking wall tension only dissipation such as GFRG/GRG systems
11. **Figure 11.** Columns base connection options
12. **Figure 12.** Rocking spring on base
13. **Figure 13.** Some AFC at base connection options
14. **Figure 14.** Grp and Grb (GRG) device
15. **Figure 15.** Details of AFC connection
16. **Figure 16.** Two shake tables working together.