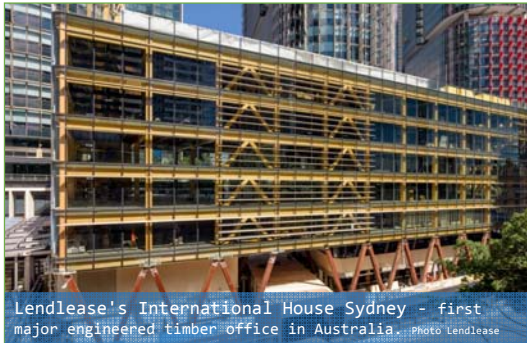




Chevron braced timber frames for tall seismic structures



2017 Part 4 Project
Bobby Kells & Shona Kalani

2018 Masters
(Mary) Yue Xiao

Presented by **Hugh Morris**

Bob Jones Building
Wellington
Tallest publicly proposed



Picture credit: StudioPacific Architecture



2017 Chevron BRB Proposal

- Cruciform steel core Timber BRB

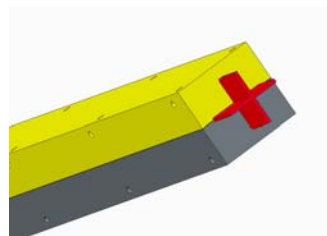
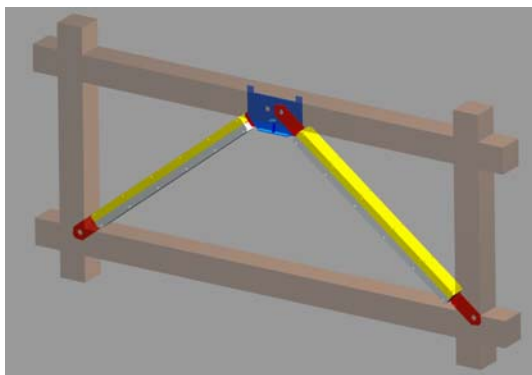
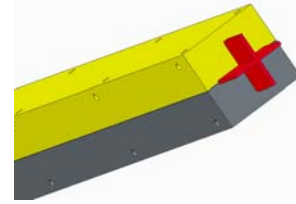


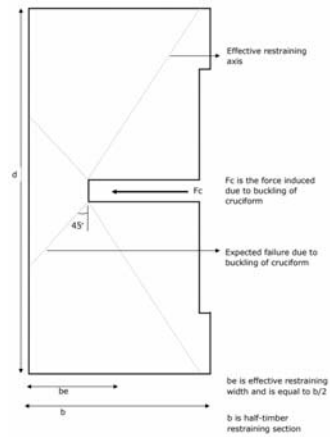
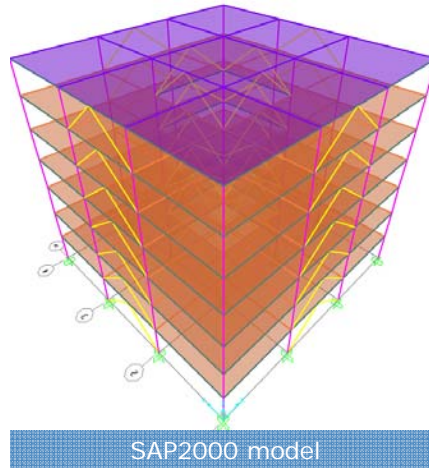
Photo credit: Equilibrium Consulting



2017 BRB Proposal



- **Building specifications:** 3 bay 6 storey office building. **Concrete topping** of 60mm on every floor to replicate a standard timber building structure
- Timber building modelled
- Columns- Beam **connection were pinned** as were our braces. To allow maximum axial loads to travel into the braces.
- **Timber properties** were assumed isotropic with a **E selected as 10.7 GPa** based on LVL standards
- We modelled our building based in **Christchurch** to test it in worst seismic zones in New Zealand. **Soil Class D**
- Design Life of 50 years
- Timber **damping** selected at 12% based on Timber Design Manual's Shear rocking wall damping and modal damping applied to RS analysis was kept at 5%
- Since timber is rather a ductile material, factor of ductility reflected this.

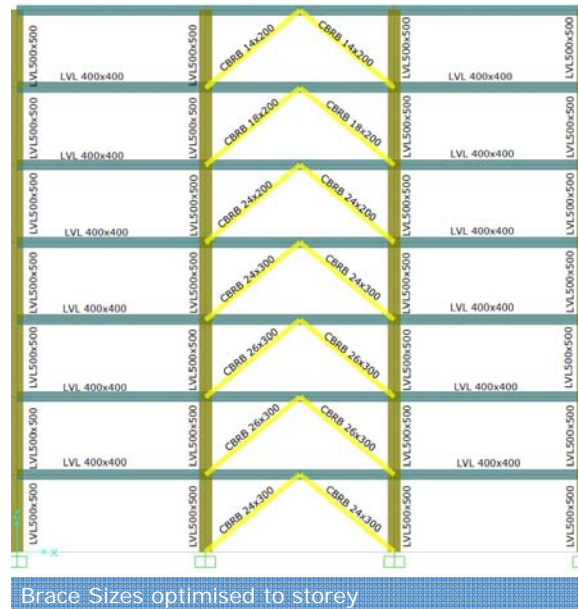


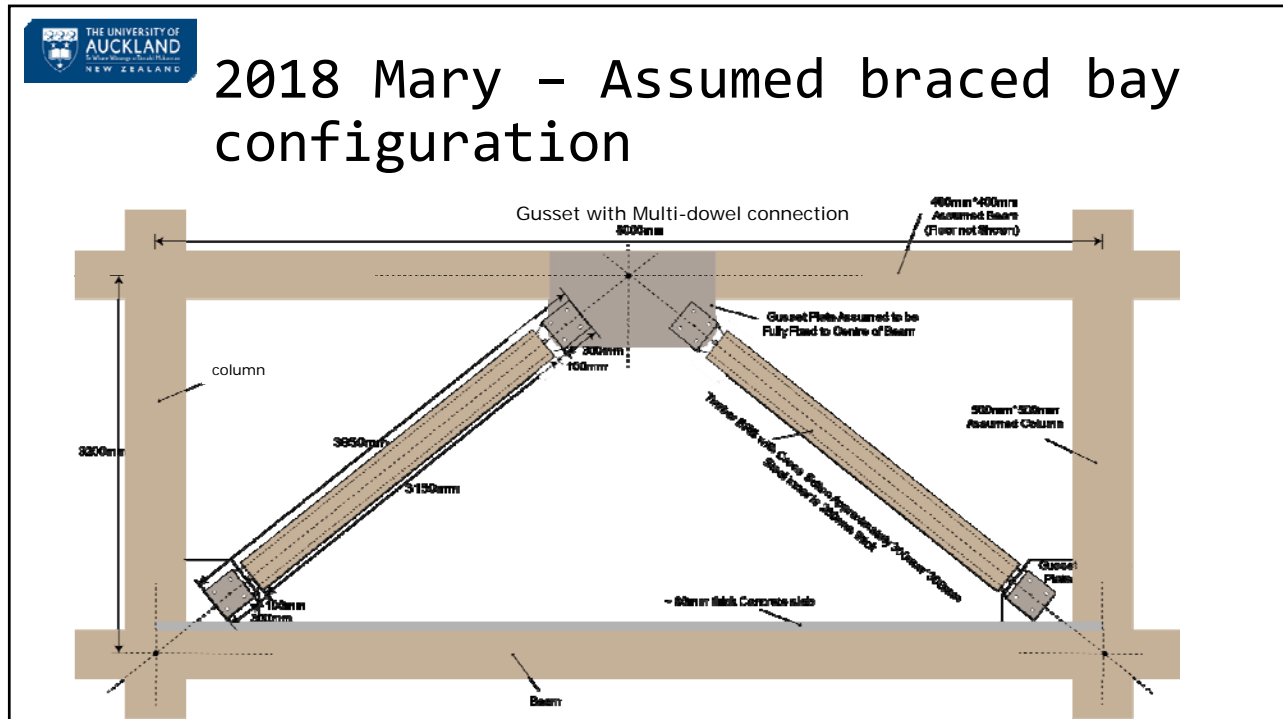
2017


• Outcome

Brace Sizes optimised to storey

Floor (i)	Max Axial load from SAP Analysis, N*	Plate Thickness (mm)	Total Cruciform width (mm)
Roof	128	14	200
6	242	18	200
5	380	24	200
4	463	24	300
3	536	26	300
2	587	26	300
1	426	24	300





 THE UNIVERSITY OF AUCKLAND
Auckland University of Education
NEW ZEALAND

2018 Initial Test Proposed

- Testing Equipment:
 - 500kN Mechanics Test Systems (MTS)
- Scale : 1/3
- Loading
 - modest quasi static cyclic loads,
 - compression load until failure
- Aim:
 - Confirm and improve design of the brace

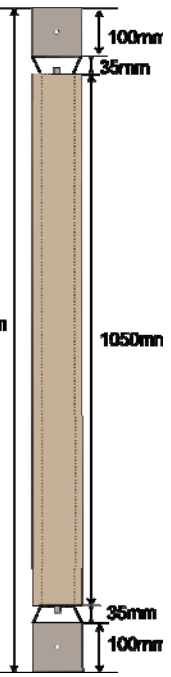
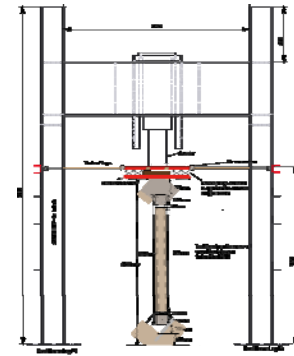
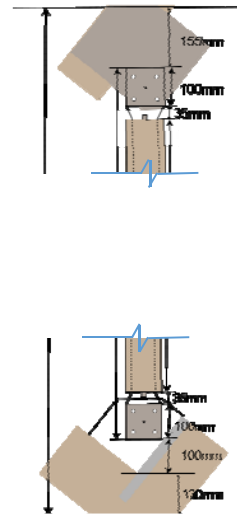


Diagram illustrating the proposed initial test specimen. The specimen is a vertical member with a total height of 1320mm. The specimen is supported at both ends by a 100mm x 35mm base and a 100mm x 35mm top support. The main body of the specimen is 1050mm long.



2018 Further tests Including end constraints

- 500kN MTS
- Scale 1/3
- Model end constraints
 - Stiffness in two directions
 - Lateral restraining frames to protect the actuator
- Loading
 - quasi static cyclic loads,
 - compression load until failure
- Two steel load frames connected by 4 Wave springs/Belleville springs will be used to approximate the stiffness of the upper beam and keep the loading level



Thanks to NHRP