

# SEISMIC PERFORMANCE OF HEAVY TIMBER FRAMES WITH BUCKLING RESTRAINED BRACES

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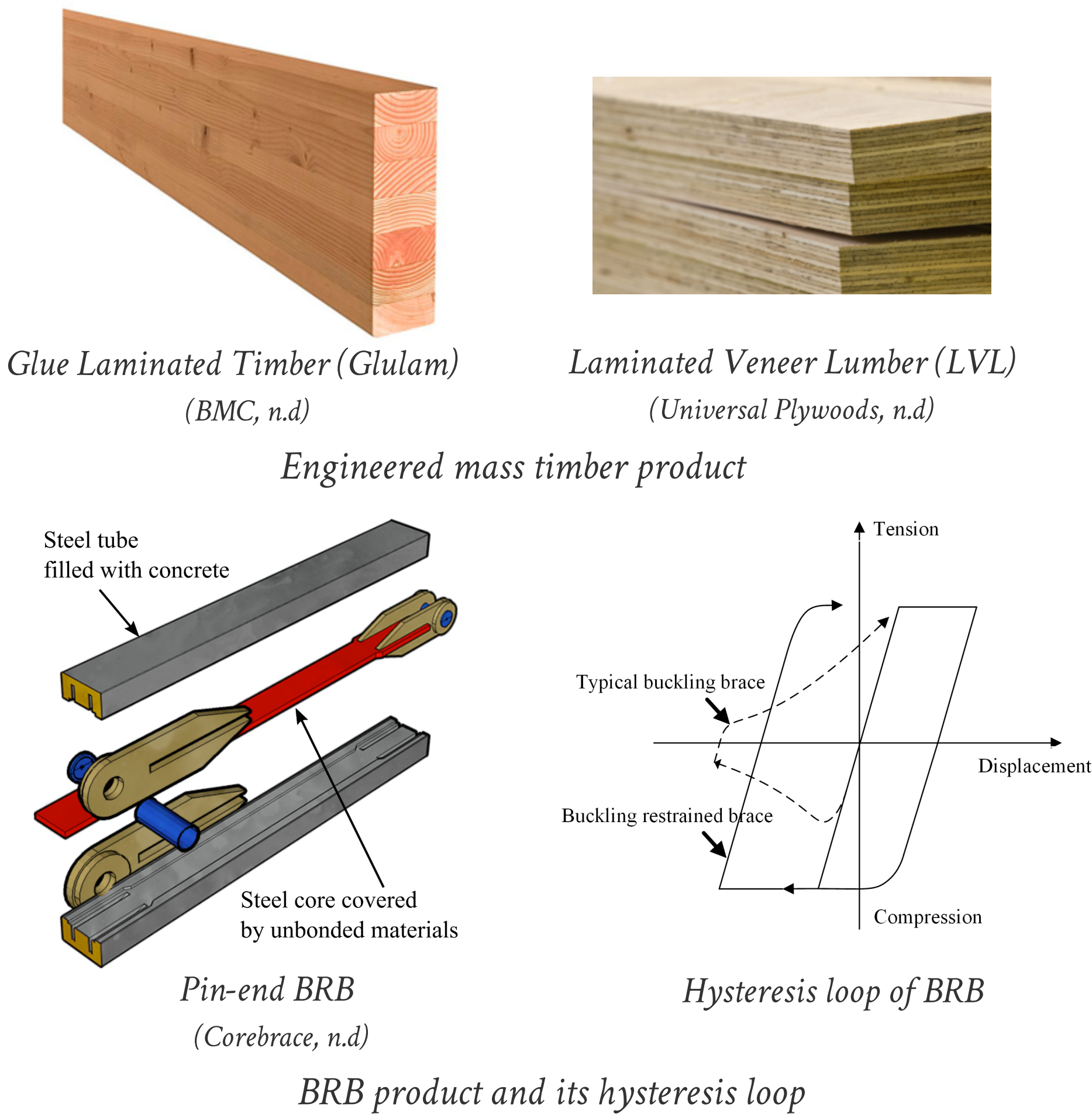
## 1 Introduction

Heavy timber frames with Buckling Restrained Braces (BRBs) are considered to be a effective solution because of advantages listed as below:

- High-quality prefabrication
- Quick assembly
- Low damage system
- Good ductility

However, some questions need to be figured out:

- Timber-steel interface connection selections
- The system perform under cyclic loading
- Timber casing BRB's performance



## 3 Timber Frame with BRBs Test

Previous research shows that BRB's performance in a frame is quite different with the one in a uniaxial specimen test, thus it is important to do the system test. A second floor frame is extracted from a six-storey building as it contains all critical joints.

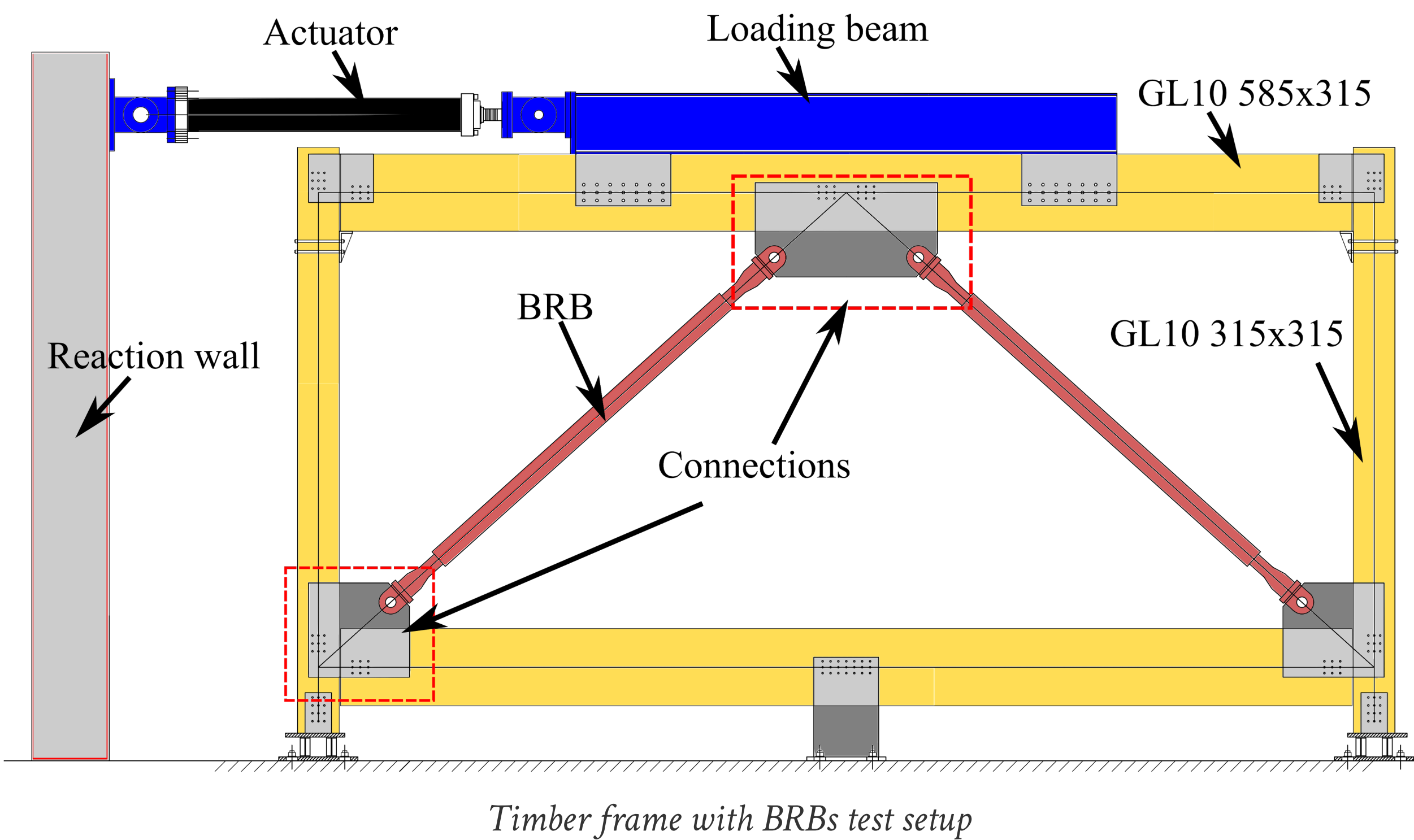
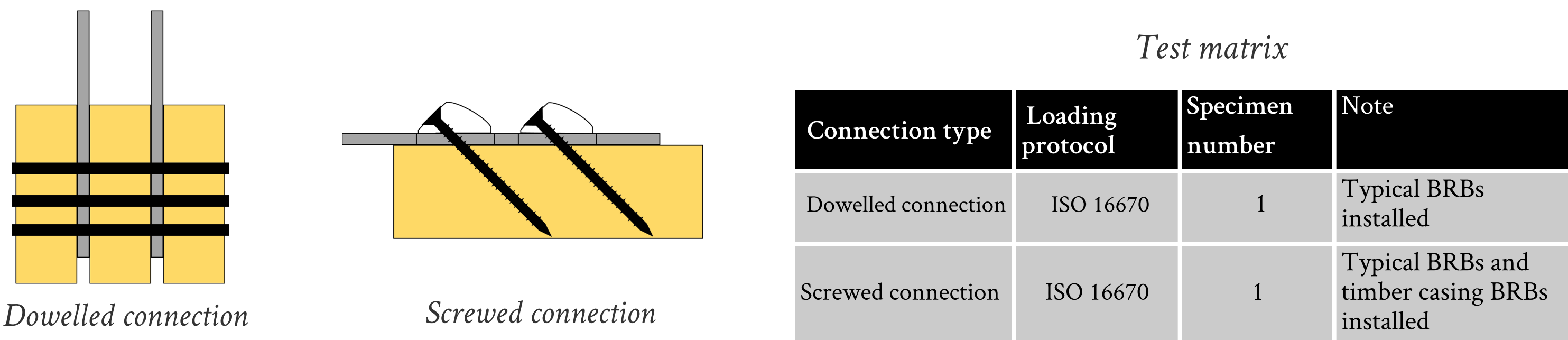
Two glulam frames will be tested in plane with two different types of interface connections:

- The dowelled connections
- The screwed connections

Two types of BRBs will be used in the tests:

- Typical steel tube casing BRBs with infill concrete
- New timber casing BRBs

Strong stiffeners for gusset plates and out-of-plane reaction frames will be used to provide out-of-plane stiffness.

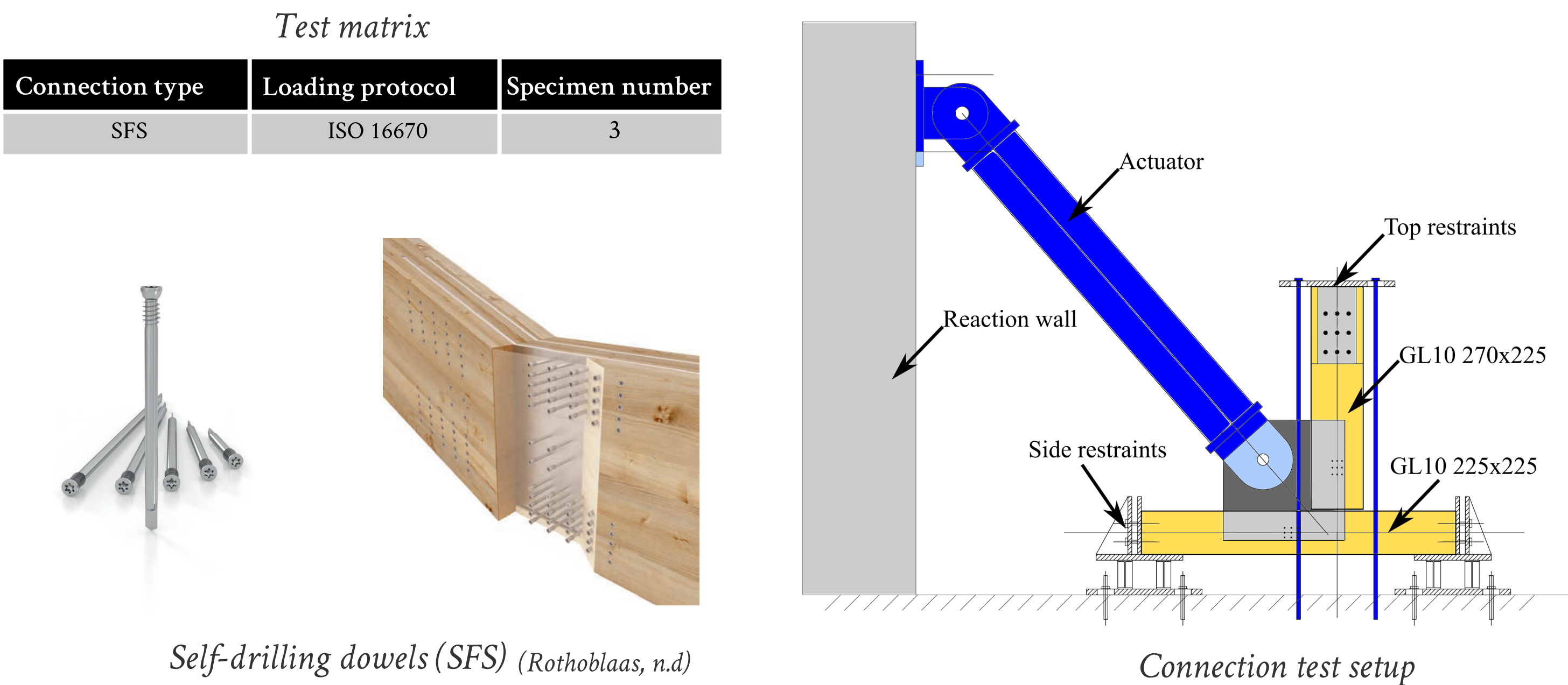


## 2 Timber-steel Connection Test

Connections in this new system are critical with special requirements listed as below:

- Higher strength because BRBs are the weakest link
- Higher stiffness since connection flexibility reduces the efficiency of BRBs

The self drilling dowels (SFS) is proposed as a good solution to connect BRBs for upper stories. The SFS can go through up to 6mm steel plate without pre-drilling. The force-displacement curves will be measured and strength and stiffness will be estimated.

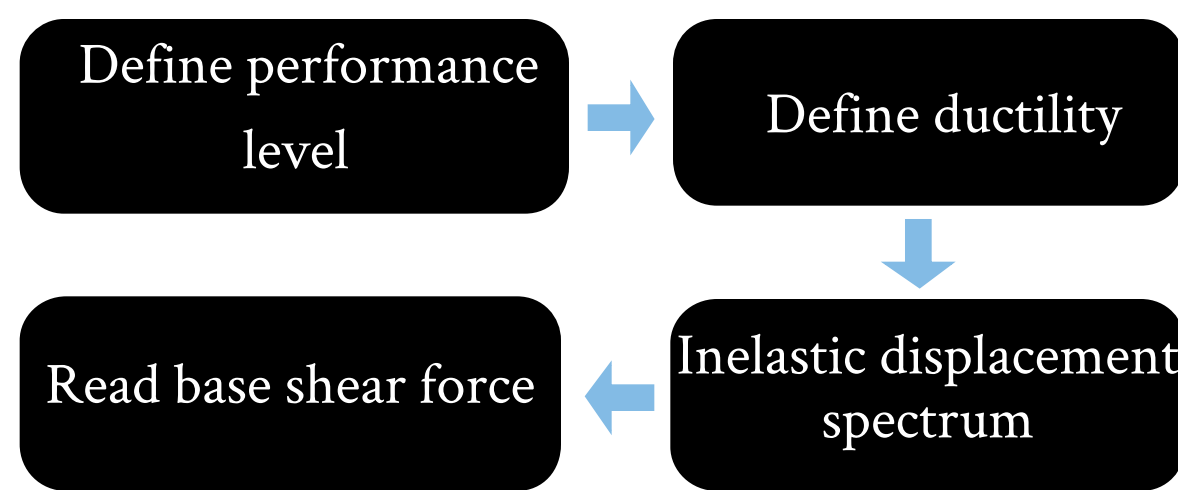
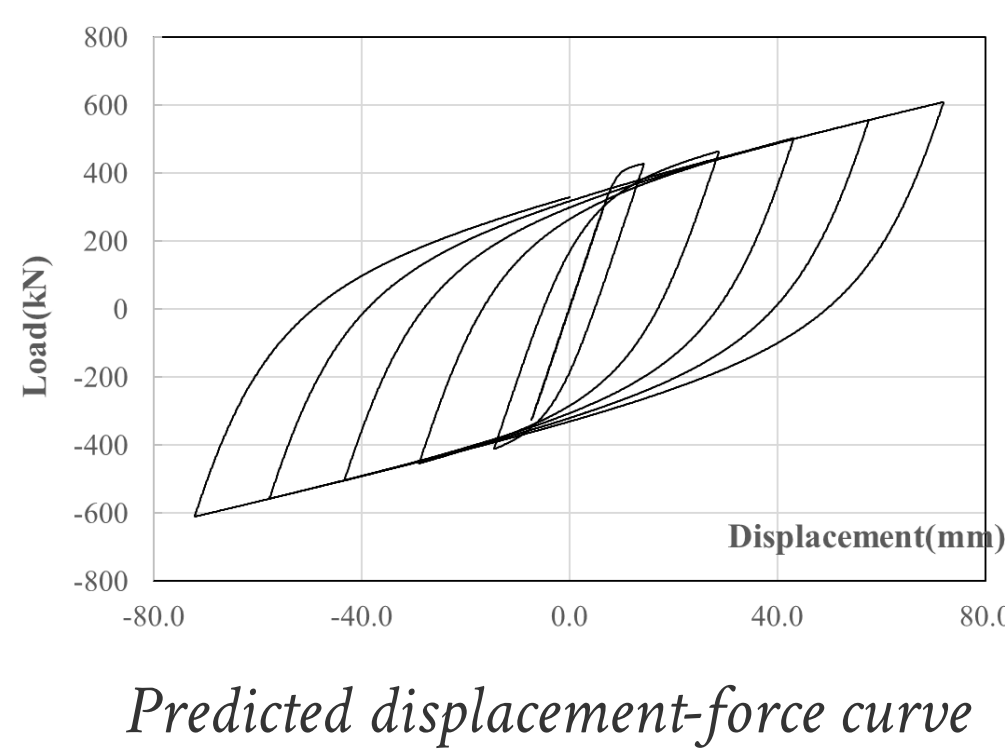
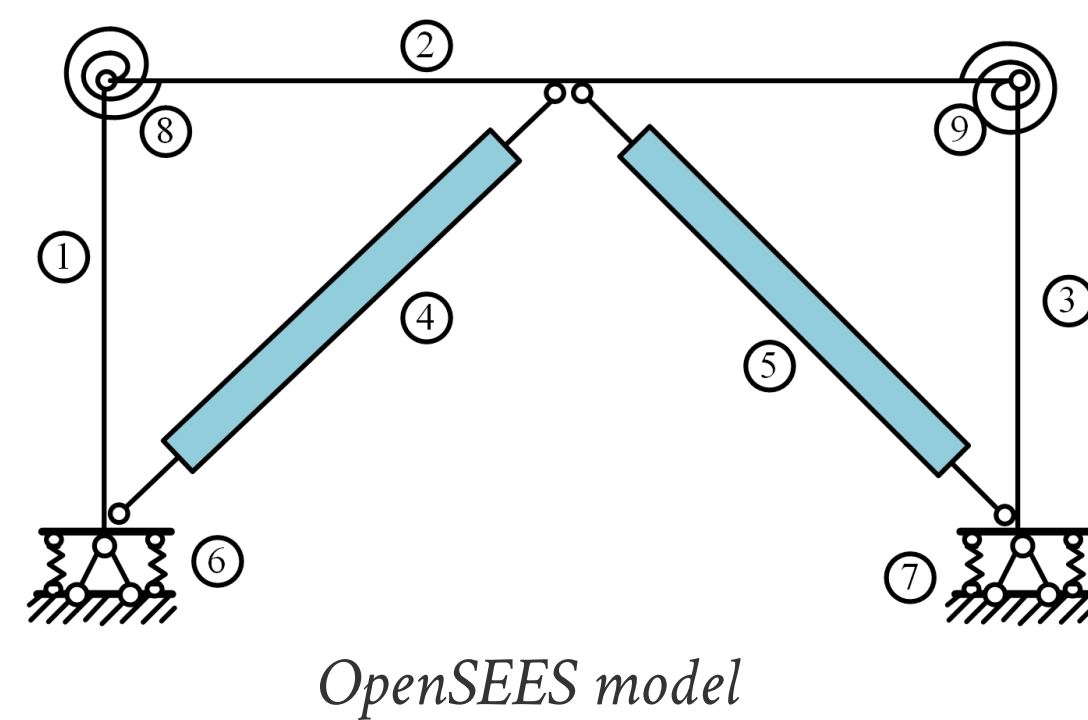


## 4 Expected Outputs

The expected results are:

- Experimental report
  - Cyclic force-displacement curves
  - Rotation measurement of beam-column joints
  - Damage records
  - Failure mechanism
- Numerical models
  - Numerical model verification based on experimental results
  - Parametric analysis
- Journal papers and conference papers
  - System test of the glulam frame with BRBs
  - Connection performance for the glulam frame with BRBs
  - Seismic performance analysis of the glulam frame with BRBs
  - Design method for heavy timber frame with BRBs
- Design method for heavy timber frames with BRBs
  - Displacement-based design method
  - Practical guidelines

- PhD thesis



Displacement-based design flowchart

## 5 Acknowledgements

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