Static In-Plane Shear Test

Material Properties of CFRTP Strand
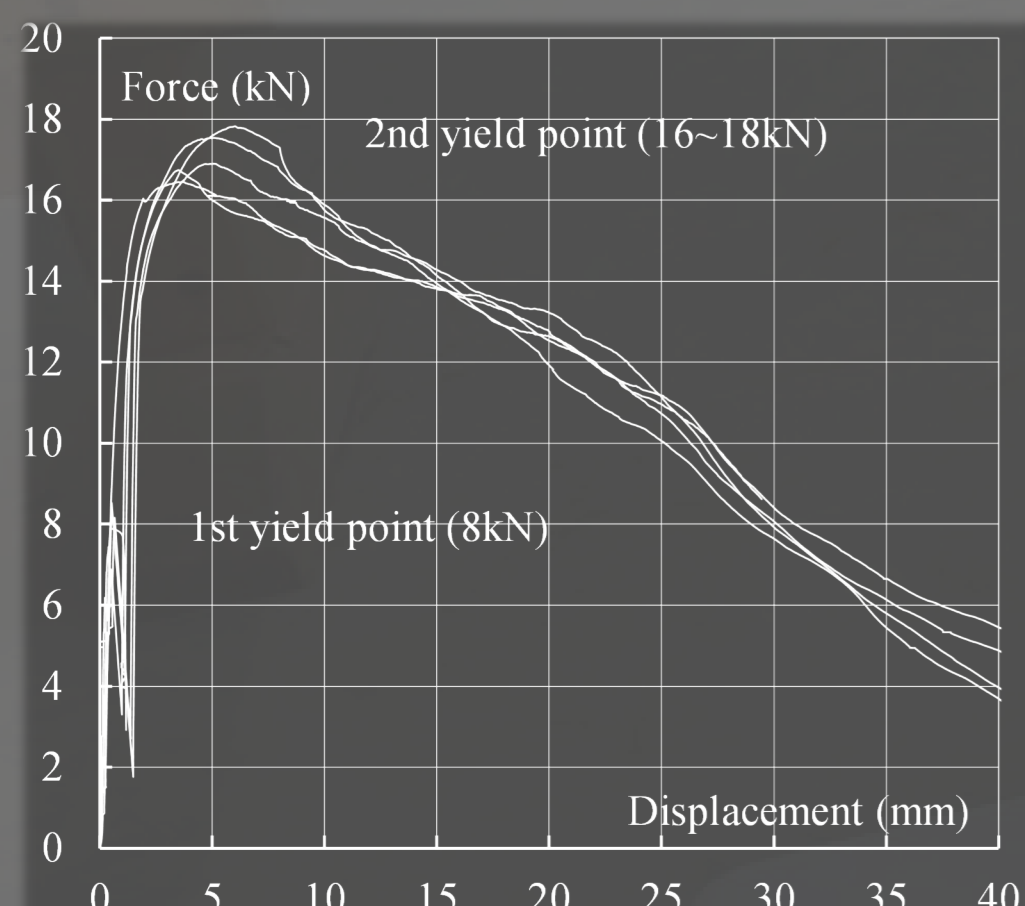
Material	Specific gravity (kg/mm^2)
CFRTP strand	0.068
Reinforcing steel (D16)	1.58

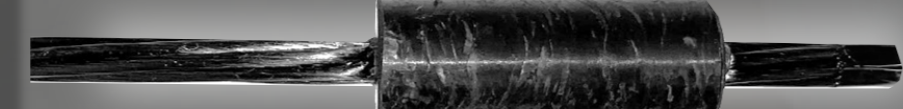| The tensile modulus	110Gpa
Cross section	24mm^2
The number of twists	7
Diameter (per 1)	6mm (2mm)

The Structure of Edge of the CFRTP Strand

①Bonding method of stainless bolts
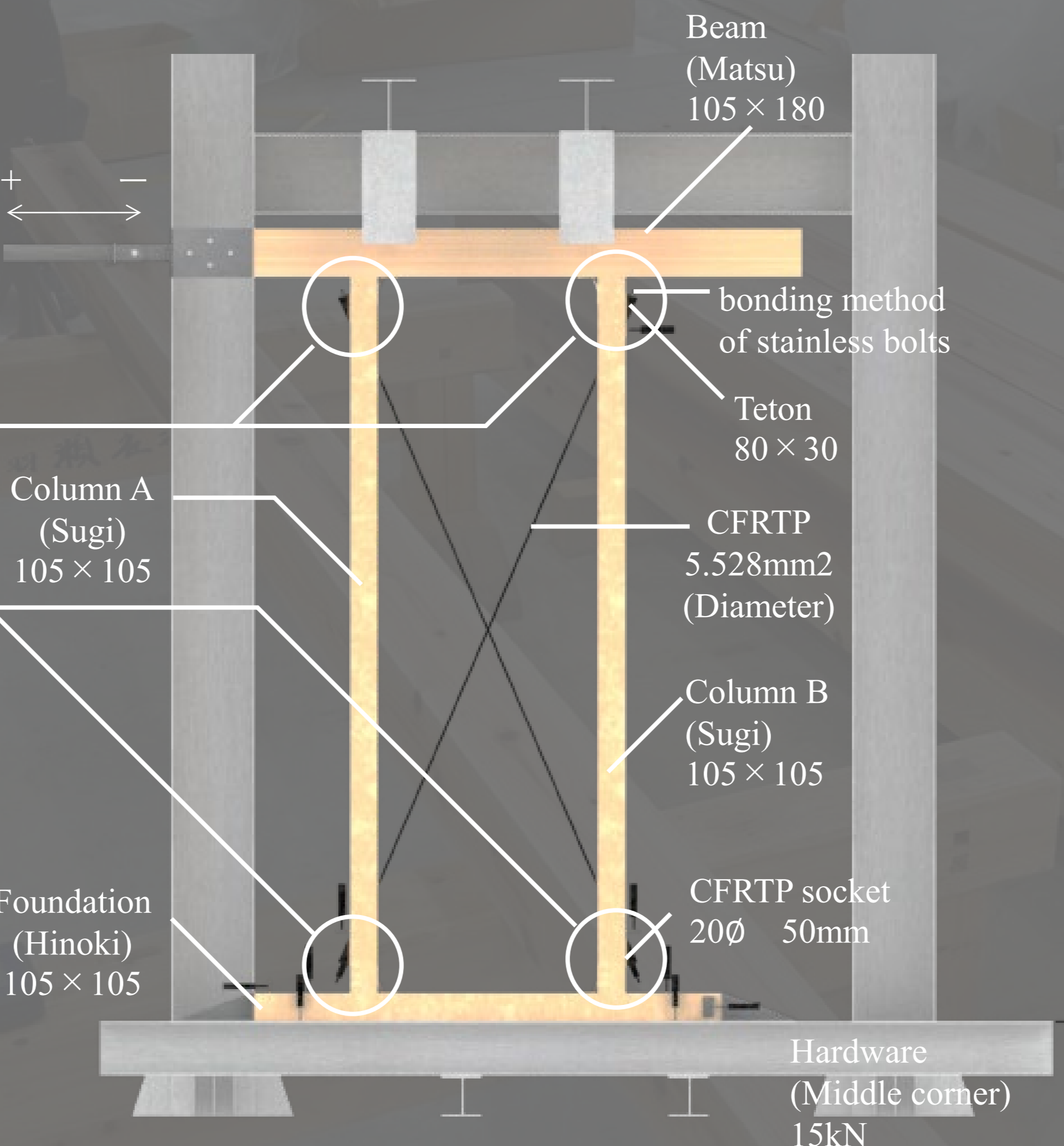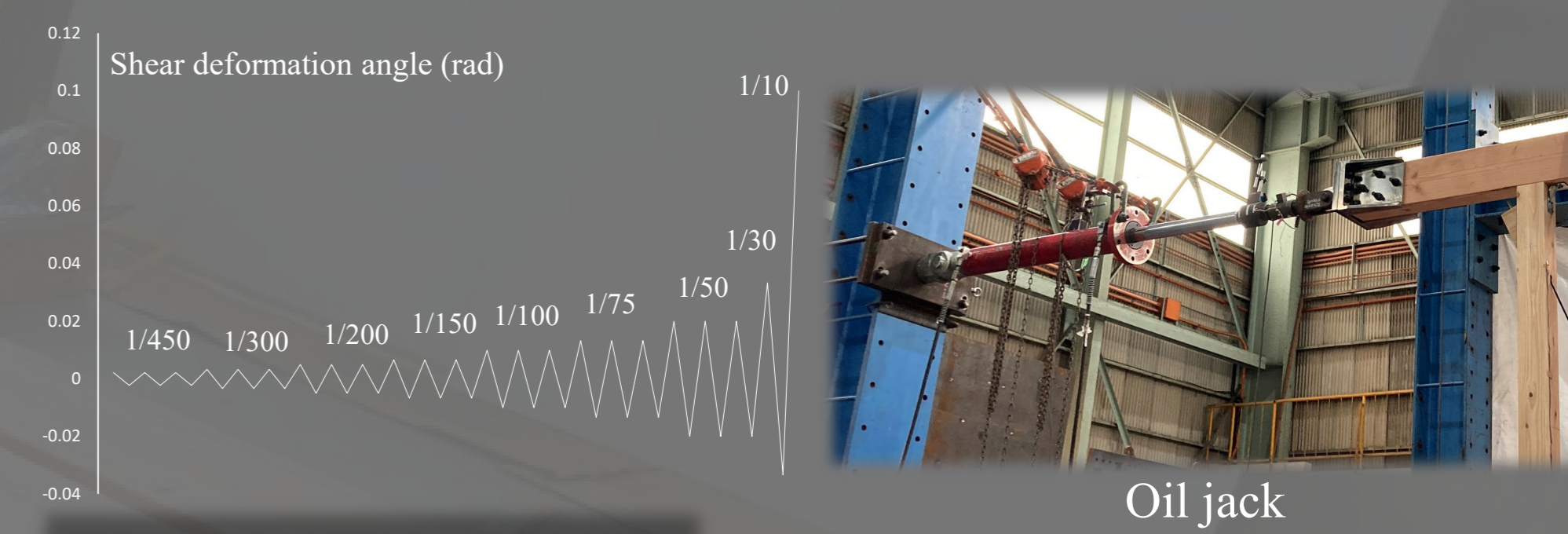
·Brittle fracture at 20kN and over

②CFRTP socket

·Ductile fracture at about 15 kN

·the guaranteed load of bonding method of stainless bolts is larger than the breaking load of the CFRTP socket
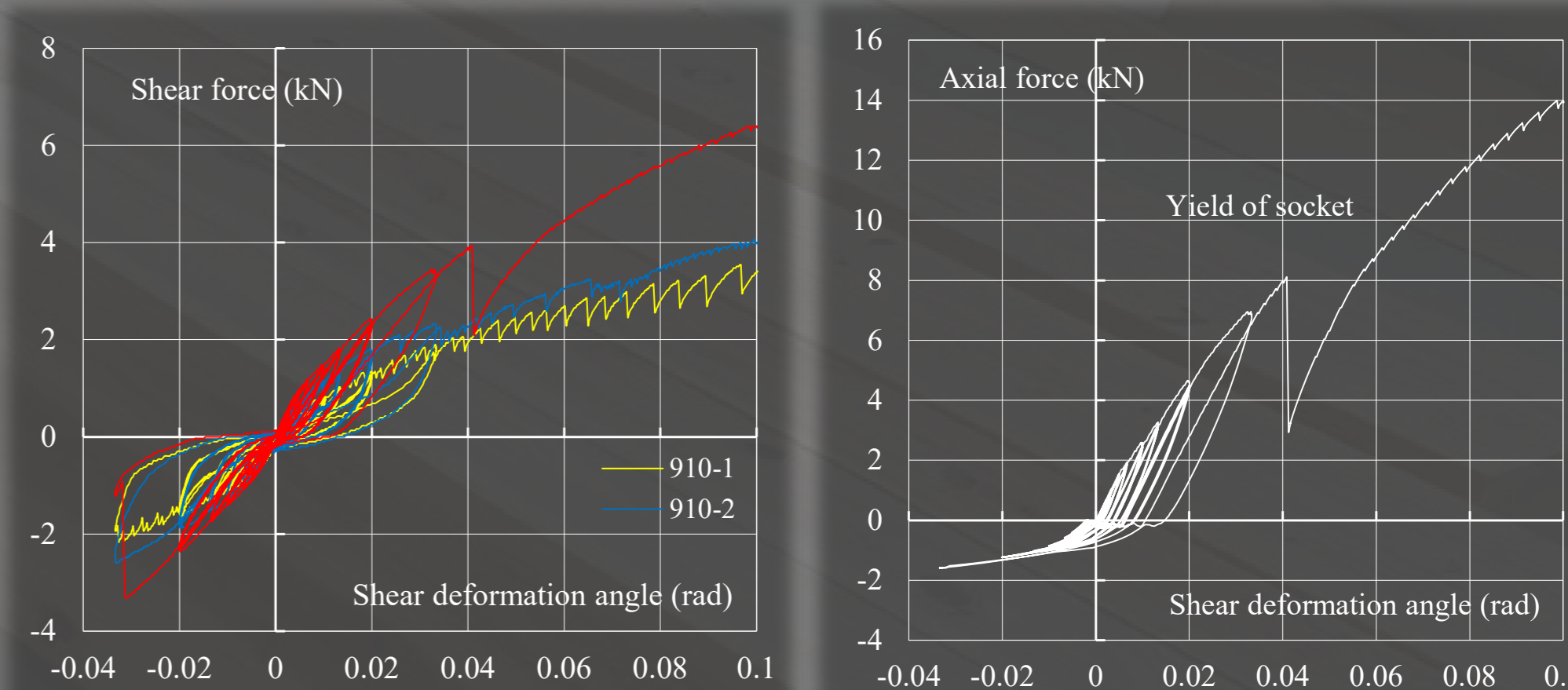
CFRTP socket
Force-Displacement Relationship

Force (kN) / Displacement (mm)
2nd yield point (16~18kN)
1st yield point (8kN)

The Outline of Specimen

Beam (Matsu) 105×180
bonding method of stainless bolts
Teton 80×30
CFRTP 5.528mm2 (Diameter)
Column A (Sugi) 105×105
Column B (Sugi) 105×105
CFRTP socket 20Ø 50mm
Foundation (Hinoki) 105×105
Hardware (Middle corner) 15kN

Fixing of Corbels and Torque value

·Fixing of corbels

The corbel was fixed with screws at 4 locations

Column
25mm 25mm
Bis(90mm)
Corbel (Oak)
CFRTP socket
40mm
40mm

·Torque value

Torque value is 2Nm when CFRTP strand is stretched tight.

Specimen	Fixing of Corbels	Torque value (Nm)
910-1	nothing	10
910-2	nothing	2
910-3	screwed	2

Repetition History

Shear deformation angle (rad)
1/450 1/300 1/200 1/150 1/100 1/75 1/50 1/30 1/10

Oil jack
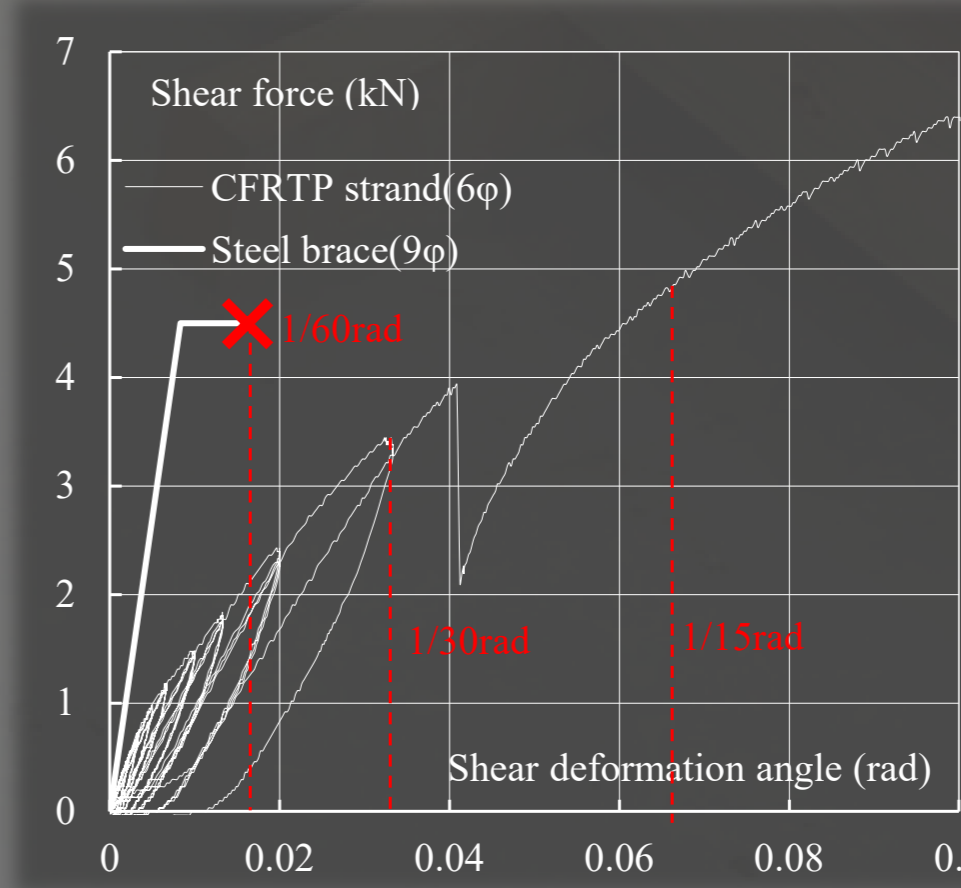
Result of the Test

Shear force (kN) / Shear deformation angle (rad)
910-1, 910-2

Shear Force-Shear Deformation Angle Relationship (910-1,2,3)

Axial force (kN) / Shear deformation angle (rad)
Yield of socket

Axial Force of CFRTP Strand-Shear Deformation Angle Relationship (910-3)

Shear force (kN) / Shear deformation angle (rad)
CFRTP strand(6φ)
Steel brace(9φ)

Shear Force-Shear Deformation Angle Relationship (CFRTP strand and Steel brace)

·CFRTP strand showed ductility capacity when shear deformation angle was 1/10rad.

· Structural performance is different depending on how to fix Corbels and torque value

·Axial force of CFRTP strand is 7.8kN at first yield and 14kN when shear deformation angle was 1/10rad

Mechanism of Shear Deformation of Specimen 910-3 when Shear Deformation Angle was 1/10rad

shear deformation

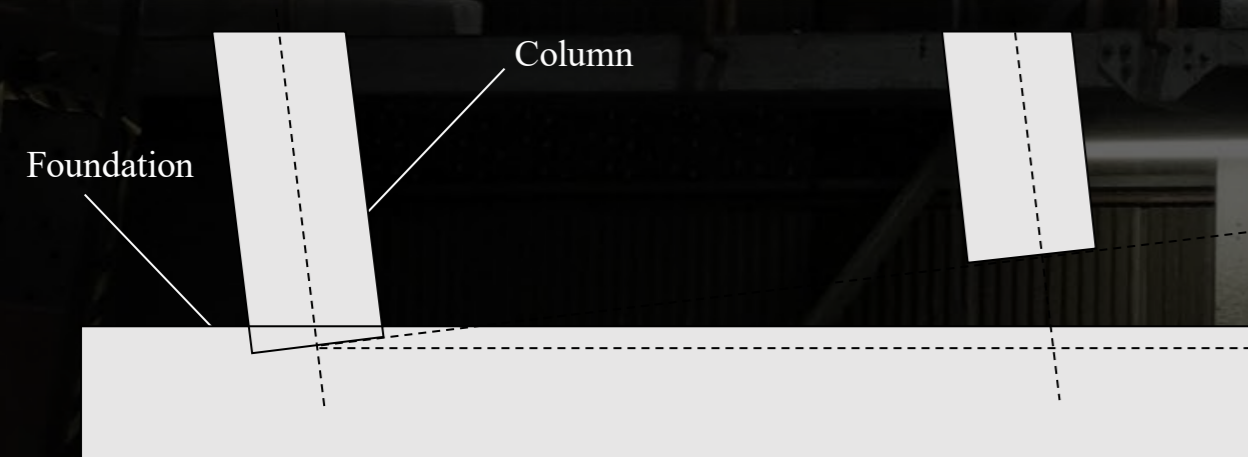## Whole Shear Deformation (84%)

※the value in ( ) is the ratio of shear displacement of each factor to actual total deformation.

Axis Deformation of CFRTP Strand (18.0%)

It was calculated by multiplying the strain measured by the strain gauge attached to the CFRTP strand by the cross-sectional area by tensile modulus of the CFRTP strand.

Rotational Deformation of the Timber (23.7%)

It was calculated by displacement meter.

Column
Foundation

Moving of the Corbel
+
Embedment of CFRTP Strand (11.4%)

It was calculated geometrically

CFRTP strand Corbel Column

Fall out CFRTP socket (30.9%)

It was measured CFRTP socket after the test.

CFRTP socket
Rod

Conclusion

In this study, we examined the adaptation of CFRTP strands to seismic retrofitting of wooden buildings.

Walls reinforced with steel braces break when the shear deformation angle is 1/60 rad. On the other hand, it was confirmed that the wall reinforced with CFRTP strands did not undergo brittle fracture until the shear deformation angle became 1/10 rad.

→ It was a useful result for seismic retrofitting of traditional wooden buildings that require deformation performance of 1/30 rad to 1/15 rad against extremely rare earthquakes.
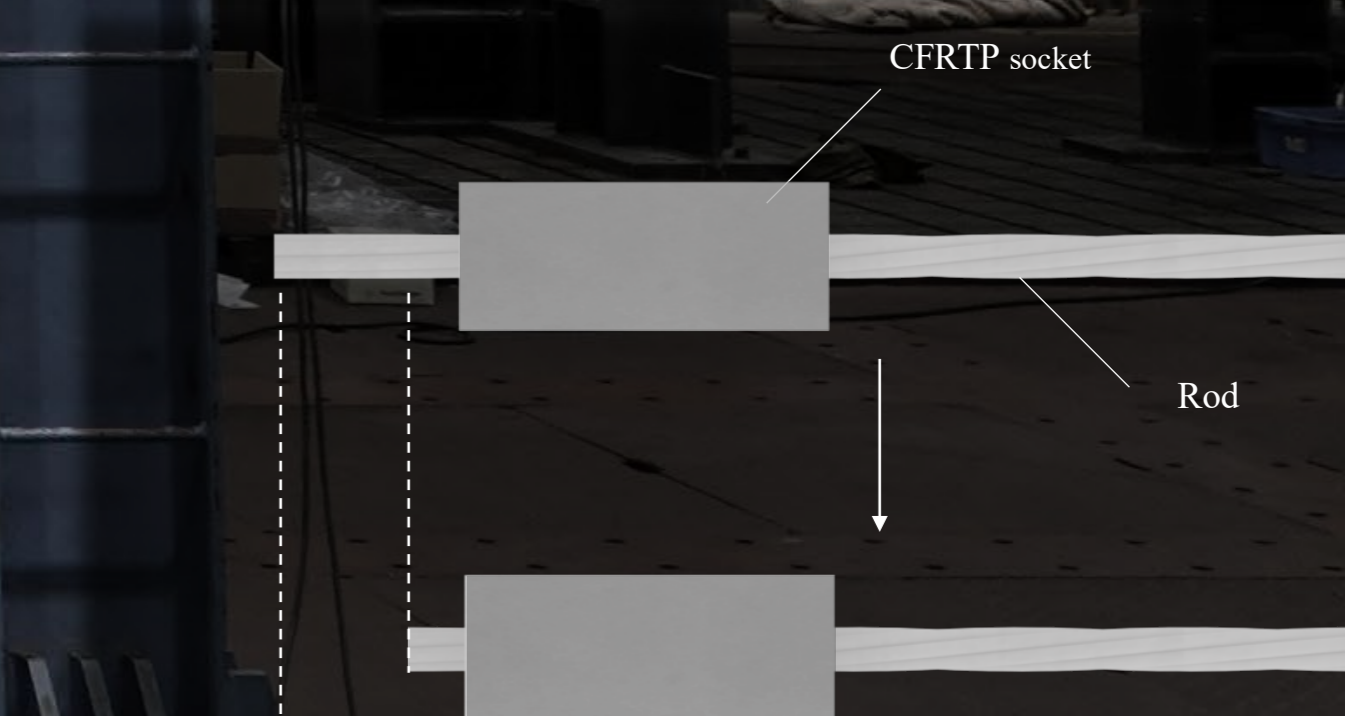
STRUCTURAL PERFORMANCE EVALUATION OF WOODEN FRAME WITH CFRTP REINFORCEMENT

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