Slip Behavior in MUTF Joints with Focus on Its Mechanism

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How Does Splice Plate Thickness Influence Slip Behavior? A FEM-Based Investigation

BACKGROUND

Huck one-sided high-strength bolts called MUTF **(Fig.1)** are widely used to repair steel structures, especially in narrow spaces or with closed sections.

MUTFs enable one-sided tightening by unique internal workings like elephant-foot bucking of the bulb sleeve.

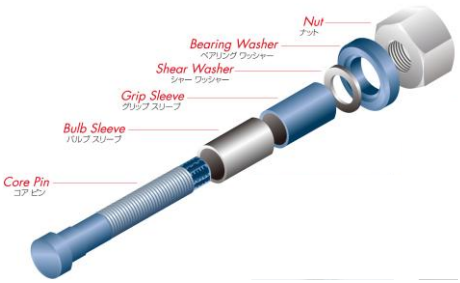

Fig. 1 Configuration of MUTF

【Issues identified in Previous Studies】

- 14% reduction in slip coefficient of the joints with MUTF20 and H-side thin plate (Surface trearment: blast clearning)
- High contact pressure around bolt holes on the H-side faying surface

→The joint behavior is investigated using FEM to improve MUTF performance

METHOD

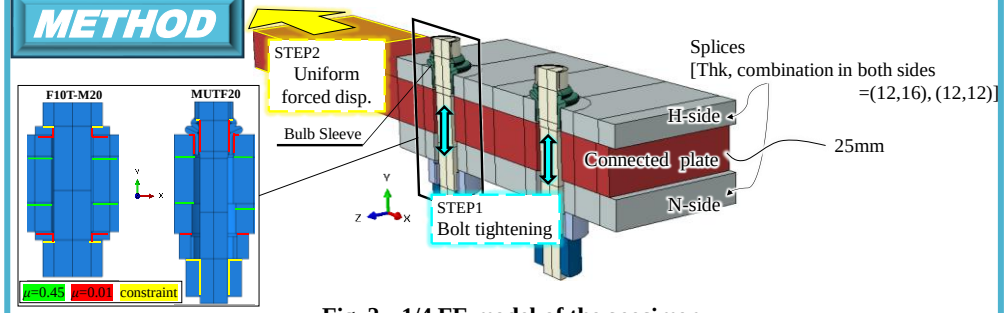

Fig. 2 1/4 FE model of the specimen

- Slip-critical Joints: the specified pretention is introduced.
- Slip load: maximum load until 0.2mm relative displacement at 10mm from the connected plate end.

【Comparison items】

- ✓ **Load vs. relative displacement**
- ✓ **Pre-tension residual ratio**
- ✓ **Plastic area of the H-side plate**

KEYWORDS

MUTF, Slip Behavior, Relative displacement

RESULTS

- In MUTF joints, a thinner H-side splice plate leads to earlier H-side relative displacement .
- Unequal splice plate thickness (sph12spn16) causes eccentric bending and earlier H-side displacement (**Fig.4**).

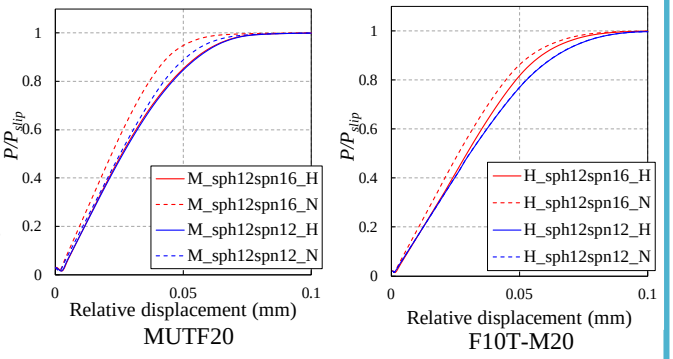

Fig. 3 Load-Relative displacement

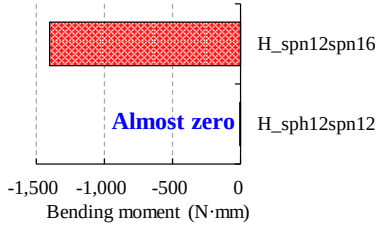

Fig. 4 Bending moment of the connected plate

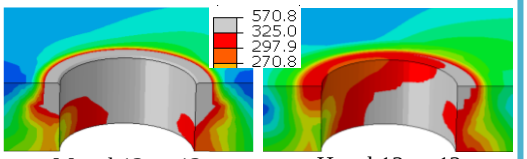

Fig. 5 Plastic state of H-side splice plate

- Despite the effect of plastic deformation (**Fig.5**), MUTF shows about 5% higher pre-tension residual ratio than F10T joint until the slippage.

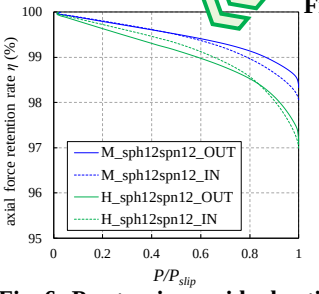

Fig. 6 Pre-tension residual ratio

- The suppression of pre-tension reduction is presumed to result from the bulb sleeve head being able to better accommodate plate thinning due to plastic deformation.

SUMMARY

- MUTF joints with H-side thinner splice are affected earlier H-side relative displacement.
- When only the H-side splice plate is reduced, the displacement difference between the H- and N-sides is further increased by the eccentric bending moment.
- Despite pronounced plastic deformation from localized contact pressure, MUTF maintains a high pre-tension residual ratio until the slippage.