Study on Limit Strength of Hybrid Joint with Friction and Bearing Type Hybrid Connection

Aim and scopes

Goal:

To investigate and develop bearing and friction type hybrid connections (BFHC) in steel bridge structures.

Research Issues:

- Load transfer mechanisms in BFHC
- Optimal fastener arrangement methods
- Deformation characteristics
- Definition of limit strength

Research Issues:

Part-I: For aging riveted joint

Proposed a replacement methods by use HSB, and strength calculate equation.

Ch. 3: FE Analysis of Rivet-HSB hybrid Connection

- Clarify load transfer mechanism in hybrid connections
- Investigate load redistribution during rivet replacement
- Determine optimal fastener arrangement
- Establish bearing capacity calculation method

Ch. 4: Experiment of Rivet-HSB hybrid Connection

- Validate FE analysis results
- Verify load transfer predictions
- Evaluate slip coefficient of aged joints
- Confirm hybrid connection performance

Part-II: For newly bridge construction

Investigate the limit state, proposed the properly bolt arrangement methods and strength calculate equation

Ch. 5: FE Analysis of IFB-HSB hybrid Connection

- Investigate load transfer mechanism of IFB-HSB hybrid connections
- Optimize bolt arrangements and joint length
- Establish design criteria for hybrid connections
- Propose strength evaluation method

Ch. 6: Experiment of IFB-HSB hybrid Connection

- Validate IFB-HSB hybrid connection performance
- Investigate slip resistance and deformation
- Study load transfer mechanisms
- Evaluate serviceability limit states

Ch. 7: Serviceability Limit states of Hybrid Connection

- Identified three-stage load transfer process
- Quantified deformation characteristics
- Established reduction factors for strength calculation

Ch. 8: Conclusions and Future research

Key Findings:

☑ This study developed and validated a novel hybrid connection system (Rivet-HSB and IFB-HSB), establishing its three-stage load transfer mechanism and limit state through comprehensive experimental and numerical analyses.

☑ A practical strength calculation method was proposed with specific reduction factors, demonstrating the hybrid system's capability to enhance joint performance while enabling shorter joint lengths.