

Structural Response of Bridge Structures

Proof Loading Tests

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Retrofit Engineering for Urban Infrastructures, Lecture #3

Proof Loading Tests

Objective

Verification of Load-Carrying Capacities of Existing Bridges, especially after the Change of Design Loads

Method

Loading Tests on Actual Bridges using Heavy Trucks with Already-Known Weights



Example of Proof Loading Tests Target Bridges

Houkikawa Bridge

4 Span Continuous Non-Composite Steel Girder with RC Deck (1973)
2 Lanes, Deck Thickness: 220mm, Span: 47.6m
Design Live Load: **TL-20** (Old Specification)



→ B-Live Load (Present Design)

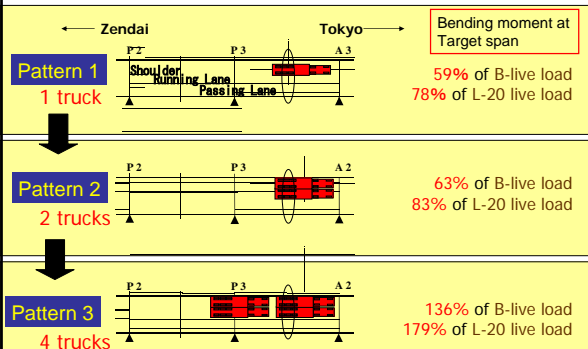
Sakabe Bridge

3 Span Continuous Non-Composite Steel Girder with RC Deck (1968)
2 Lanes, Deck Thickness: 170mm, Span: 25.2m
Design Live Load: **TL-20** (Old Specification)



→ B-Live Load (Present Design)

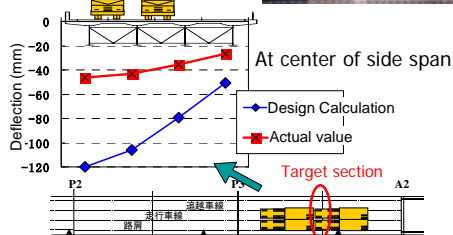
Loading Patterns



Test Results –Deflection–

Houkikawa bridge

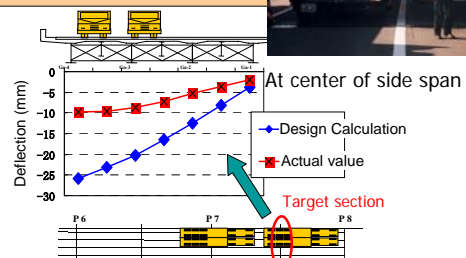
4 trucks (69 tons)
on the center of a side span
135% of B-live load
178% of L-20 live load



Test Results –Deflection–

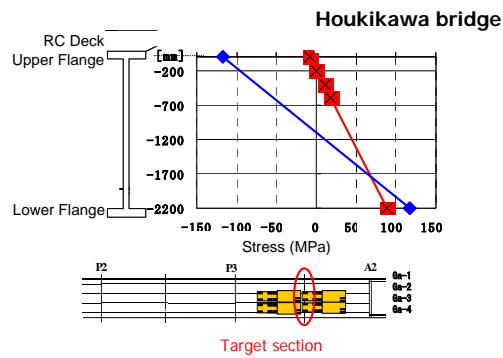
Sakabe bridge

4 trucks (39 tons)
on the center of a side span
172% of B-live load
181% of L-20 live load



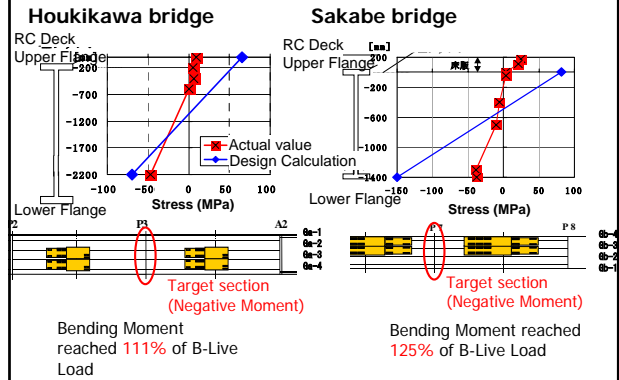
Test Results –Stress-

Stress Distribution of A Main Girder at center of side span



Test Results –Stress-

Stress Distribution of A Main Girder at an intermediate support



Evaluation of Load-Carrying Capacity

Safety condition

$$\phi \cdot \sigma_r \geq \gamma_D \cdot \sigma_D + \gamma_L \cdot \sigma_L$$

σ_r = Stress of limit state (σ_y or σ_{cr})

$\sigma_{D, L}$ = Stress due to dead load and live load

$\gamma_{D, L}$ = Factor for dead load and live load

($\gamma_D=1.2$ $\gamma_L=1.7$)

ϕ = resistance factor = 1.0