

# Durability checks

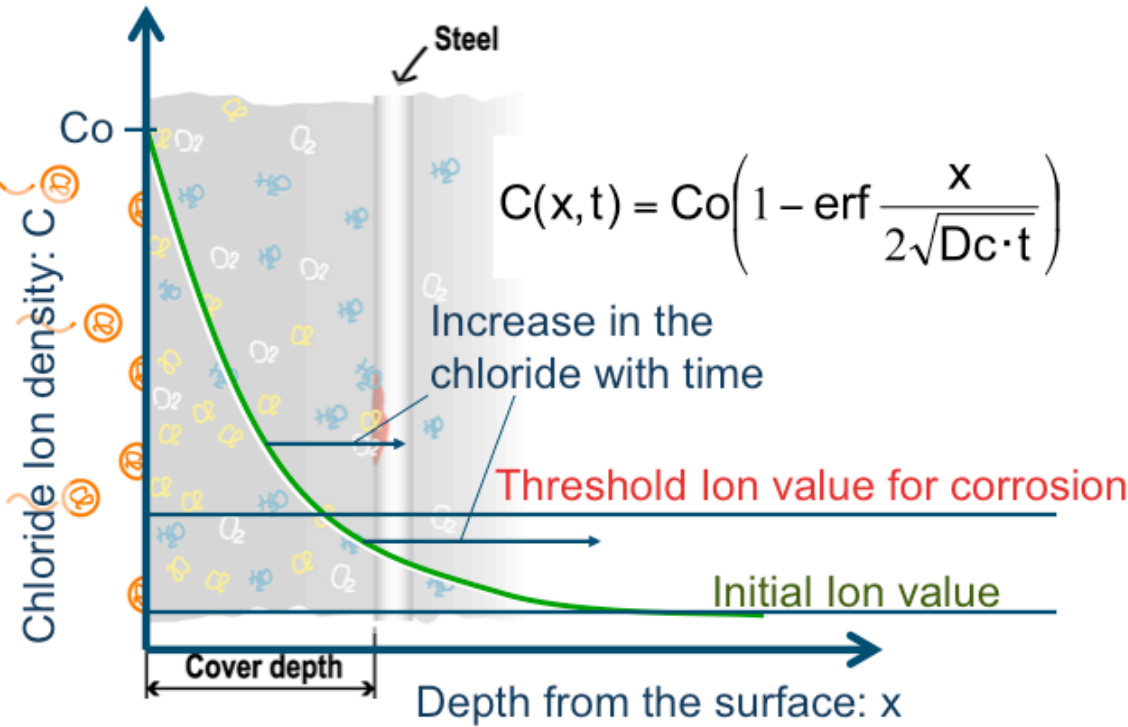
Following checks were introduced in 2002 in addition to earlier structural details.

- Fatigue design for steel members
- Concrete cover depth design for structures near the shoreline
- Deck slab design (fatigue design)
- Water-proofing for deck



No specific design method or safety factors in terms of redundancy

# Theory for the chloride ingress time-evolution and nation-wide observation of flying chloride reached to the surface of bridges

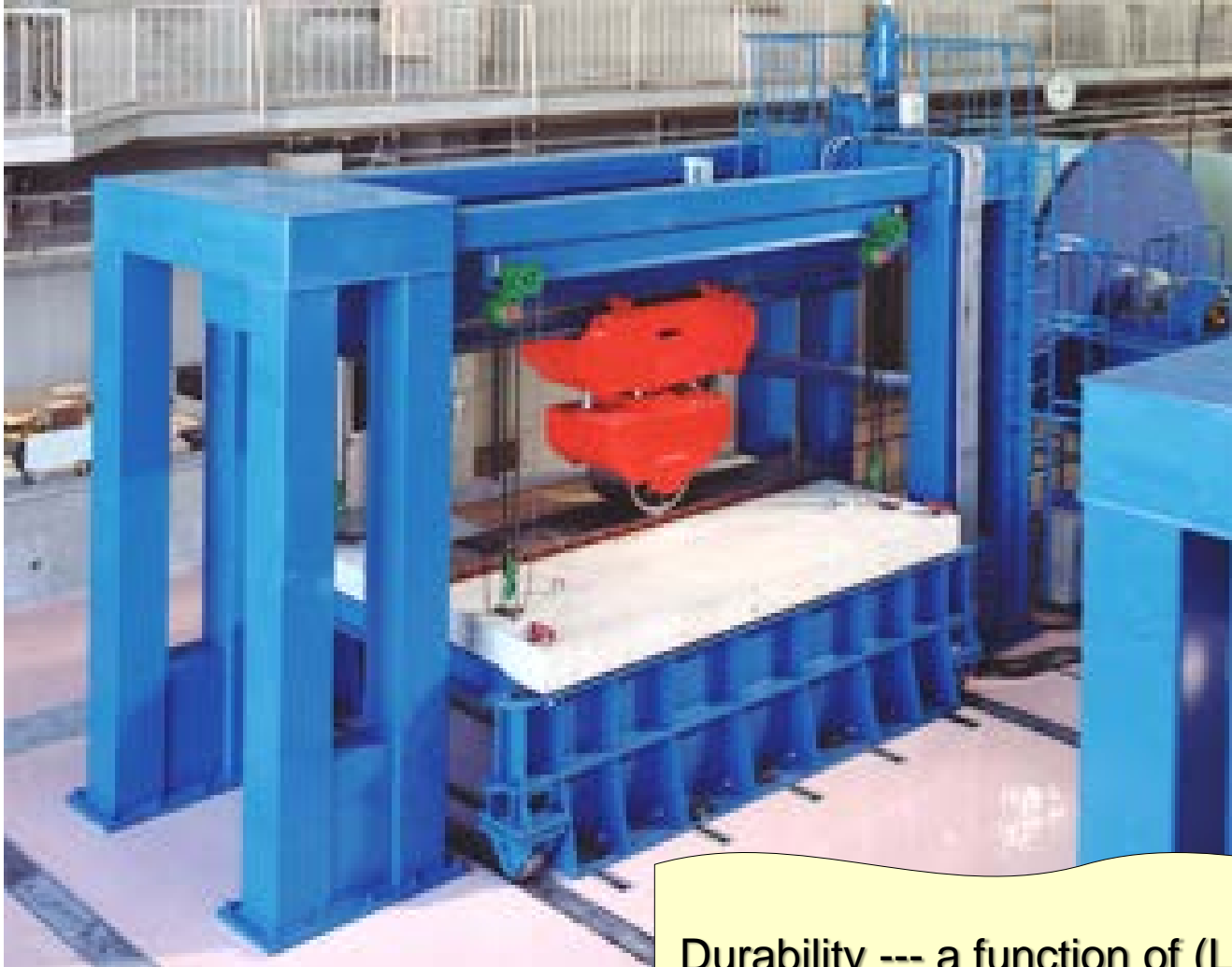


Minimum cover depths to prevent reinforcement from corrosion over 100 years for each regions

e.g Minimum cover concrete depths for cast-in-place prestressed concrete superstructures

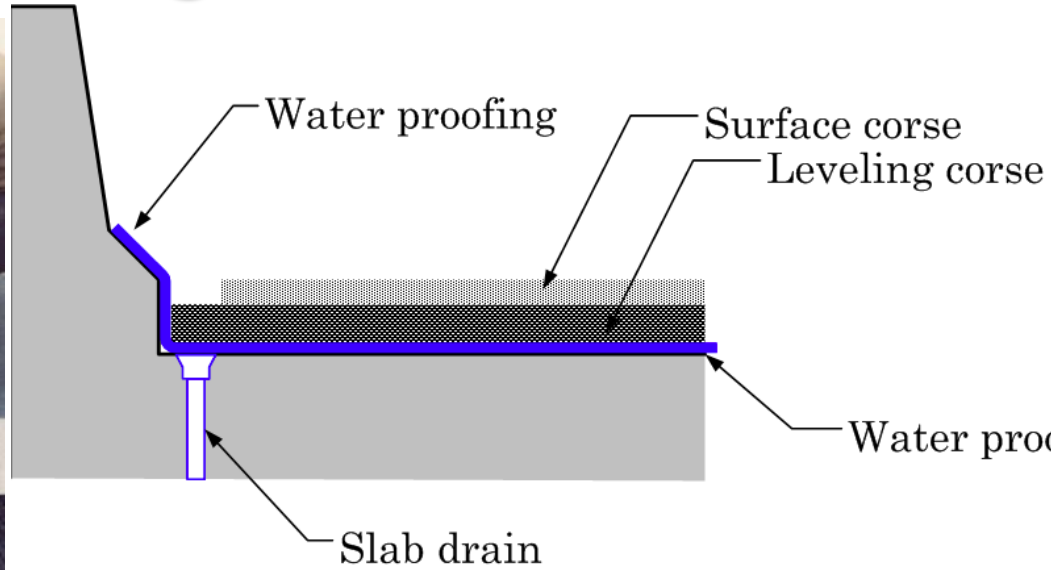
Regional category	Cover Concrete Depth (mm)
S	$70 + \alpha$
A	70
B	50
C	35

# Fatigue tests using a moving wheel loading machine

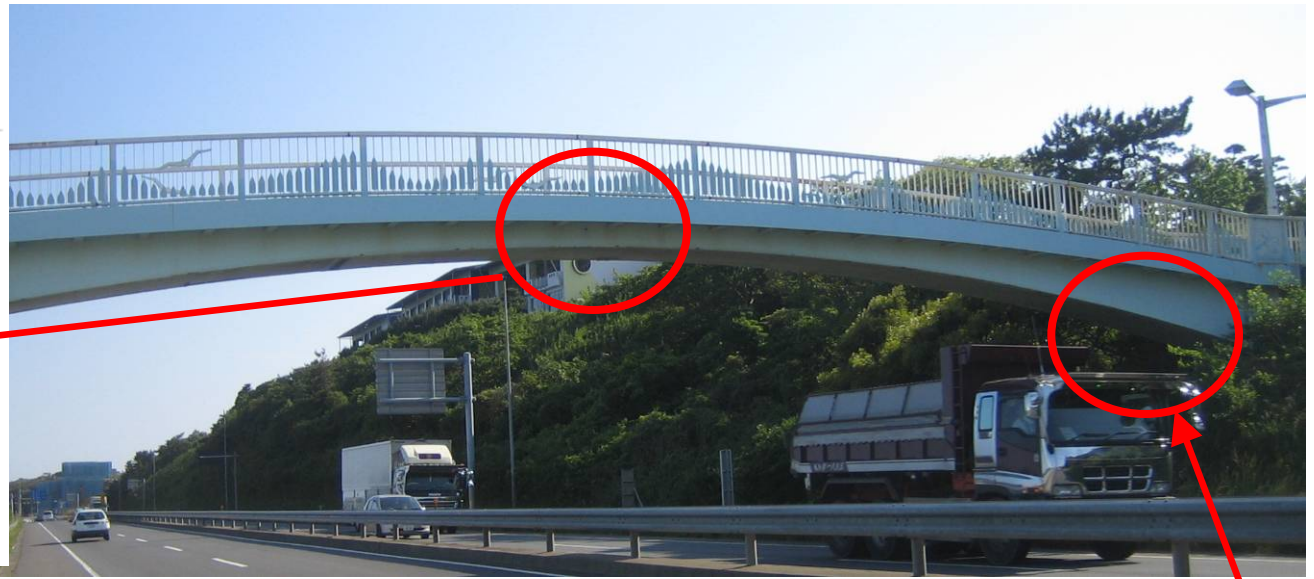
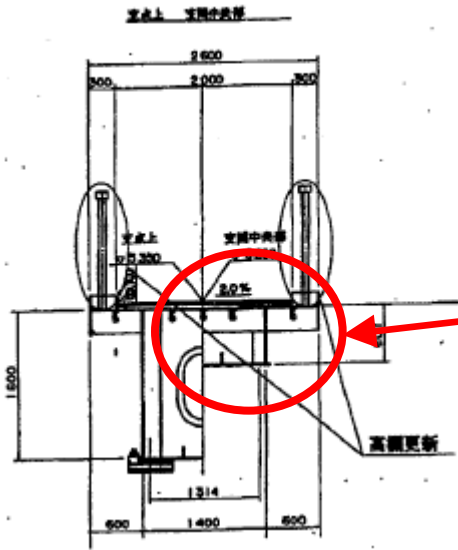


Durability --- a function of (Load)<sup>12</sup>

# Water proofing for decks



# Considerations requested in design for maintainability



**Hole for inspection  
(No manhole on the other side)**

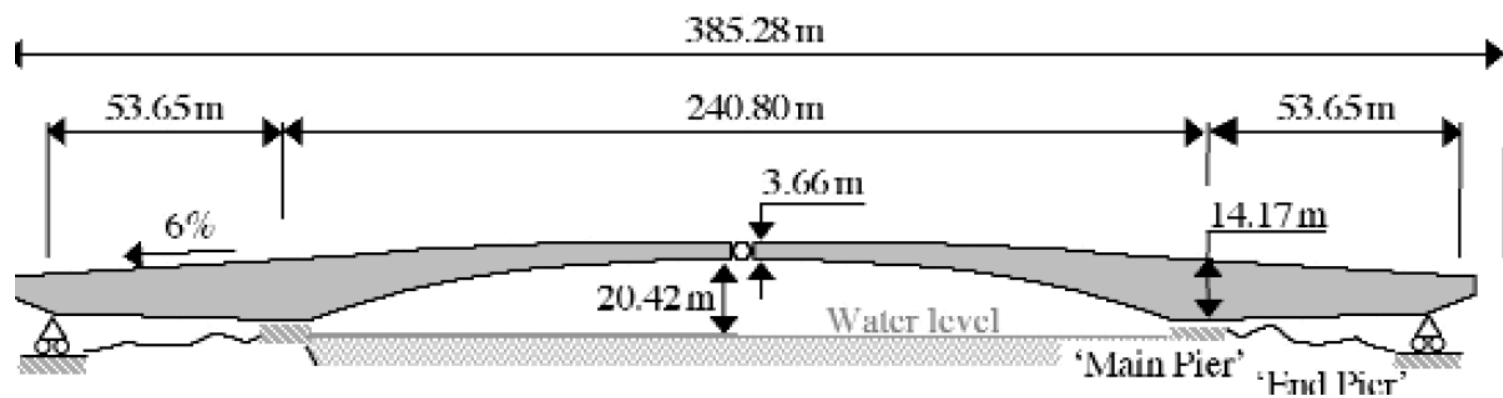


# Need to design for maintainability in initial design

Collapse of Koror–Babelthuap, Palau, in 1996 (Burgoyne & Scantlebury, The Structural Engineer – 6 June 2006)

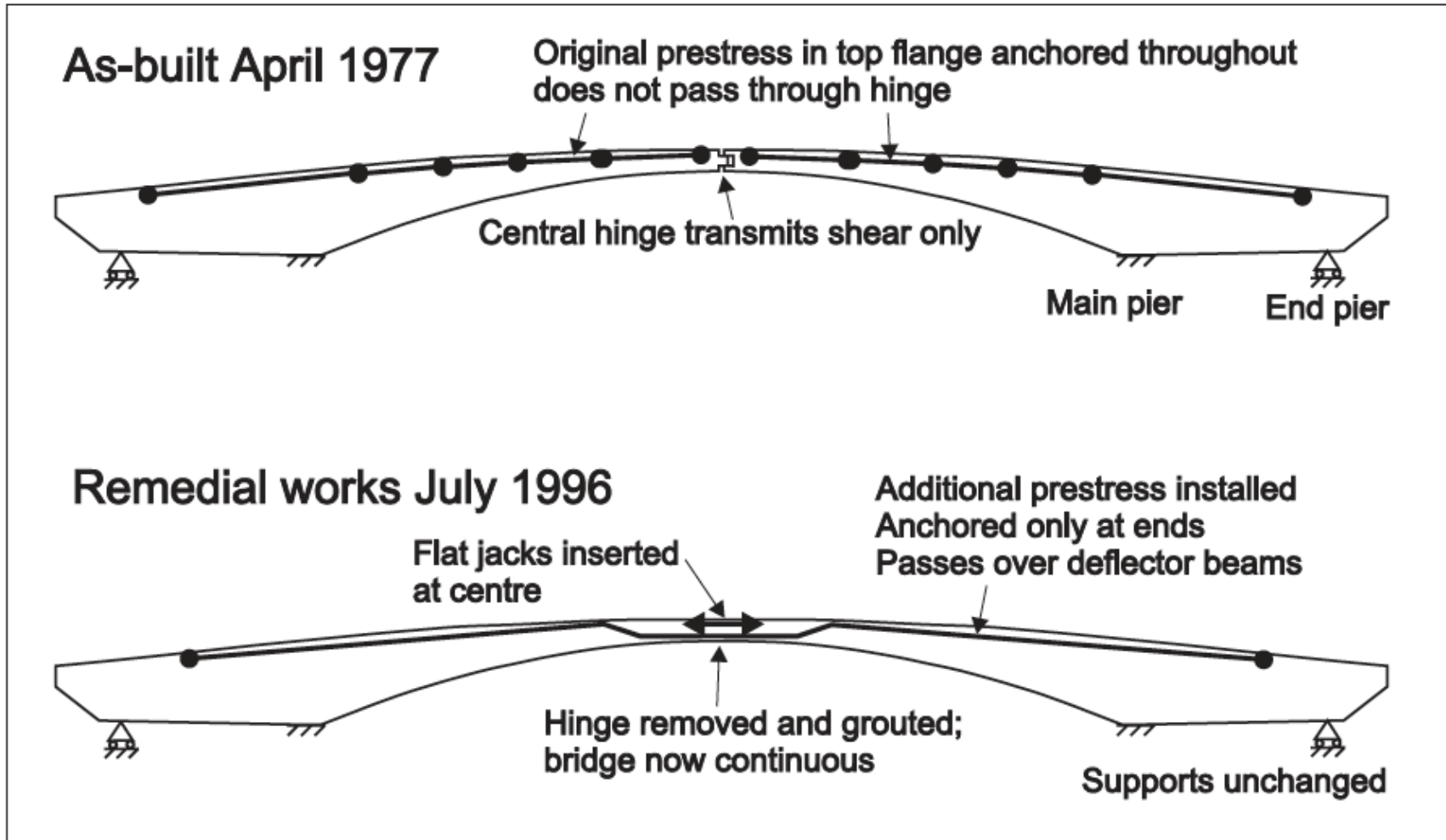
Built in 1977





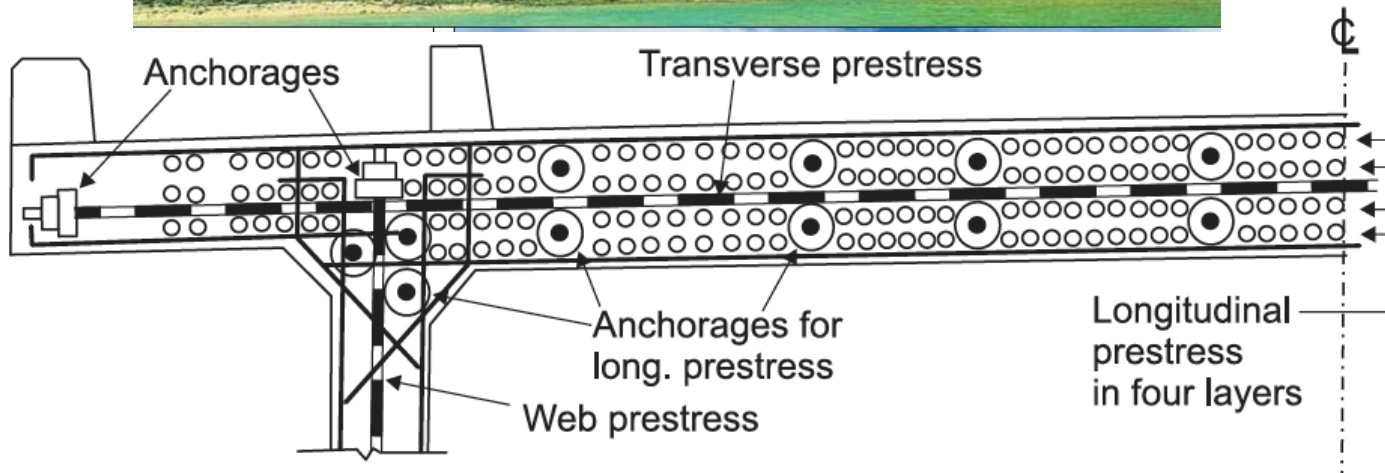


# Remedial work in 1996.



6a

## 2-year after the retrofit



PC-cables were originally congested at the top flange

Little reinforcement surrounding PC cable anchorages

Concrete quality was not good → Larger creep factors.

Concrete deck material was partially removed prior to resurfacing.

**→ Localized stress and crack could appear at the top flange.**

# Japan-Palau Friendship Bridge, 2002 (Aided by Japan)

