Breathing Life into Hardwood Bridge Trusses: A Marriage of Steel and Timber

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Setting

- Three 80 year old single lane Howe Truss bridges
- Akatarawa Road: a strategically important route
Setting

- Trusses analysed for a Class 1 load (85% HN)
- Critical elements identified from careful field inspection.
- Structural steel additions designed and built
- Each bridge remained open during repairs.
Analysis

• Simplified manual analysis using 85%HN loading
Design

• Main challenge was nodes (joints)
• Some timber ends were seriously decayed
• Objective was to span across ends with steel
Design

• In the picture below, the thrust block is split
• End diagonal post seriously decayed at base,
  – 80% loss of end section
• Steel brace repair reacts thrust back into bottom chord
Design

- Blocks reacting hanger load are split
- Unable to be replaced without unloading hangers
- Instead, strapped to provide hoop strength

Light strapping was also added to confine split struts
Construction

• Scaffold erected alongside carriageway
• Structure waterblasted to reveal decay
• Careful inspection
• Limited ability to see transoms or deck soffits, but abseiling provided some viewpoint
• Carpenter set out plywood templates
• These were used for fabrication of steelwork
• Steelwork done locally and fabricator executed welding on site (to hangers)
• High level of interaction between designer, carpenter and steel fabricator
Placing Elements

Site measurements for fitting were critical
Placing Elements

- Fitting two segments into position
- Then site welded to hanger
Placing Elements

Coring 50 mm holes for ring connector
Issues

- An efficient solution has been designed and constructed, but some issues remain:
  - Tension chords
    - Tension splices in chords are a critical element
    - Only outside faces could be inspected
    - Some evidence of decay commencing on one
    - No room to install strengthening
    - Propose that monitoring, including extension measurement, be implemented
- Because of uncertainty that all weak spots have been identified, and with the expectation that decay will continue, recommended that replacement commence in five years.