Condition Assessment of Iowa Timber Bridges Using Advanced Inspection Tools

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Outline

- Introduction – Iowa Timber Bridges
- Bridge Cluster Overview
- Case Study 1: Blackhawk 5
- Case Study 2: Clarke 1
- Wrap-up
Introduction

Iowa

- ~2,454 Timber Bridges
  - 189 timber slab
    - Majority built after 1990
  - 2265 timber girder
    - Majority built between 1940-1990
Bridge Clusters

- Public road
- Access (safety, ‘arms length’ inspection, etc)
- Similar design type, age
- Location
Iowa Clusters

- Bremer County
- Blackhawk County
- Clarke County
Iowa Clusters Cont.

- **Bremer County**
  - Bremer 1
    - 1996
    - 21ft
  - Bremer 2
    - 1997
    - 21ft
  - Bremer 3
    - 1994
    - 22ft
  - Bremer 4
    - 1994
    - 22ft
  - Bremer 5
    - 1997
    - 27ft

*All Girder Bridges*
Iowa Clusters Cont.

- Blackhawk County
  - Blackhawk 1
    - 1983
    - 19ft
  - Blackhawk 2
    - 1985
    - 18ft
  - Blackhawk 3
    - 1985
    - 17ft
  - Blackhawk 4
    - 1985
    - 18ft
  - Blackhawk 5
    - 1985
    - 18ft

*All Girder Bridges*
Iowa Clusters Cont.

- Clarke County
  - Clarke 1
    - 1985
    - 30ft
  - Clarke 2
    - 1983
    - 30ft
  - Clarke 3
    - 1983
    - 30ft
  - Clarke 4
    - 1983
    - 30ft
  - Clarke 5
    - 1982
    - 30ft

*All Deck Bridges*
Decay Hazard Zones

US
Case Study 1: Blackhawk 5

- FHWA 74731
- Timber girder; transverse plank deck
- Single span, 18ft
- 1985
- Steel guardrail
- Timber abutments
- Gravel wearing surface
Blackhawk 5
Blackhawk 5
Blackhawk 5
Blackhawk 5
Blackhawk 5
Blackhawk 5

Girders
• No noticeable rotation at bearings
• Small (1/8-1/4in.) settlement of several girder ends under load
• Numerous bottom ‘flanges’ splintered

Deck
• Moisture staining
• 1/8-1/2in. gaps btw planks
Blackhawk 5

Girder G19

- Plywood shim on top
- Large splinter
  - Bottom flange
  - \(~6\text{ft long, from near EOB to midspan}\)
  - Located ~\(\frac{1}{3}d\) from bottom
Blackhawk 5

- Girder G25
  - Deterioration
    - Start: 2ft from BOB
    - End: ~2ft E. of midspan
  - High moisture content, low 20’s, very soft
  - Stress Wave
  - Resistograph
Blackhawk 5

Stress Wave Readings

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Blackhawk 5

Resistograph Readings

Resistograph

Readings

29
Blackhawk 5

Resistograph Readings

Amplitude [%]

Drilling depth [cm]
Blackhawk 5

Resistograph Readings
Blackhawk 5

Resistograph Readings

Resistograph ID

BOB

EOB

29 31 30 32 33 34 35 36 37

G25

Abut. Cap

C-channel

29

34

37
Blackhawk 5

➢ Other ‘Findings’...
Case Study 2: Clarke 1

- FHWA 12821
- Longitudinal Deck
- Single span, 30ft
- 1985
- Timber guardrail
- Timber abutments
- Asphalt Wearing Surface
Clarke 1
Clarke 1

Midspan Transverse Stiffener Beam
Clarke 1

Moisture Content Readings

Mid to Upper Teens
Timber Slab Bridges

- Three main issues found:
  1) Condition, maintenance, of wearing surface
  2) Adjacent deck panel connection detail
  3) Abutment backwall movement
Timber Slab Bridges

1) Wearing Surface
Timber Slab Bridges

- Panel "A"
- Panel "B"

4" nominal laminations

Lapped joint is formed by spiking laminations that are 1/2 the deck thickness to each panel and connecting them vertically with spikes.
Timber Slab Bridges
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Timber Slab Bridges
Thanks for your Attention