2012 Hagwilget Suspension Bridge Refurbishment

New Hazelton, BC, Canada

By: Jeff Mellor, M. Eng
Hagwilget Suspension Bridge

- Opened to traffic 1932.
- Single Lane, grating deck.
- 640' long, 460' between towers.
- 250' above the Bulkley River.
Works Location & Constraints

- Town split by the Bulkley River & crossed by the Hagwilget Bridge.
- Regional hospital on far side.
- 5-7 hour detour if bridge closed.
- Bridge closures limited to 15 minutes.
- Significant commercial traffic including double logging trucks.

New Hazelton, BC. Area population 6,000.
Refurbishment Works Summary

- **Works Done with Live Traffic:**
  - Replace all 31 Needle Beams supporting truss.
  - Unwrap, wedge, inspect and re-wrap Main Cable at (10) locations.

- **Works Done with 15 Minute Closures:**
  - Replace all Upper Plan Gussets.

- **Two Night Closures Used:**
  - Remove & replace (6) hangers to check capacity by destructive testing.

- **Other Works:**
  - Replace all sway bracing.
  - Replace all upper plan bracing.
  - Replace cap beams at Bents 8, 9
Needle Beams & Upper Gussets

1. All Needle Beams

2. All Upper Plan Gussets

< 30" to fit in hanger clamp, jack, temporary needle beam, & jacking deflections

29.9"
Why Replace the Needle Beams?

- Significant section loss to flanges.
- Significant web section loss with through holes.
- D/C estimated 1.15-1.39 in worst areas.
Buckling Analysis

Live Load Capacity Factor vs. Section Loss

- **CASE I**
- **CASE II**
- **CASE III**
- **CASE IV**

*Reduction in thickness of both flanges and web*
Buckling Analysis
Needle Beam Replacement – Temporary Works
Needle Beams: Preliminary Works

- Measuring eyerod extension.
- Drilling vertical gussets for temporary needle beam connection.
Temporary Works Installation

- < 30" between highest spelter socket top & lowest point of main cable hanger clamp at midspan.

- Temporary Needle Beam limited to 7" at spelters & jack fully inset into hanger clamp.

- Temporary Needle Beam halves spaced to allow spelter tops to come up in between.
Temporary Works Complete
Lowering New Needle Beams Over the Side
Just Clearing...

- Bearing bar chamfered to clear spelters.
- Spelters up in between the 7" temporary needle beams.
- Varying hanger skew eccentrically positions spelters to centerline of the temporary needle beam.
- Box diaphragms between temporary needle beams visible.
Needle Beam Exchange
Old Needle Beam Removal
Main Cable Enclosures

- 130' inspected out of 1540' of main cable
  - 4 Anchorages
  - 4 Tower Saddles
  - 2 Midspan
Main Cable Inspection

- Un-galvanized 19 x 1-1/2" wire rope.
- Packed in raw linseed oil & graphite.
- Generally, minimal corrosion & pitting.
- Tower saddles showed most severe loss.
The adjusted D/C for the range of section loss noted during the inspection is 0.51 to 0.65.

- Typical state away from Towers.
- Typical at either ends of West Tower Saddle.
Main Cable Re-Wrapping
Upper Plan Gusset Replacement – Temporary Works

NEW TOP LATERAL GUSSET P, TYP
(64 TOTAL REQ’D)

JACKING POST

EXISTING FLOORBEAM

JACKING BEAM
TWIN HSS
8"x4"x\(\frac{3}{4}\)"

NEW TOP LATERAL BRACE
(62 TOTAL REQ’D)

DECK SECTION
SCALE 1/4" : 1"
Upper Gusset Jacking Beam Installation

- Paired 8" x 4" HSS sections.
- Connected to new holes in the upper vertical gussets.
Bolts Substituted for Existing Rivets
Jacking Post in Position

- Single jacking post fabricated for use on both truss lines.
- Jack raised end of floor beam ¼" & elastically deflected the edge beams (stringers).
Truss After Steelwork Replacement

- New Upper Gussets & Plan Laterals
- New Sway Bracing
- New Needle Beams
2013 Works: Full Coating Now In Progress

2014 Works (estimated):
Lower Chord Vertical Gusset Replacement

Questions?