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STEEL-WOOD COMPOSITE BRIDGE

INTRODUCTION AND OUTLINE OF THE PROJECT

NAIL CONNECTED LONGITUDINALLY LAMINATED DECK

- Deck deteriorates after a few years and show required deck problems.
- Bridge inspection and/or testing indicated that the strength between laminates is the most important requirement to improve the deck load capacity.

TRANSVERSE PRESTRESSING AS A MEANS OF KEEPING THE LAMINATES TOGETHER

- Tests carried out before shoring Herbert Creek Bridge produced a local failure at test vehicle loads of 730 kN.
- Transverse prestressing increased the bridge capacity well above 900 kN gross.
- The installation of Herbert Creek Bridge postproved infeasibility.

DECK DEFLECTIONS HERBERT CREEK BRIDGE

PRESTRESS HARDWARE

EXAMPLE OF NEW CONSTRUCTION

EXAMPLE OF REHABILITATION

TRANSVERSE LAMINATED DECK

BRIDGE WITH TRANSVERSE DECKING

- Deck disintegrates after few years.
- Post-tensioning transverse deck is difficult and expensive.
- Little advantage gained by making the transverse deck composite.

USING PLATE AS SHEAR CONNECTOR

USING CONCRETE BULKHEAD AS SHEAR CONNECTOR

TEST RESULTS

DECK DEFLECTIONS UNDER DUAL AXLE LOADS

DEFLECTIONS MEASURED AT DUAL AXLE LOAD OF 127.5 kN

- Timber bridges are not temporary bridges.
- Nearly 10% of bridges in Ontario are timber bridges.
- The life and performance of nail connected longitudinally laminated wood bridges is considerably enhanced by transverse prestressing.
- Transverse laminated wood decking or steel girders cannot effectively increase the strength of girders because of low E_c of deck in the transverse direction.
- Transverse prestressing of wood decking is last for more than about 10 years.
- In wood steel composite bridges
 - deck laminates are made longitudinal so that their contribution to girder strength is substantial.
 - the decking is transversely prestressed to enhance its load carrying capacity.
 - two methods are proposed to provide shear continuity between the wood decking and steel girders:
 - the decking is partly supported by cross beams.

PRESTRESS CYCLING

- Prestress loss after first prestressing was generally large.
- Subsequent prestressing reduced the prestress loss considerably.
- Reached equilibrium stress loads after approximately 50,000 minutes.

PRESTRESS LOSSES

- Bridge required two weeks to prestress due to limited availability of jacks.
- Slow application of prestress constituted an effect similar to repeated stressing.
- Showed higher long-term prestress level.

COMPARISON OF STEEL WEIGHTS

Bridge Span m	Steel Beam Minimum Section Weight (kg/m)	
	Using Non-Composite Transverse Decking	Using Composite Longitudinal Decking
10	80	35
20	125	70
30	175	105
40	250	140
50	415	245

ADVANTAGE OF RE-ORIENTING THE DECK LAMINATES

- Longitudinal moments and shear forces can be shared between the steel beam and the longitudinal laminates.
- The deck can be easily made composite with steel beam which would further improve the deck capacity.
- Bridge deformations are considerably reduced due to much higher E_c value in the longitudinal decking.