



Practical Steps To Extend the Lives of Bridges

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Probabilistic Evaluation of Allowance for Dynamics

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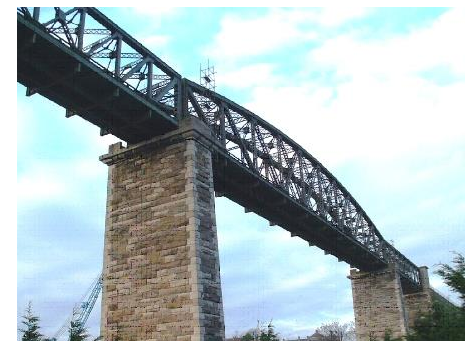




Overview

Traffic induced Bridge Dynamics

- Complex problem
- Vehicles
 - Mass (ratios)
 - Velocity
- Bridge
 - Type
- Other
 - Track irregularity
 - Wheel flats
 - ...



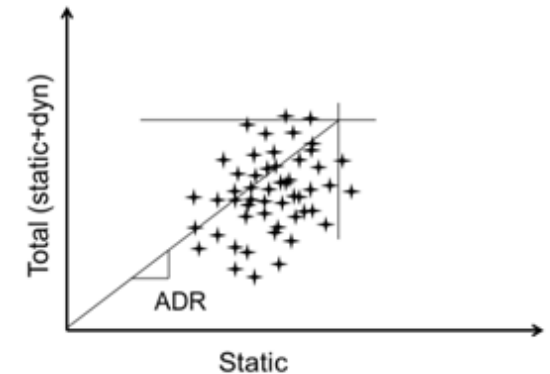
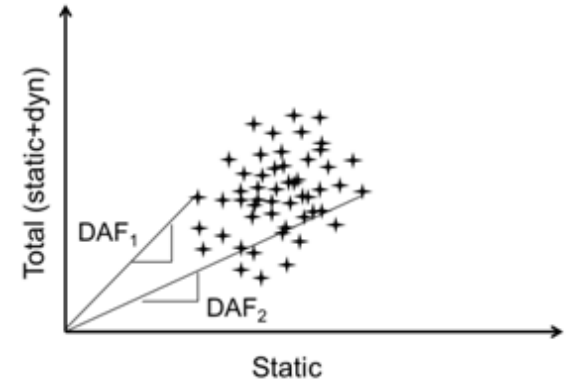
Allowance for dynamics

- Dynamic Amplification factor DAF
 - Too conservative for assessment

$$DAF = \frac{LE_{Total}}{LE_{Static}}$$

- Assessment dynamic ratio ADR
 - Site-specific
 - Smaller than DAF

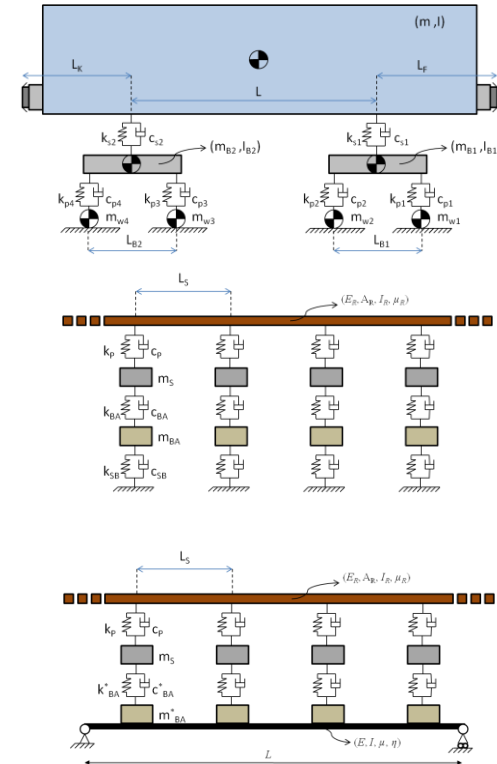
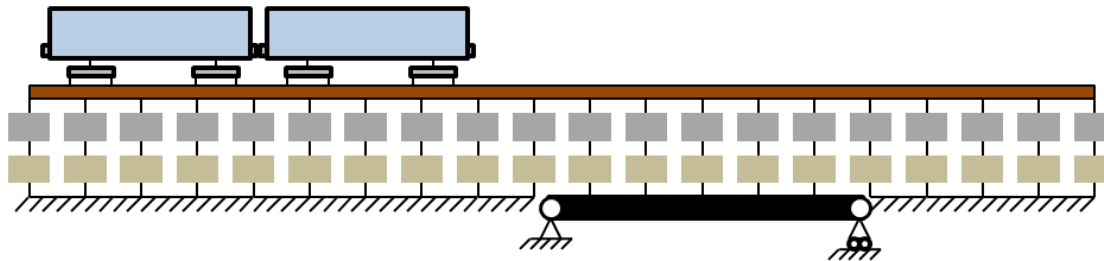
$$ADR = \frac{\widetilde{LE}_{Total}}{\widetilde{LE}_{Static}}$$



Modelling

Numerical model

- Vehicle
- Track
 - Rail + Pad + Sleeper + Ballast
- Bridge

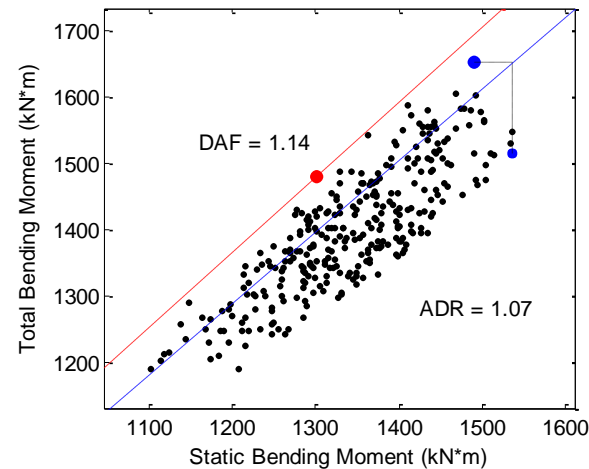
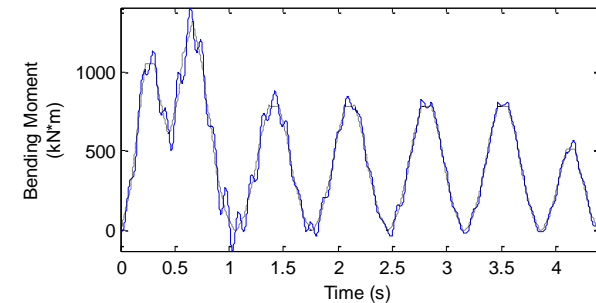


Numerical Analysis

Examples

- Single event
 - 1 locomotive + 5 passenger wagons

- Multiple events
 - DAF vs. ADR





Methodology

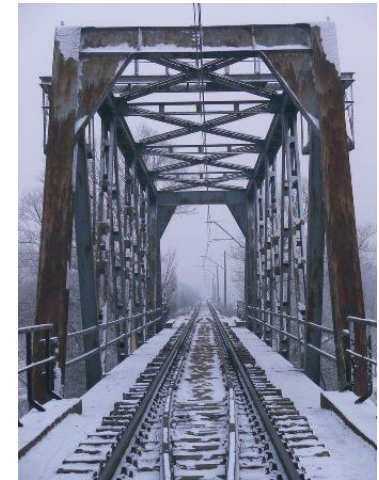
- Numerical model development
 - Vehicle + Track + Bridge
 - Uncertainties definition
- On-site investigation
 - Instrumentation
 - Measurements
- Model calibration
- Long-term traffic simulations
- Dynamic analysis of critical events
- Dynamic allowance calculation





Applications

- Structural assessment of existing structures
 - Preventing unnecessary reparations/replacements
- Change in traffic conditions
 - Increase freight load
 - Up-grade to “high-speed”



Effectively extending the lives of bridges

Thank You

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Project Website

www.longlifebridges.com

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