ASSESSMENT AND MAINTENANCE OF OPEN DECK RAILWAY BRIDGES

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V/Line

9th small bridges conference –

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Topics:

- Open deck bridges - Pros and cons compare to ballasted deck bridges
- V/Line transom bridges
- Typical legacy drawings for short and large span bridges
- Common defects/issues of transom bridges – track issues on the bridge approach's
- Structural issues : bearings and substructures - possible causes of these issues
- Inspection and maintenance : What can be improved?

Open deck bridges - Pros and cons

Timber sleeper/transoms directly supported by the bridge girders,

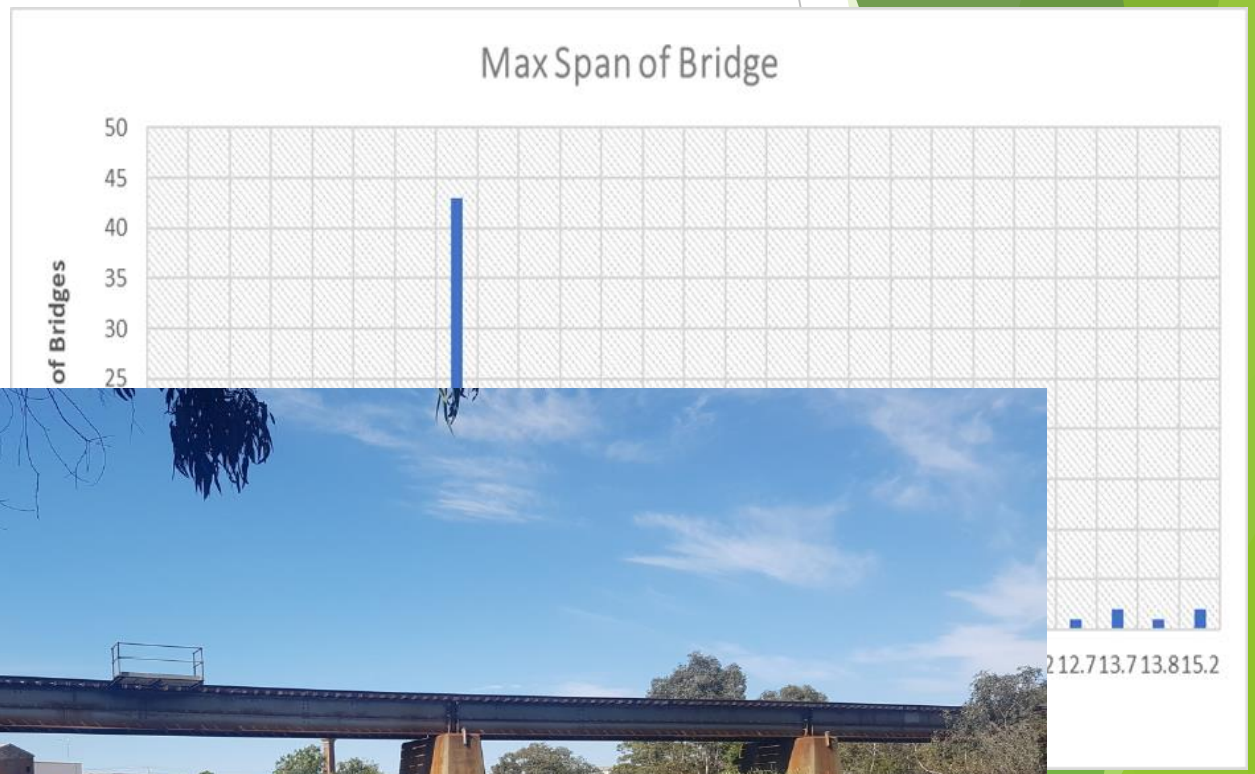
- much lower dead load, free draining, less costly to build and inspect and maintain no tamping, less corrosion

However,

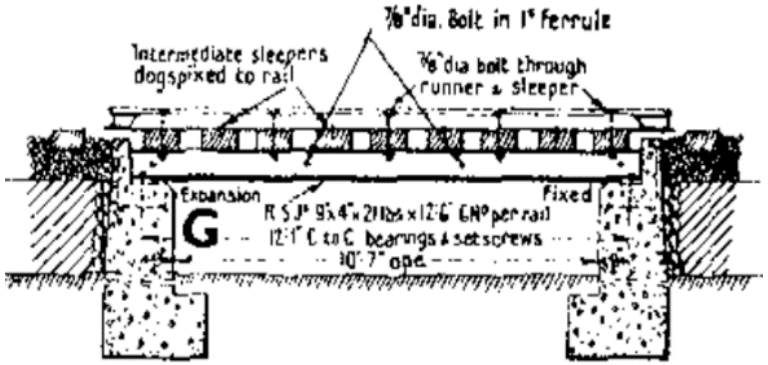
- More dynamic loads due to direct fix nature,
- Track related issues on the approaches
- Direct force on the bearings – traction & braking forces
- Thermal effect can be transferred from the track to the structures –

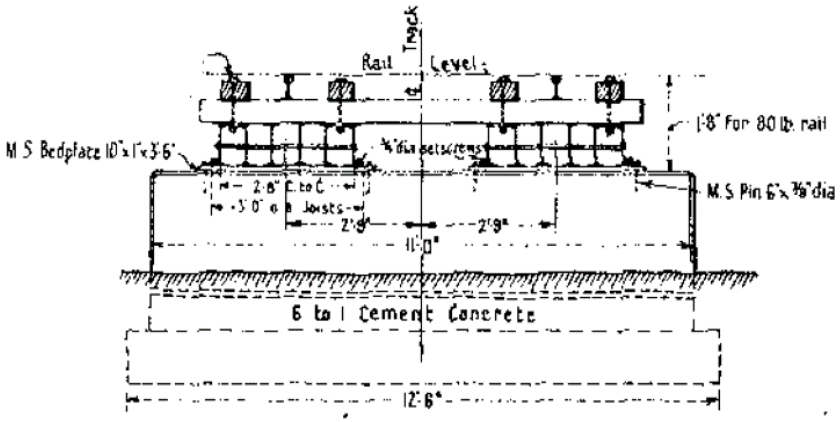
V/Line Transom Bridges

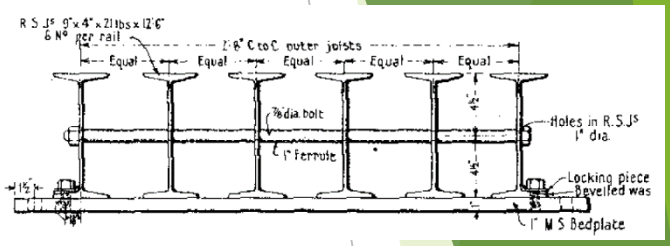
- Currently 108 transom bridges- more than 10% of the bridges in both passenger and freight lines
- Span varies from 1.3 m to 15.2 m
- Their average age is approaching about 100 years
- RSJ beams are original and the timber transoms have



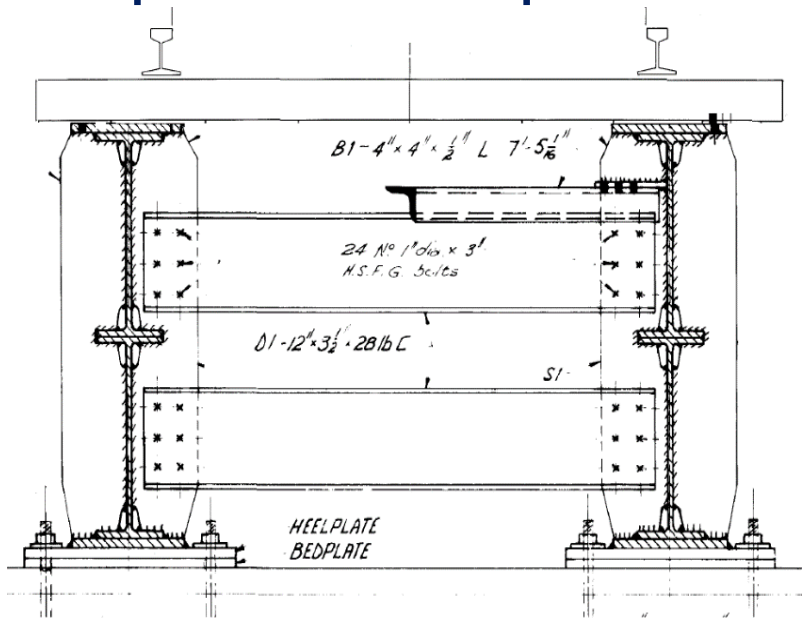
Typical simply supported 3.8 m transom bridge - span 12 ft.- 3.8 m

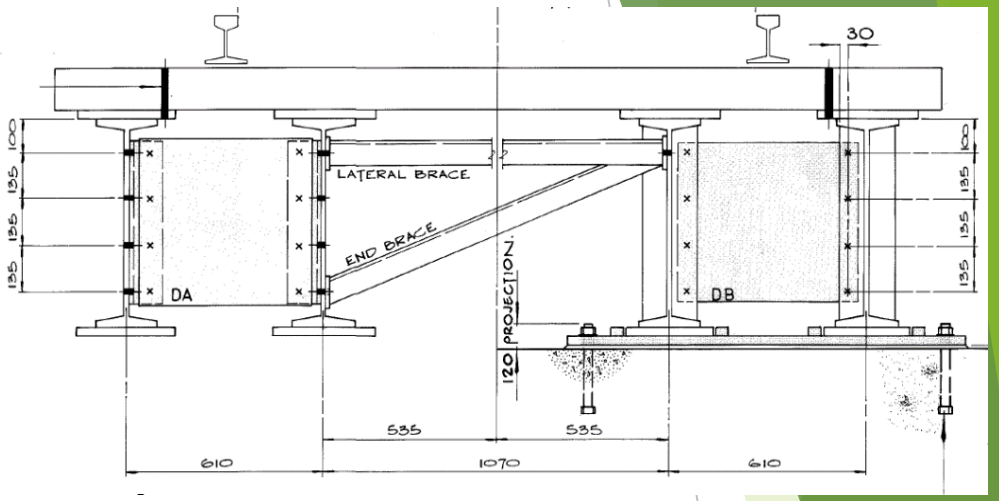






Two common standard for long span transom bridges - (Top): 40ft 4 beams type. (Below): two-beam plan for 50 ft. spans



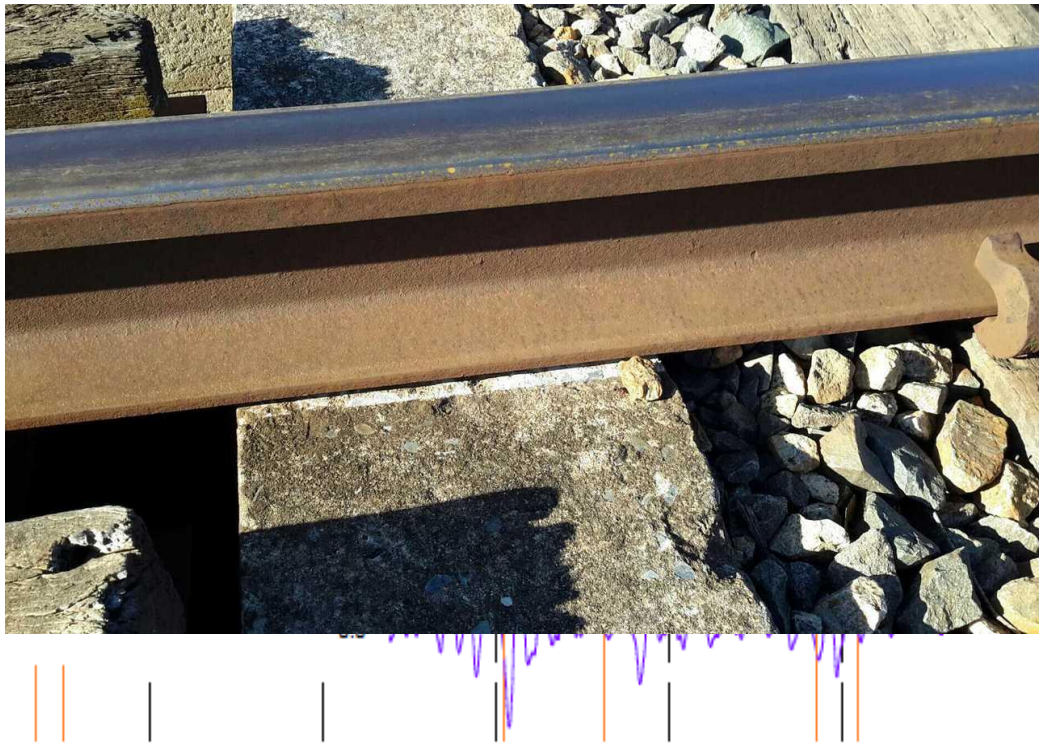


Common issues/defect on transom bridges

- 1: Defects on bridge approaches- Dip

Common issues/defect on transom bridges

- 2: Track related defects on the bridge approaches



Common issues/defect on transom bridges

- 3: Bearing defects

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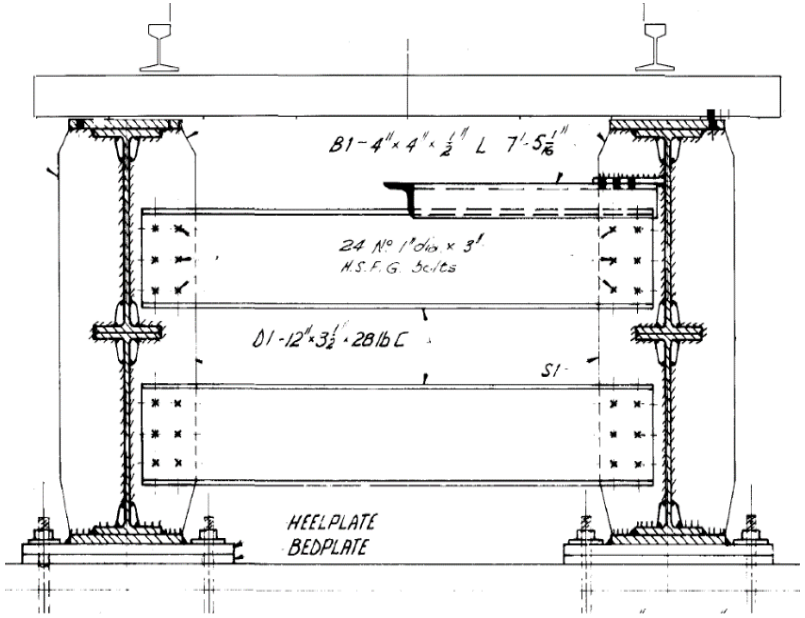
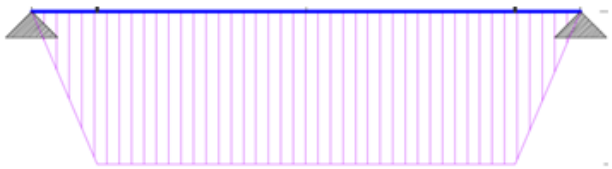
Flexibility of transom bridges





Bending moment

Shear Force

The stiffness of the track formation changes from 20 kN/mm to 150 kN/mm -

Load rating as per AS 5100

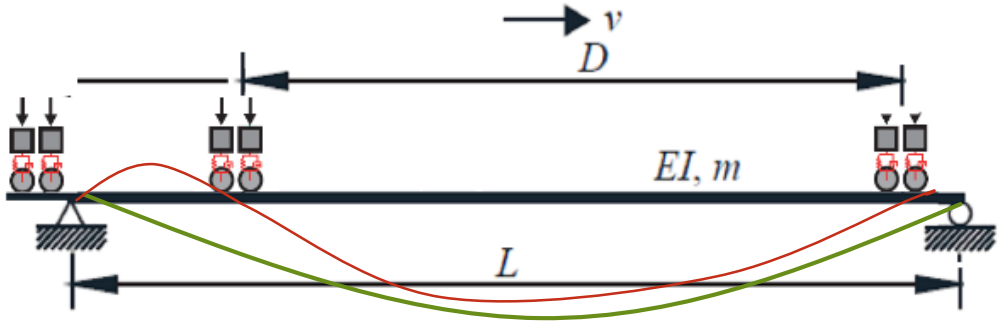
- Dynamic Load Allowance (DLA) in bending has been reduced However, lack of transition approach to a bridge abutment means more 50% DLA unless otherwise approved by relevant ARO.
- Recent load ratings of several transom bridges in the V/Line network as per AS 5100 (2017) show that they are not compliant, but still compliant with V/Line NIST-2616 for the current rolling stocks. It needs to be mentioned that these bridges are deemed safe as per AS 13822 assessments

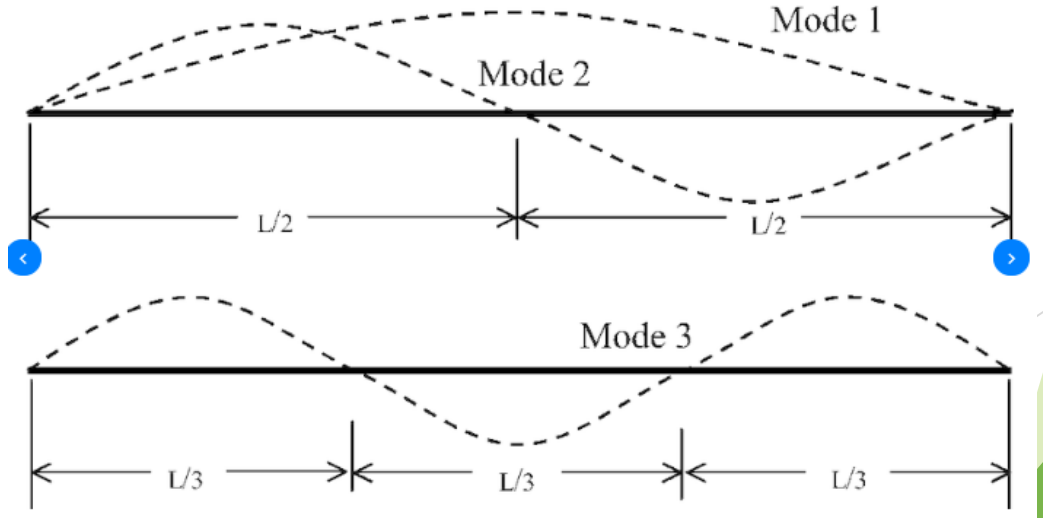
- However recent identified defects on the bearings show Bearings of the direct fix bridges need more attention specially in shear and uplift
- Loads depends on the track condition, defect condition and etc.

Possible causes of the defects

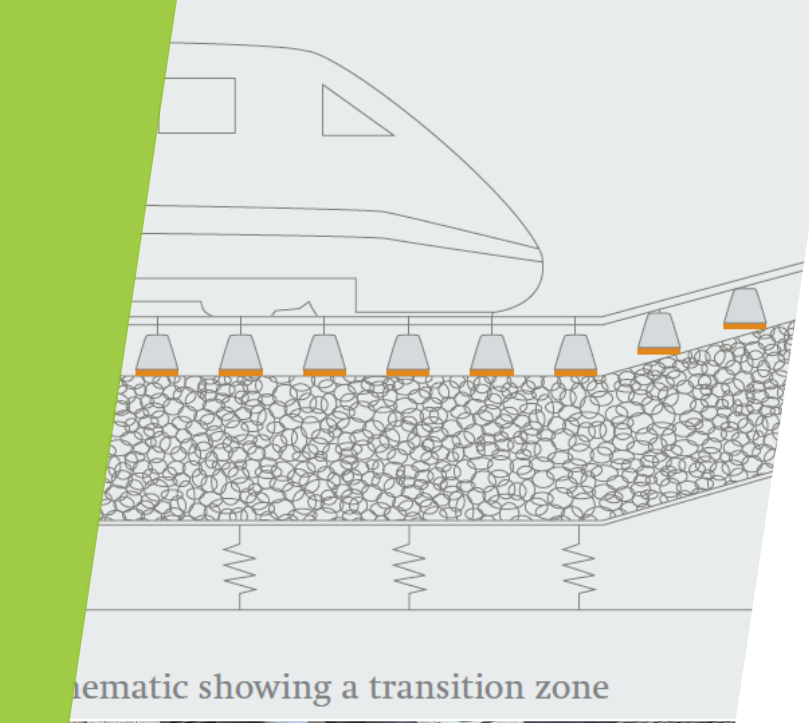
- High dynamic forces due to nature of transom bridges
- Uplift loads on the bearings due to dynamic response to train moving loads
- Approach issues and track issues
- Aging structures
- Frequent services
- Partial resonance

$$V_{cr} = \frac{f_n . D}{l} \ , l = 1,2,\infty$$





Theoretical mode shapes of a simply supported uniform beam.



ematic showing a transition zone

How to deal with the defects

- An amended TMP technical maintenance plan can help- more frequent inspection of these structure
- Modified TMP for track – track recording car
- Less tolerance for track related defects on and around the bridges
- New transition approach slab
- New modified bearings
- More agile maintenance –corrective actions
- Further investigation into dynamic behavior
- Speed –up to 160 km/h, (is it is good idea?), major investments is required to upgrade these assets
- More investment, asset lifecycle for aging assets

Thank You
Question?