# Monitoring of a high speed railway viaduct

D.R.M. Milne, L.M. Le Pen, G.V.R. Watson,
W. Powrie, D.J. Thompson

University of Southampton
Engineering and the Environment

## Monitoring

Monitoring can provide evidence of behaviours leading to track defects. Monitoring was carried out on a defect near a structure expansion joint, on a high speed railway viaduct.

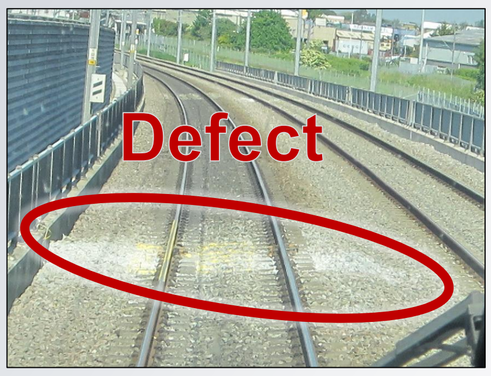


*Figure 1 –View of defect*

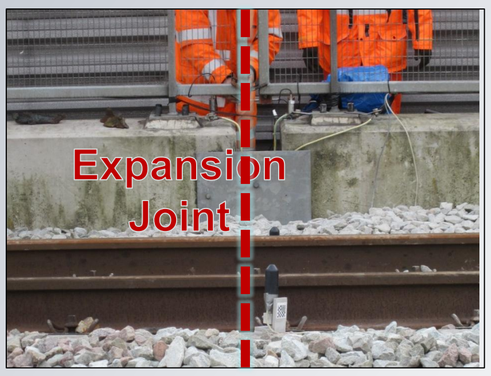


*Figure 2 – Expansion joint*

This allowed assessment of track performance, occurrence of voiding and track structure interaction.

Geophones and high speed video for digital image correlation (DIC) captured the response of the track and bridge spans in and around the defect.


*Figure 3 – Geophone and DIC target*

## Bridge

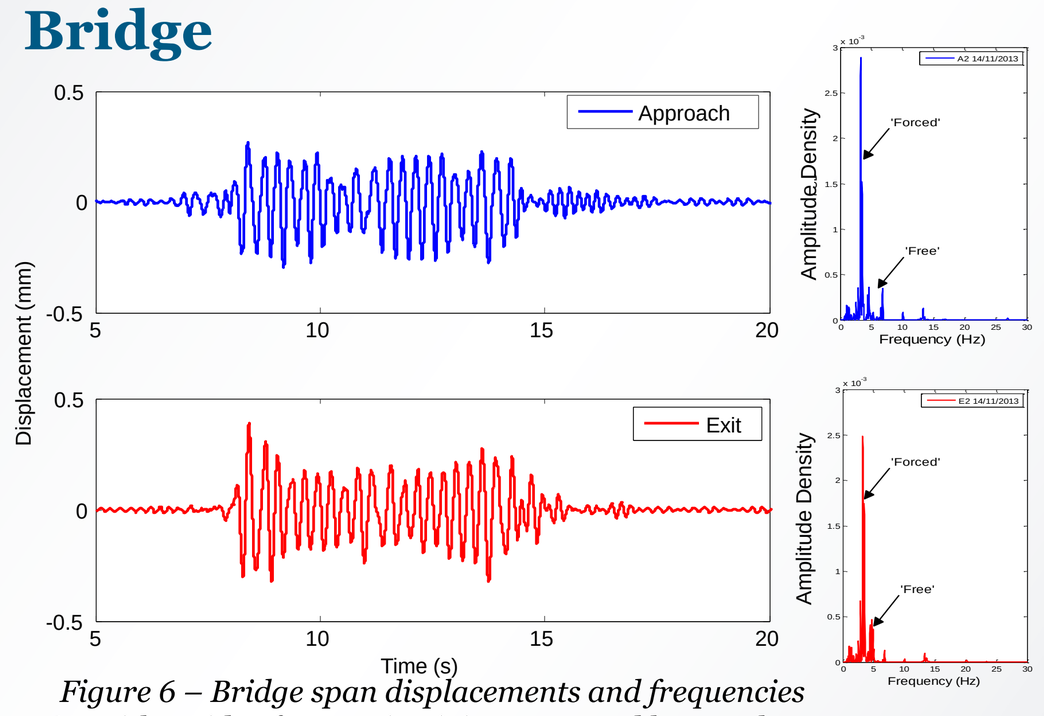


*Figure 6 – Bridge span displacements and frequencies 6 m either side of expansion joint measured by geophone*

Measurement, 6 m from the joint, suggested the bridge spans were being forced close to their natural frequency, meaning dynamic effects could be significant.

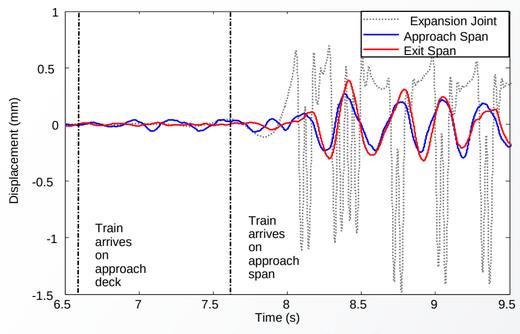


*Figure 7 –Relative displacement of span to track over expansion joint*

Maximum displacement of the spans either side of the defect occurred simultaneously and when the defect was not loaded.

## Track

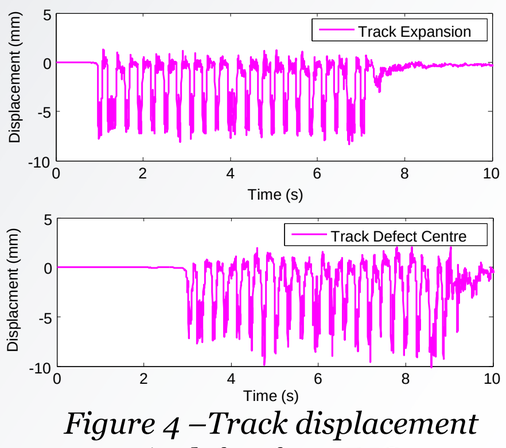


*Figure 4 –Track displacement in defect from DIC*

DIC confirmed certain sleepers were voided. Displacements were measured in excess of 8 mm, suggesting poor performance.

Geophone results show that away from the defect track was performing well, displacing up to 0.5 mm.

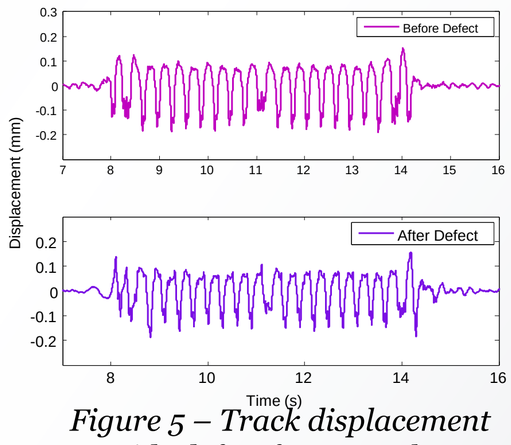


*Figure 5 – Track displacement outside defect from geophones*

## Implications

Whether this response results in unfavourable geometry, increased dynamic loading or settlement warrants further investigation.

Geophone and DIC are useful for capturing the response of track and associated structures under operational conditions. DIC was effective for large displacements.

*Figure 8 – 373 'Eurostar'*

*Figure 9 – 395 'Javelin'*

Identification and understanding of mechanisms which may initiate track defects are the next stages of this work.

## Acknowledgements

Thanks to Simon Morely and Mick Hayward of Network Rail High Speed for identifying, providing access to the site and support of the research.

## Sponsored by:

EPSRC
Engineering and Physical Sciences Research Council

NetworkRail

## Contact:

**D.R.M. Milne**
Infrastructure and ISVR Dynamics Groups
Engineering and the Environment,
**T:** 023 8059 7705 **E:** d.milne@soton.ac.uk