

Railway Bridge Monitoring: Pairing the Physical and Virtual Worlds using Digital Twins

Background

- Network Rail has over 600,000 bridge spans on its network, many of which were built over 150 years ago, and have now exceeded their design service lives.
- Current bridge maintenance practices largely depend on visual inspection which is subjective, expensive, and labour intensive, putting inspectors at risk.
- Over 20% of the UK's 155,000 bridges are reported as structurally deficient based on such qualitative techniques.

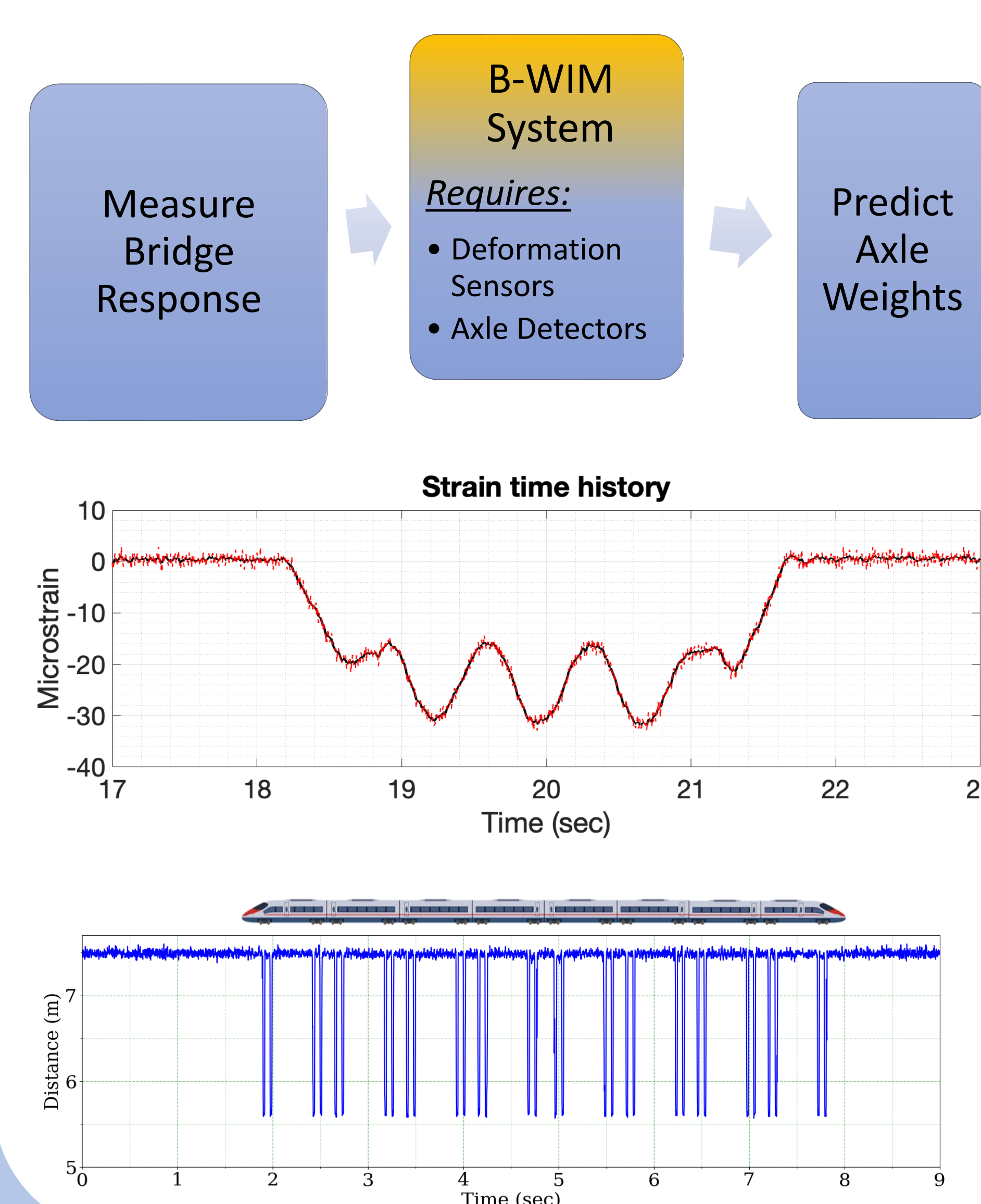
Our Objective

"is to use an instrumented railway bridge in the UK as a research testbed to develop performance monitoring and visualisation tools focusing specifically on half-through metallic bridges, which constitute 40% of the national railway bridge stock."

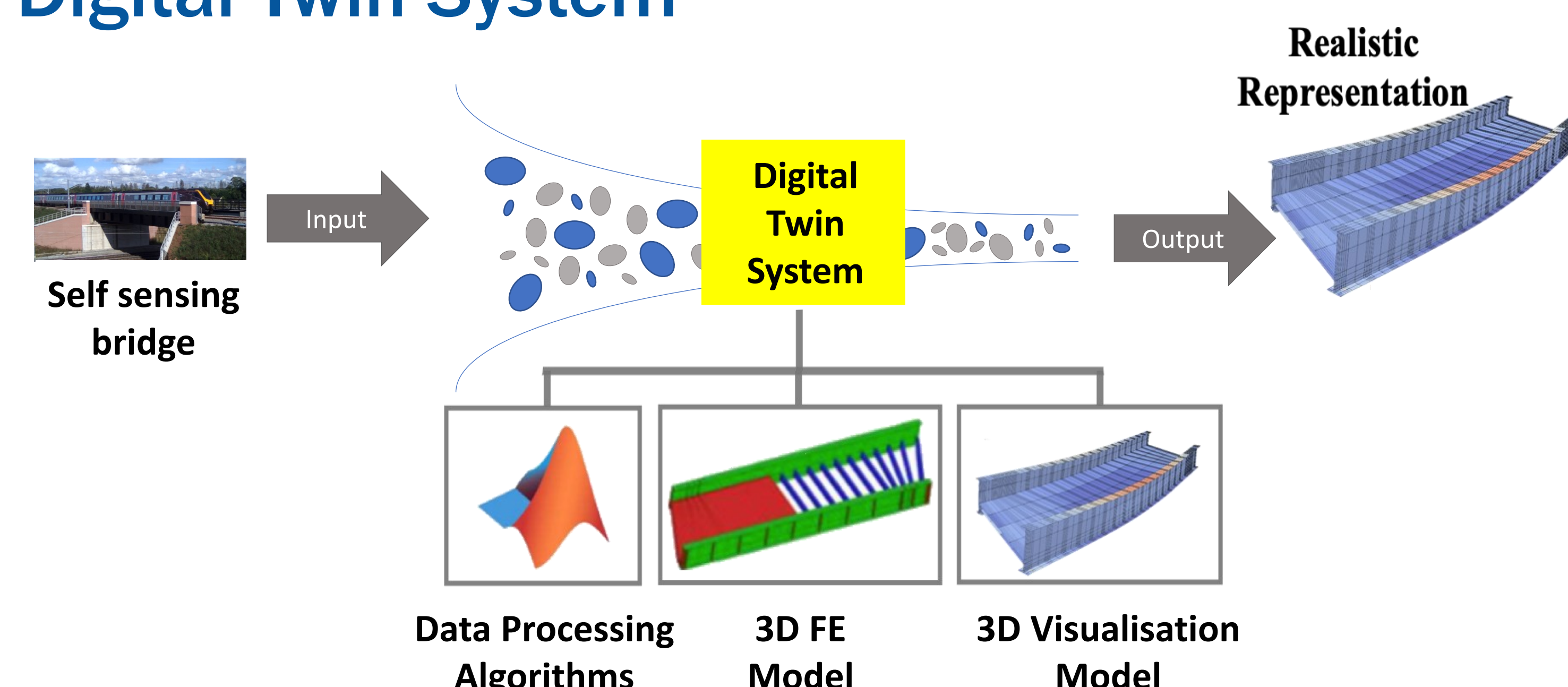
Self Sensing Bridge



Live Train Load Monitoring



Digital Twin System



Input parameters

Loading:

- Permanent
- Traffic Loading

Structural properties:

- Boundary conditions
- Contribution of non-structural elements,
- Transverse load distribution etc.

Output parameters

- Deformations at everywhere
- Stress/strain distribution,
- Load actions: moment, shear
- Load rating factor
- Deterioration model
- Structural Assessment at an element level

Potential Impact

- Predictive maintenance would benefit asset managers to plan maintenance schedules more effectively, resulting in significant cost savings.
- Understanding the actual in-service loading experienced by the UK's railway network would help ease current weight and speed restrictions and increase the network productivity.