

BUILDING RESILIENCE THROUGH STRUCTURAL ASSESSMENT AND SUSTAINABLE ASSET MANAGEMENT - PORT TALBOT M4 MOTORWAY VIADUCTS

ABSTRACT The M4 motorway is a vital component of Wales's transport infrastructure, facilitating connectivity to England and international trade routes as the nation's economic artery. Four strategically important viaducts – Llewellyn Street, Afan, Dyffryn and Tan-y-Groes Viaduct – support the M4 through Port Talbot, forming a vital link for traffic and trade into West Wales, with limited alternative routes available. The viaducts are multi-span reinforced concrete structures comprised of reinforced concrete deck slabs supported on rows of columns, with different construction methodologies (such as down-stand beams and trusses, or precast T-beams) implemented where required by design.

On behalf of the South Wales Trunk Road Agent (SWTRA) and the Welsh Government (WG), AtkinsRéalis have completed the assessment of all four viaduct structures, originally constructed in 1966, to update their load ratings to current DMRB assessment standards, considering asset condition, operation and deterioration. The results have been used to evaluate the existing asset health and inform future management to CS 470 and ensure continued resilience along the M4.

A Stage 1 Finite Element Analysis (FEA) assessment (using LUSAS) was completed to establish a baseline for the as-built condition with subsequent Stage 2 Assessments through Yield Line Analysis (using LimitState:SLAB for critical deck slabs) or global FEA model refinements (such as spring support conditions, and realistic element releases) to remove conservatism and maximise utilisation of structural members. Deterioration assessment considerations were suggested with reference to Special Inspection observations to evaluate existing health and inform future asset management.

This paper will illustrate how structural assessment can be used to support sustainable asset management (aligned with PAS2080:2023 and the Carbon Reduction Hierarchy) through:

- Enhancing infrastructure resilience to facilitate operation and extend asset life (UNSDG 9);
- Avoiding severe disruption and exhaustive interventions (UNSDG 11);
- Optimising asset use to deliver whole-life carbon savings supporting net-zero goals (UNSDG 12, 13).