



ElevArch® - Jacking heritage masonry bridges to allow for railway electrification

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Abstract

Hundreds of Britain's masonry railway bridges are in the way of Network Rail's electrification programme. ElevArch® is a unique method to raise a masonry arch to create sufficient space for the overhead line equipment to be installed beneath. The full-scale demonstrator on East West Rail in 2016 proved the method was viable by successfully lifting a farm accommodation bridge by 900mm.

The secret to its success is the careful sequencing of operations to control the arch thrust when the arch is cut free from the foundations. The method is cheaper than the two current alternatives of track lowering and bridge reconstruction and is, therefore, of interest not just for heritage structures but across the railway network. With Network Rail's electrification programme restarting after a long pause, it is time to reconsider ElevArch as a viable and cost-effective option. This paper explains ElevArch in detail to enable designers, contractors, and asset owners to assess whether the technique could be suitable for their structures.

Keywords: ElevArch, masonry arch, bridge jacking, railway electrification, route clearance, heritage structures, sustainability.

1 Limitations of existing methods

Many of Britain's historic masonry arch bridges are in the way of railway electrification schemes because there is not sufficient space beneath the arch to fit in the Overhead Line Equipment (OLE). The two principal solutions for creating substantially more headroom are track lowering and bridge reconstruction and both can present problems.

Track lowering can cause or exacerbate flooding and may require geotechnical works to protect bridge foundations, which are often shallow. Excavation and re-laying of track typically extends

over several hundred metres to limit gradients. If the structure is close to another asset, such as a station, altering the track level might not be viable. The method is very disruptive to the rail user and is expensive, typically £1,5-2 million per bridge.

Bridge reconstruction usually involves demolishing the masonry arch and installing precast reinforced concrete portal beams in its place. There are risks associated with demolition and with heavy cranes, especially if overhead utilities are present. Access for the crane and delivery of precast concrete can be problematic. The removal of the arch destroys any heritage value. The solution usually requires two weekend possessions of the