



METALLIC FOAM BRIDGE DECKS A NOVEL APPROACH FOR THE SEISMIC RETROFITTING OF BRIDGES WITH LIGHTWEIGHT YET HIGH CAPACITY COMPONENTS

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ABSTRACT

The objective of this paper is to assess the performance of metallic foam, shown in Figure 1, to be used for retrofitting of bridge decks based upon critical seismic design parameters such as mass, stiffness and resultant bending moments and deflections. An existing bridge of the UK ‘Brogborough interchange north’ was used as a case study for comparison. Ultimately the utility ratio of metallic foam bridge deck was compared with that of case study. Metallic foam sandwich panels, as a bridge deck, are discussed in this paper as they offer high rigidity combined with inherent vibration damping and noise cancellation. This research presents conceptual design of a bridge deck that utilizes actual bridge information provided by the Highway Agency in the UK. This work demonstrated that 30% weight savings are possible in comparison to a conventional concrete deck, when replacing the heavy concrete slab of the bridge by lightweight, yet high-capacity, metallic foam panels. Sandwich panels, with smart detailing, enable modular construction and fast assembly. At the same time, reduced weight of the superstructure minimizes the seismically induced inertia loads and as such diminishes the prospected seismic loads of the potentially deficient substructures, i.e. piers and foundations. Prospected interaction of the bridge deck with the abutment is well controlled by the fusing function of the metallic foam deck slab. Further work is needed to explore the benefits of these modular sandwich decks for expanding the traffic capacity of highway bridges, i.e. to increase the traffic mass of existing highways, especially in densely populated urban areas. This work is part of a larger effort to help develop metallic foam as a material with relevance to civil engineering applications.

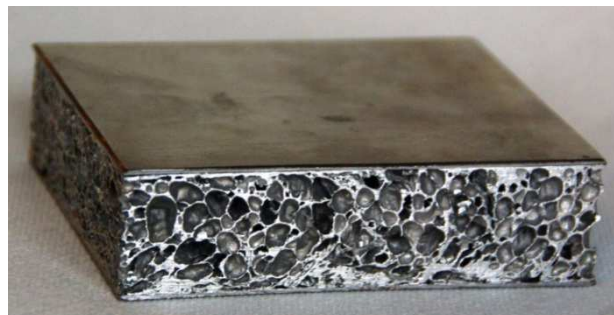


Figure 1. Aluminium foam sandwich panels.

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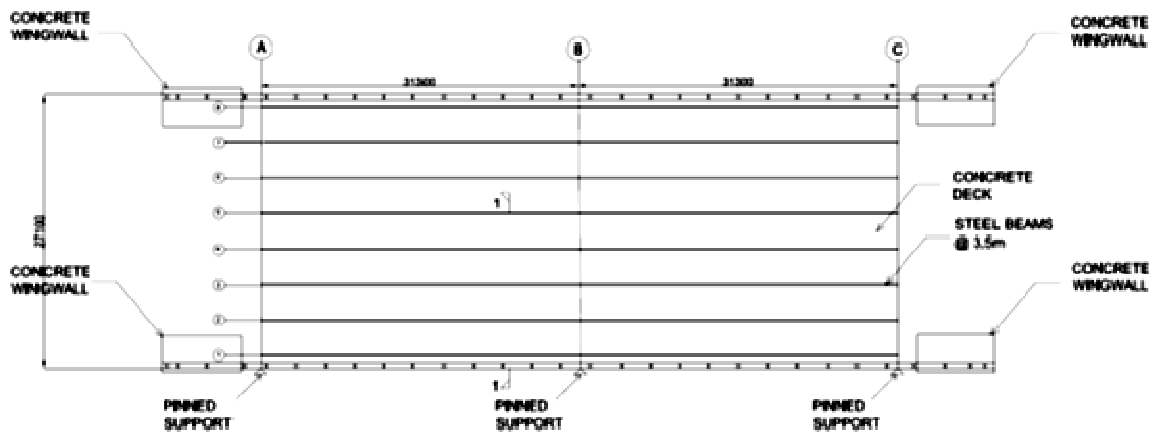


Figure 2. Bridge plan view.

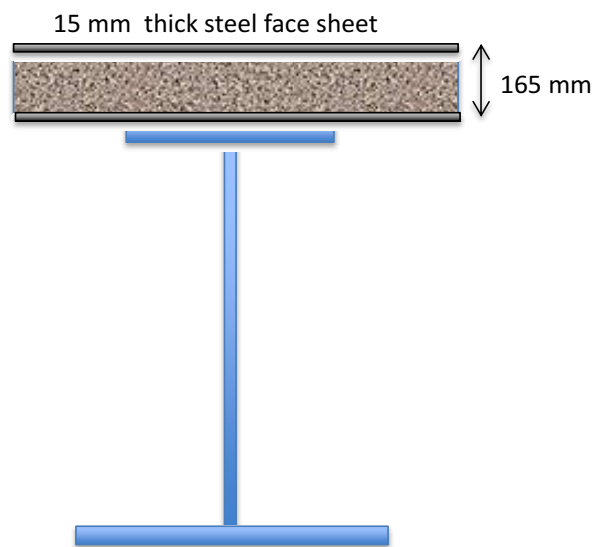


Figure 3. Sandwich panel seismic deck.