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Numerical Evaluation of the performance of different composite bridge decks.

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Abstract. A comparative analysis was conducted to facilitate the selection of composite bridge deck configurations. Composite bridge decks, with their lightweight design, corrosion resistance, prefabrication, reduced construction time, and wide design flexibility, reduce substructure costs and offer durability. Static and buckling analyses were conducted using finite element software to compare their weight, stiffness, composite inverse reverse factor, and buckling resistance. The analyses considered the same boundary conditions, loads, composite layup configuration, and material mechanical properties. Various geometries were selected from different literature to evaluate their performance and identify an appropriate design. This paper presents a numerical investigation into the structural performance of five different composite bridge decks under the same conditions. G. Rectangle emerged as the easiest manufacturing deck, consisting of pultruded rectangle tubes, and the worst deck for deflection and buckling. The G. Triangle has the lowest deflection and the highest strain energy density. The G. Arch distinguished as the lightest bridge deck, also has good performance against buckling and a low strain energy density. Finally, the G. 2Trapezoidal and G. Trapezoidal have better total performance than all other decks as they have the highest inertia.

Keywords: composite material, bridge deck, static analysis, buckling analysis, finite element analysis, structural performance.