IMPROVE THE LATERAL STABILITY OF VARIABLE HEIGHT STEEL TRUSS TYPE PEDESTRIAN BRIDGES IN SRI LANKA

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This paper investigates the methods of improving the lateral stability of variable height truss type steel bridges that are used for pedestrian purposes in Sri Lanka. A bridge is a structure that provides passage without blocking the way underneath over an obstacle. A truss is one of the key engineering features related with bridges in the emerging civil engineering contest. Several truss type steel bridges have been built for pedestrian use in the recent past. Modified Warren and variable height bridges can be commonly seen in the Southern Province of Sri Lanka over the major river crossings. When designing a pedestrian bridge for local conditions, it is very important to consider the loads due to pedestrians, wind, and sometimes light weight vehicles in the rural areas. So, it is preferred to investigate the applicable truss types and their shortcomings by conducting a detailed analysis. The aim of this research is to provide an overview of the Finite Element (FE) method with the focus on lateral stability of the variable height steel truss type pedestrian bridges, their analysis, and various applications. The applicability of steel hollow and composite sections to improve the lateral stability of steel truss type bridges were studied. A comprehensive literature review was carried out to identify the behaviour of different member sections under applied loads. FE analysis was performed using the SAP2000 software to investigate the behaviour of truss type steel bridges. The loads acting on the pedestrian bridges were calculated based on BS 5400: Part 2: 1978, where the design code BS5950: 2000 was used for the design of member sections. Later, MIDAS CIVIL software was used when analysing the truss bridges having concrete infilled composite sections for the top chord members by accounting for the buckling analysis. Span vs tonnage graphs were developed for the Variable Height Arch, Inverted Arch and other selected bridge types to investigate their steel usage for different spans. Almost all the bridges consume similar tonnage up to 25 m span, and their tonnages notably varied thereafter. Results from this study indicated that variable height bridges with concrete infilled sections consume less steel tonnage compared to those with hollow sections and other truss types. Furthermore, it was evident that the steel truss bridges with circular hollow sections consume slightly less steel tonnage compared to those with rectangular hollow sections for all the spans. This trend could be seen for both hollow and infilled sections. Overall, it can be concluded that the lateral stability of variable height bridges can be improved by using infilled sections, reducing their buckling effect, which is the main shortcoming of variable height steel truss type bridges.

Keywords: variable height trusses; pedestrian bridges; numerical analysing; composite sections; buckling analysis

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