

PERFORMANCE EVALUATION OF TWO CONSTRUCTIVE METHODS FOR TIMBER LENTICULAR BRIDGES

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Abstract

Timber lenticular truss bridges have been constructed since early 19th century, showing an intriguing shape. This shape is based on a parabolic curve formed by both chords of the truss. The objective of this study is to evaluate two different constructive methods for the lenticular shape for trusses: Gable and Double Howe type truss. A reduced model was tested with diagonal bars on and later without it, simulating both types. The chosen parameter for this evaluation was the displacement caused by the same load history for both methods. The results were also compared with a numerical model using the software FTOOL. The comparison between both experimental models shows a ratio between their displacement of approximately 3.7 times, showing that the Double Howe construction method is more rigid than the Gable type.

Keywords: timber structures 1. superstructure 2. numerical model 3. Double Howe 4. Gable 5.

Resumo

Pontes lenticulares treliçadas de madeira vem sendo construídas desde o início do século 19, mostrando uma forma interessante. Esta forma é baseada na curva parabólica formada por ambos banzos da treliça. Este trabalho tem por objetivo avaliar dois métodos construtivos diferentes para treliças com formato lenticular, no caso uma treliça tipo Gable e uma Double Howe. Para isto, um modelo reduzido foi ensaiado com suas barras diagonais e depois sem elas, de modo a simular ambos. O parâmetro escolhido para esta avaliação foi o deslocamento causado por um mesmo histórico de carregamento para ambos os métodos. Os resultados foram também comparados com um modelo computacional através do pacote computacional FTOOL. O comparativo entre ambos os modelos experimentais mostra uma diferença entre os valores da flecha em aproximadamente 3,7 vezes, evidenciando que o modelo construtivo Double Howe é mais rígido que a treliça tipo Gable.

Palavras-Chave: estruturas de madeira 1. superestrutura 2. modelo computacional 3. Double Howe 4. Gable 5.

1 Introduction

According to Guise (2007), the lenticular shape is based in the ideal parabolic curve formed by the chords of the structure. He also mentioned that the stresses in all the segments of a parabolic chord are equal, since the moment diagram produced by a uniform load on a horizontal span is a parabola. Moreover, the diagonal web members of a parabolic truss under a uniform load undergo almost no stresses.

Figure 1-Timber lenticular truss bridge built in America, 1858.

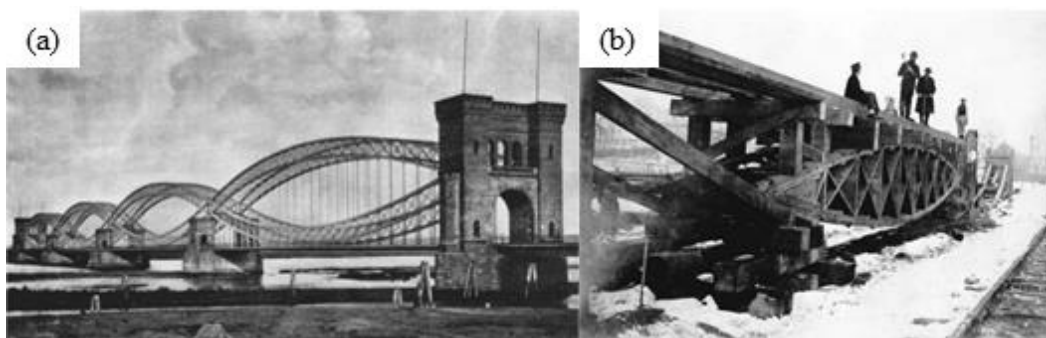


Font: Guise, 2007.

In America, the first lenticular bridge patents were created in the 19th century, but this construction method was originated in Europe, a half century before it.

Examples of timber lenticular truss bridges built in America are shown on Figure 1 and 2-a, Germany (Figure 2-b), Canada (Figure 3-a) and Brazil (Figure 3-b). Figure 2-b shows one of many lenticular truss deck bridges built by engineer and Union General Hermann Haupt, during the Civil War with truss spans of 60 feet long and 6 feet high, as cited by Guise.

Figure 2-Example of lenticular truss bridge (a - 1868) and all-timber lenticular truss deck bridge (b).



Font: Guise, 2007.