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Shells as Bridge Decks

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Abstract

A numerical study on the behavior of shell bridge decks under the worst possible effect of dead load, loading vehicles of the American Association of State Highway and Transportation Officials (AASHTO), and earthquake loads was carried out. Three practical aspect ratios covering small to medium span bridge decks each with several flatness ratios and slab thicknesses were considered. The effect of these parameters on the response / maximum deflection of shell bridge decks were discussed. Finally, the responses (deflection) of shell bridge decks were compared to those of corresponding flat bridge decks in order to show their suitability over flat decks in earthquake zones.

Introduction

Because they support large external loads and exhibit excellent architectural appearance, shell structures have been adopted in many bridge construction projects as shown in Figure 1. Liang and Scordelis [1] reported the existence of more than a hundred reinforced concrete shell bridges of spans up to 25 m in China.

Although they have been extensively used as over the years, very little work has been documented on the study of their behavior of shell bridge decks. Bairagi and Mohammed Ismail [2] presented a numerical study on the behavior of circular cylindrical shell bridge decks under the worst possible effect of the Indian Road Congress loading. Fanous et. al. [3] presented a service load-test of a 1:3 scale shell bridge model. The objective of the study was to assess the feasibility of using shell-structured bridge as replacement for the bridges that have been classified as in need of rehabilitation or replacement.

This paper presents a numerical study on the behavior of shell bridge decks under the worst possible effect of dead loads, AASHTO loading vehicles [4], and