Evaluation on a load-carrying capacity of the stiffened plates subjected to biaxial forces considering the local buckling of the longitudinal ribs

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Abstract

This study analyzed load-carrying capacity of stiffened plates under one and two-directional forces with variations in the rib arrangement and the ratio of applied vertical to horizontal stress. The analysis was based on the Metropolitan Expressway Company's standard drawings for Steel Deck Structures. In the case that subjected to uniform compression along the bridge axis, reducing the number of longitudinal ribs from 8 to 6 increased the width-to-thickness ratio parameter from 0.54 to 0.70, with little impact on the obtained load-carrying capacity. On the other hand, the case under uniform compression perpendicular to the bridge axis, reducing ribs resulted in decrease of load-carrying capacity. In the case that subjected to biaxial forces, the load-carrying capacity curves depend on the width-to-thickness ratio parameters of each direction, and it demonstrated the difference buckling resistance of the ribs.

Keywords: Stiffened plates, load-carrying capacity, rib arrangement, biaxial forces

1 Introduction

The steel deck plates are stiffened with both longitudinal and lateral ribs. The required relative stiffness between the deck and the longitudinal rib is specified In Japanese specifications for highway bridges (JSHB) [1] to prevent local buckling of the panels surrounded by longitudinal and lateral ribs. Since they have many ribs more than that determined by the required relative stiffness in JSHB, considering the fatigue durability and cracks of the pavement, it is considered safe for local buckling of the panels between ribs. It might be possible to reduce the number of longitudinal ribs based on load-carrying capacity.

In addition, as the length of the bridge become longer, structural verification of stiffened plates subjected to biaxial forces should be required, such as thebridges categorized as follows:

(1) Box girder bridges consisting of steel decks as the upper flange plates and slender floor beams, where the deck plates are subjected to not only the longitudinal in-plane stress due to the longitudinal bending but also the