# Large-scale load carrying capacity test of curved steel box girders with/without horizontal stiffeners subjected to bending

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## Abstract

Due to the girder curvature, automatic welding robots cannot be applied to welding of horizontal stiffeners to the girder web in the fabrication of curved steel box girder bridges, which increases the manufacturing costs. Therefore, elimination or reduction of the number of horizontal stiffeners without increasing the web thickness is desirable. In the present study, ultimate load carrying capacity test has been carried out and the failure process was verified in order to evaluate the mechanical effects of horizontal stiffeners on the ultimate load carrying capacity. From the experimental results, it was found that, even in case the horizontal stiffeners are eliminated, the ultimate load carrying capacity decrease is much smaller than the decrease of the bending buckling strength of the web panel specified in the general design code. Furthermore, it was concluded that the compression flange of box girders restrains bending buckling of the web panel.

**Keywords:** steel box girder bridge; horizontal stiffener; ultimate load carrying capacity; load carrying capacity test; bending buckling strength; failure process; Experiment.

## 1 Introduction

When welding horizontal stiffeners to curved steel box girder webs, automatic welding robots cannot be applied due to the girder curvature and increases of the bridge manufacturing costs. So, elimination or reduction of the number of horizontal stiffeners without increasing the web thickness is desirable.

Since the flange of the steel box girder constrains the web, it may also restrain bending buckling of the web panel. So, papers [1] to [3] focused on curved steel box girders that were designed based on the Japanese Specifications for Highway Bridges [4] (JSHB) and investigated their failure process by FEM analysis. From the results, it was concluded that, even in case horizontal stiffeners are eliminated, the ultimate load carrying capacity does not decrease until global buckling occurs in the compression flange.

Based on this series of analytical studies, pure bending tests of curved steel box girders with a radius of curvature of 40m designed according to the JSHB was conducted in the present study. Then, in order to demonstrate experimentally, that the ultimate load carrying capacity decrease is limited even if the horizontal stiffeners eliminated and also

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