



# Experimental study on the cooperative slip/bearing limit state of high-strength bolted frictional girder connection

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## Abstract

Bolted girder connections resist applied bending moment through the cooperation of flange and web resistances. To utilize the bending plastic capacity of the girder connection at the ultimate limit state, the bearing capacity of the girder connection should be defined by the cooperative resistance and the ductility of bolt hole deformation. In the present study, pure bending test of plate girders bolted connection has been conducted to evaluate quantitatively the resistance and the ductility of the connection. From obtained results, it was found that the overall slip would not occur until the bolt group in the web other than around the neutral axis reaches their slip strength. In addition, overall slip strength formula with a 5% discrepancy from the experimental results has been newly proposed. As for the deformation capacity, it was found that the flange bolt hole deformation was about 10% of the bolt diameter at the design full plastic moment.

**Keywords:** girder bolted connections; high-strength frictional bolted joints; slip limit state; bearing limit state; cooperative resistance mechanism

## 1 Introduction

Flange and web splices of girder connections are designed individually in general design codes such as Eurocode 3 [1] and Japanese Specifications for Highway Bridges [2]. However, actual girder connections resist the applied bending moment through the cooperation of flange and web resistances [3,4]. Although AASHTO (American Association of State Highway and Transportation Officials) LRFD Bridge Design Specifications [5] include the cooperative resistance mechanism, details of the cooperative resistance mechanism

are not clear due to the lack of enough data on the influences of the various structural parameters.

However, cooperative resistance exists at both the slip and bearing limit states. Furthermore, to utilize the bending plastic capacity of the girder connection at the ultimate limit state, the bearing capacity of the girder connection should be defined by both the cooperative resistance and the ductility of bolt hole deformation.

In the present study, pure bending test of plate girders bolted connection, having various magnitude of flange bolt tension and various number of a bolt-column at web splices, has been