

# Analytical Study on Slip Strength of Long Bolted Joint Combing with Bearing Type Bolts

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## Abstract

In recent years, high-strength bolt friction joints have been becoming larger and longer owing to the increase in load and need for the rationalization of steel members. However, as the length of the joint increases, the force that the bolted joint can resist decreases because the distribution of the bolts inside the joint becomes uneven. The present study proposes a method that improves the slip strength of a long friction bolted joint by combining it with the bearing type joint. Finite element (FE) analysis was conducted to clarify the load share and slip strength of the hybrid joint. From FE analysis result, we found that the slip load/design slip strength ratio of the long friction bolted joint is 0.83, while the ratio of the hybrid joint B2 with bearing type bolts installed at each end of the joint is 0.94 and 0.98 in the B4 case. Therefore, it could be concluded that the hybrid joint with bearing type bolts installed at both ends of the long friction bolted joint can effectively improve its slip strength.

**Keywords:** long bolted joint; friction type bolt; bearing type bolt; high-strength bolt; slip strength.

## 1 Introduction

High-strength bolts are widely used when constructing steel bridges to fasten steel members together through a frictional joint to resist force[1]. In recent years, owing to the increase in load and need for the rationalization of steel members, high-strength bolt (HSB) frictional joints have become larger and longer[2,3], as shown in Figure 1.

The structural design of long or large high-strength bolt frictional joints has several problems. There are concerns that larger HSB frictional joints can reduce cross-section area due to drilling. Therefore, a reasonable compact joint structure must be developed to allow the use of fewer bolts to

transmit more load, which could also improve the service limit capacity of the joints.

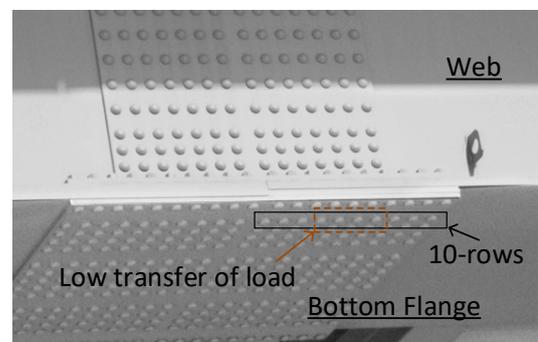


Figure 1 Long bolted joints at bottom flange

On the other hand, as the length of the joint increases, the actual force that can be withstood