

## Fatigue study on rib-to-deck welded joint considering weld penetration rate

### JU Xiaochen

Associate Researcher

China Academy of Railway Sciences Corporation Limited

Beijing China  
[juxc2008@163.com](mailto:juxc2008@163.com)

Mainly engaged in fatigue, fire resistance and health monitoring of railway bridge

### LIU Xiaoguang

Researcher

China Academy of Railway Sciences Corporation Limited

Beijing China  
[lxgrails@163.com](mailto:lxgrails@163.com)

Mainly engaged in fatigue, fire resistance and information technology of railway bridge

### ZENG Zhibin

Researcher

China Academy of Railway Sciences Corporation Limited

Beijing China  
[tkyzzb@163.com](mailto:tkyzzb@163.com)

Mainly engaged in structure stability, fatigue and health monitoring of railway bridge

### ZHAO Xinxin

Associate Researcher

China Academy of Railway Sciences Corporation Limited

Beijing China  
[xyzxx000@163.com](mailto:xyzxx000@163.com)

Mainly engaged in bridge deck pavements, fire resistance and health monitoring of railway bridge

**Contact:** [juxc2008@163.com](mailto:juxc2008@163.com)

## 1 Abstract

The U-shaped rib-to-deck welded joint in orthotropic steel deck is a part with multiple fatigue cracks. The penetration rate which is the ratio of penetration depth to U-shaped rib thickness has an important influence on fatigue performance of partial joint penetration (PJP) welds. In this study, the influence of penetration rate on the fatigue performance of U-shaped rib-to-deck welded joints was studied. Firstly, the finite element model of U-shaped rib-to-deck welded joints with penetration rate of 65%, 75%, 85% and complete joint penetration (CJP) welds were established. The mechanical characteristics of different welding forms under typical loading conditions were analyzed. It was found that with the increase of penetration rate of PJP welds, the stress concentration at the weld root weakened. Then fatigue tests on specimens with different weld penetration rate were carried out. The fatigue cracks of CJP welds all started at the inner welding toe of the U-shaped rib. However, the fatigue cracks of PJP welds mainly started at the welding root of the unfused weld. Fatigue *S-N* curves for PJP and CJP were regressed, respectively, it could be found that the fatigue performance of CJP welds was superior to that of PJP welds.

**Keywords:** fatigue property; weld penetration rate; rib-to-deck welded joint; orthotropic steel deck.