

**Reinforcement of Old-type Bridges against Earthquake by
Integrating Railway Steel Girder, Abutments and Embankment**

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The abutments are a kind of the structures to resist an earth pressure from an embankment. The abutments are located at the boundary between the embankment and the bridge, and are important structures compared with other structures such as a pier and a viaduct. The conventional abutments can be weak points, so they are apt to suffer from damages such as settlements during train passage and earthquake, receiving always the earth pressure from embankments. In this study, we have proposed a method to reinforce such conventional old-type bridges by integrating them with an embankment, and carried out a construction test using a real scale model, focusing on integration of girders with abutments and integration of abutments with embankments using nails. In addition, we carried out a series of vertical loading tests and long-term field observations using the real scale model and investigated the performance of the proposed integrated structures “Integral Bridge with Nail - Reinforced Soil” on small load levels.