

A New Seismic Retrofitting Method for Steel Bridge Piers in Japan

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Abstract

Japanese highway bridge design codes have been modified a lot since the Hyogoken-Nanbu Earthquake in 1995, but only used for designing new bridges. The aged steel piers constructed with old design code should be strengthened appropriately to adopt with current design code. With the purpose of improving the seismic performance of existing steel piers, a preventive seismic retrofit method by using GFRP plate, rapid hardening concrete, rubber-latex mortar, and reinforcement is proposed in this paper. The static loading tests on the steel piers before and after strengthening were performed to confirm the effects of the present strengthening method. Moreover, three-dimensional FE models were built to make a comparison study between the strengthened and the original steel piers. Load versus deflection relationship and sectional strain distribution on the piers were measured and compared between original piers and strengthened piers. Both experimental and numerical results indicate that the present strengthening method can greatly enhance the stiffness and reduce the stress levels of steel pier, resulting in the extension service life and improvement of the seismic performance of aged steel piers.

Keywords: Steel piers, seismic retrofit, loading test, numerical analysis.

1 Introduction

In Japan, severe damages of bridge piers have been caused in earthquakes, particularly in the 1995 Hyogoken-Nanbu earthquake. For steel bridge piers

with rectangular cross-sections, local buckling often occurs in the stiffeners during earthquakes, sometimes even resulting in the rupture of welded corners. On this background, seismic retrofit on existing bridge piers has become a concern.