



## Study on Large-Scale Repair Plan of the Kanmon Bridge (a Long-Span Expressway Suspension Bridge)

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### Abstract

The sliding and rotation functions of the line bearings that support the floor framing stringers have diminished; thus, fatigue cracks have developed in the floor framing around the deteriorated bearings. Also, water that leaks from the expansion joints of the floor framing stringers has caused noticeable deterioration. To prevent further deterioration and damage, replacements of bearings supporting the floor framing stringers, and connection of floor framing stringers were proposed. To secure seismic performance, installations of vibration dampers between the end of the floor framing stringers and the main tower or anchorage were proposed. Additionally, installations of elastic restraining cables were proposed for stability both under normal conditions and during earthquakes. A dynamic analysis of a large-scale earthquake taking into consideration the elasto-plasticity of the steel members was conducted to check the seismic performance.

**Keywords:** long-span suspension bridge; fatigue damage; large-scale earthquake; replacement of bearing; connection of floor framing stringer; seismic damper; elastic restraining cable; dynamic analysis; elasto-plastic behaviour.

### 1 Introduction

The Kanmon Bridge, the subject of this paper and whose panoramic view is shown in Figure 1, was constructed at the dawn of the long suspension bridge era in Japan (1973). Built specially for an expressway that crosses a strait, this suspension bridge has played an important role as an artery connecting Honshu and Kyushu. After being in

service for 42 years, the bridge is showing signs of deterioration from the natural environment and fatigue damage from increased traffic volume and larger vehicles. Specifically, the sliding and rotation functions of the line bearings that support the floor framing stringers have diminished; thus, fatigue cracks have developed in the floor framing support points. Also, water that leaks from the expansion joints of the floor