Corrosion Protection for Steel Bridge by Titanium Enclosure System

1. Introduction

With steel bridges constructed over the sea and in coastal regions, the maintenance and repair costs involved in repainting are major problems. In the case of elevated bridges spanning railways or trunk roads, it is difficult to safely install scaffolding for repainting. Besides, such maintenance and repair work on those bridges causes traffic jams, which in turn pose even more difficult problems relating to the environment, safety, and costs. Nippon Steel Corporation has developed a titanium enclosure system that helps resolve the above problems and prolong the life of bridges.

2. Structure and Features of the System

The titanium cover measures 1 m in width, 1.8 m to 20 m in length and 35 mm in thickness. It is exceptionally light (11 kg/m^2) and employs a rigid panel prefabricated at the factory. The panel is installed to the main girder of the bridge via a frame member made from structural steel. It employs a sandwich construction made of titanium sheet, painted steel plate and urethane core. Characteristically, the titanium cover installed on the main structure of a steel bridge (a) shuts out such corrosive elements as salt, wind and rain, and (b) provides a permanent scaffolding for routine maintenance, inspections and repairs. In the case of a steel plate-floored bridge, for example, the titanium enclosure system applied thereto reduces the cost of the initial heavy corrosion-preventive painting plus the cost of first repainting to about 60%. Taking into account the permanent scaffolding the system offers, it is economical in terms of the initial cost of construction too. This new technology has been registered in the New Technology Information System (NETIS) of the Ministry of Land, Infrastructure and Transport (registration number: HR-030027).

3. Verification of Corrosion Preventive Performance

The titanium enclosure system has already been applied to a seaside bridge (14 m in length, 5.6 m in width) along the quay that adjoins the raw materials yard within NSC Kimitsu Works. This bridge is about 5 m away from the edge of the quay. Thus, the area is highly corrosive which is characterized by considerable sea salt content and high humidity. Because sea salt significantly advances corrosion of steel, we measured the amount of sea salt deposited on the bridge to determine the efficacy of the system. The amounts of sea salt deposition on the inner and outer surfaces of the titanium cover were measured by removing them with a piece of gauze. The inner surface of the titanium cover showed very little salt deposition, whereas the amount of salt deposition on the outer surface was about 650 mg/m^2. Three types of exposure test surfaces (bare SS 400, inorganic zinc-rich primer and modified epoxy resin coat) were set up

Photo 1 General view

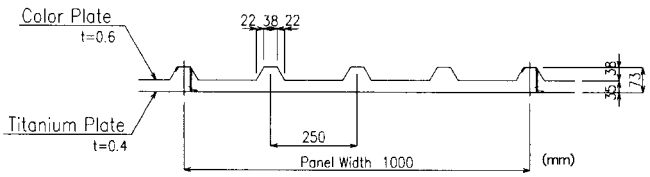

Fig. 1 Titanium cover section

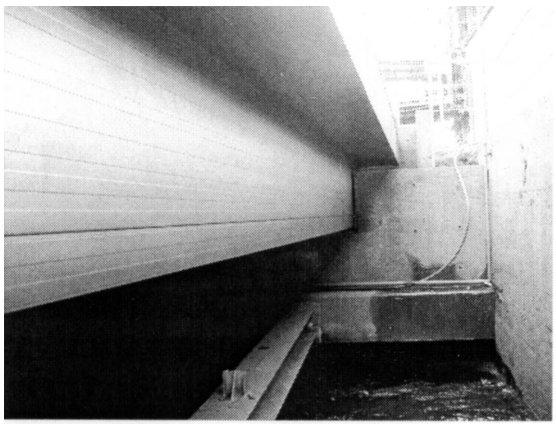

Photo 2 A bridge on Kimitsu Works

on the inner surface of the titanium cover. Using an exposure test carried out one year later, it was found that the primer and the coat were completely free of corrosion and that the bare SS 400 had been corroding very slowly, although a little rust was observed (**Photo 3**).

From the above results, it was confirmed that the titanium cover shuts out corrosive elements (salt and other impurities) and dramatically improves the corrosive resistance of the bridge body inside the cover.

For further information, contact
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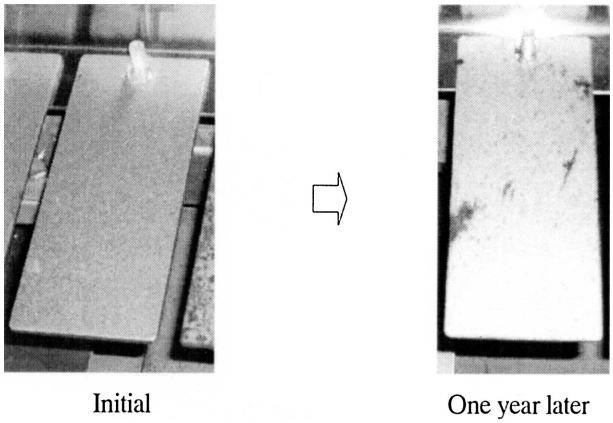

Photo 3 Exposure test-piece