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Railway Bridges of Corrosion Resistant Steel in Japan

Ponts ferroviaires en acier résistant à la corrosion au Japon

Eisenbahnbrücken aus korrosionsbeständigem Stahl in Japan

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1. INTRODUCTION

A considerable number of railway bridges have been constructed of corrosion resistant steel, so-called "weathering steel", without painting in these ten years in Japan (say, 70 sets of span and 11,742tons in total). Some of them were furnished with test specimens for future observation. This type of bridge has been applied to only an open type bridge, where the structural members are well exposed to rainfall and located in rural areas where air is not polluted. Such conditions are favorable to formation of the stable patina, an anticorrosive surface layer,which is essential to the protection of steel from corrosion. At present, all the brides are generally in a very satisfactory condition and prove to be successful.

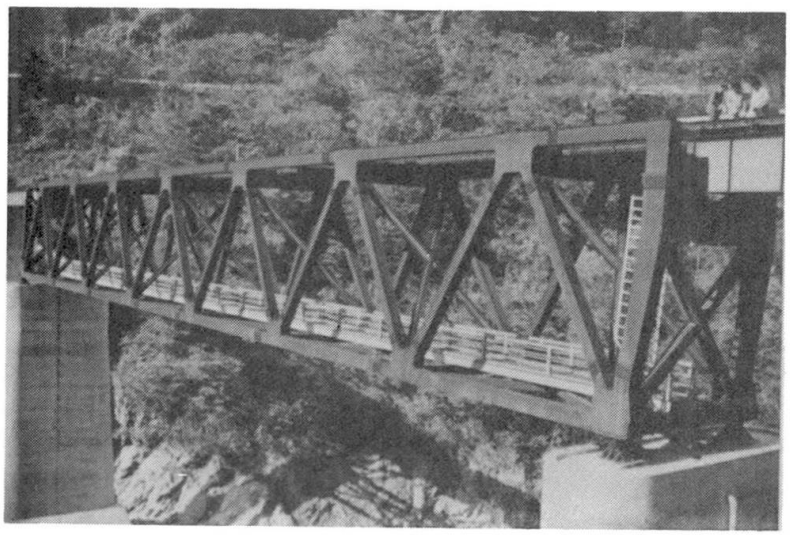

Photo 1. Third Okawa Bridge

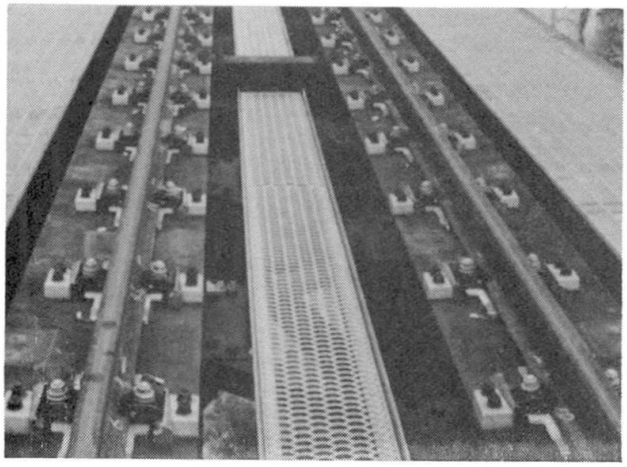

Photo 2. Track structure

2. STRUCTURAL DETAILS

The structural details of the weathering steel bridges for railways in Japan are so modified, as to fit the use of weathering steel without painting. They have been carefully designed, so that water and dust staying on the structural members should be minimized as shown in Fig. 1. Such considerations will be useful also to ordinary painted bridges for better durability. In Third Okawa Bridge (Photo 1), for instance,

1) The upper surfaces of horizontal members, even the flanges of stringer and

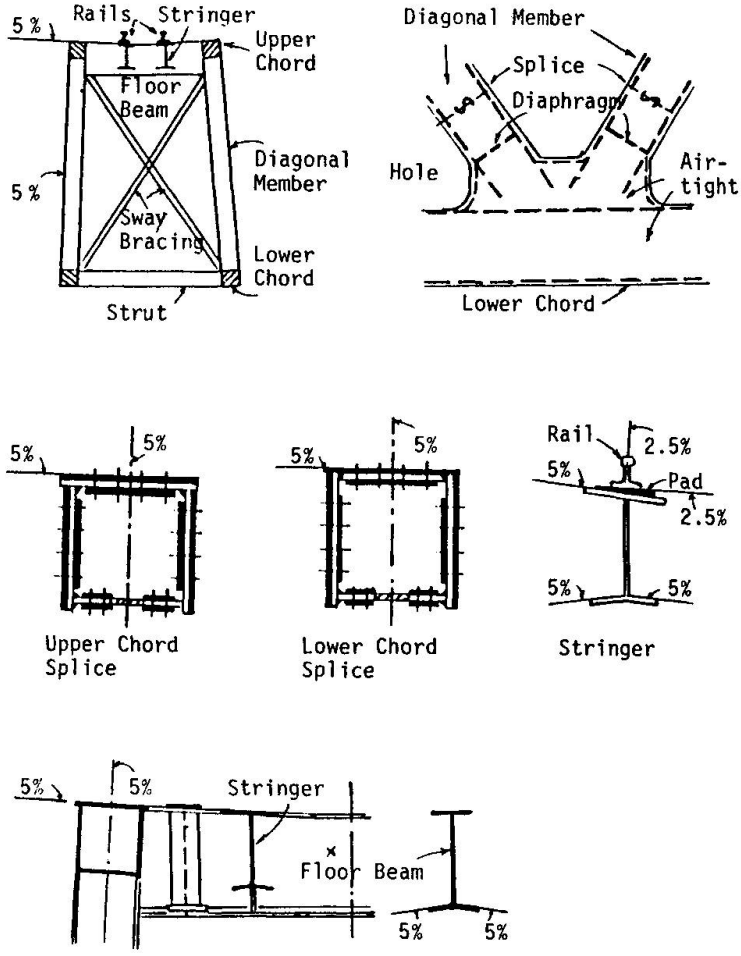

Fig.1. Examples of structural details

floor beam and chord members are inclined by 5%.

2) Larger horizontal gusset plates are provided with large openings.

3) The chord members and the panel point portions are closed for air- tightness, except for their splice portions, the inside of which is coated with tar - epoxy resin paint.

4) The rail track structure is different from an ordinary one with wood sleepers. Since the flange surface in contact with the sleepers is usually most severely damaged by corrosion, the rails are fastened to the flanges of the steel girders with a special device instead of wood ties as shown in Photo 2. It is drastically effective in reduction of maintenance work for the track as well as the bridge structure. And

5) The edge of the upper side of concrete pier is raised and water is gathered to the drain pipe, so that rainwater washing the bridge may not stain the flank of pier, as seen in Photo 1.

3. EXAMPLE OF OBSERVATION

Five years after Third Okawa Bridge was erected and opened to traffic, the bridge structure and the test specimens installed nearby were closely examined, by the visual inspection, X-ray test, Ferroxyl test, etc. In addition, some bolts used in the bridge were removed to see the state of bolts themselves and the inside of bolt holes. The summary of the results is as follows; 1) As a whole, the condition is so good, that reduction in the plate thickness can not be measured. 2) According to Ferroxyl test on various parts of the bridge and X-ray test on the exposed specimens, the stable patina has been better formed on the surface which has been directly exposed to rain-fall and dried immediately. From this point of view, the upper surface is most favorable, if water does not stay, and followed by the vertical surface on a sunny side. In case water is apt to stay on horizontal surface, however, the patina is not easily formed. On the surface of underside, the patina is seldom formed and slight corrosion pits are recognized, but the rate of corrsion is very slow if the enviromental atmosphere is not humid, and 3) Some of the bolt holes were filled with water. Though it has resulted in no appreciable detrimental effect as yet, it may cause the corrosion of the bolts in the future. It will, therefore, be necessary to keep them water-tight.