Applicability of a New Method for Selecting Weathering Steel for Bridges

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Weathering steel bridge has recently received increased attention because correct applications of weathering steels to infrastructures are beneficial for reducing maintenance cost. In Japan, the conventional weathering steel specified as Japan Industrial Standard G 3114 SMA (JIS-SMA weathering steel) and advanced weathering steels from three Japanese steel makers, are available commercially. In the construction of the weathering steel bridges, it is important to judge whether the weathering steels applied to the structure are suited to the local environment. Since corrosion loss is related to deposition rate of air-born salt, the Japanese Roads and Bridges Policy Manual(1) states that JIS-SMA weathering steel can be used without rust controlling surface treatment for bridges in regions where the deposition rate of air-born salt is less than 0.05 mdd (NaCl:mg/dm^2/day). However, the standard to be applied to advanced weathering steels is not stipulated clearly. Corrosiveness of atmosphere differs by location, so a corrosion prediction method for both conventional and advanced weathering steels is needed at the planning and/or design stage to ensure selection of materials that will enhance structural durability. JSSC technical report (2) proposes a new material selection method for conventional and advanced weathering steels, which can be used on the spot. In this study, this proposed material selection method was applied to weathering steel bridges to be built in Matsue. This area has a hot and very humid rainy season that lasts from early June to mid-July. Also, in the winter season, air-born salts are abundant due to prevailing westerly winds. The applicability of the method and other issues are discussed on the basis of exposure testing results and observation of the environments.

The proposed method is based on short-term exposure testing using a new type of exposure specimen (2) (50mm x 50mm x 2mm/t). Figure 1 shows the localities of environmental observations and exposure testing points. In Figure1, point A is an exit bridge near the construction site, and points B and C are exposure localities site. The simplified stand used for the exposure testing as shown in Photo 1. Figure 2 shows the curves for rust thickness vs. exposure period for exposed specimens at points A and B.

We tried the new short-term exposure testing method to predict long-term corrosion losses that could occur on the weathering steel bridges. The penetration curves of weathering steels can be expressed by the following equation(3),

$$Y = AX^B \qquad [1]$$

where X is time in years, Y is the penetration (mm), A is the first year corrosion loss(mm), and B is the index of corrosion rate diminution. From the short-term exposure testing results, we were tried to find the value of A and to estimate the corrosion loss in Matsue after 100 years.

In summary, the proposed method is useful to assess the applicability of recently developed advanced weathering steels, but we also admit that there is still room for improvement in this proposed method.

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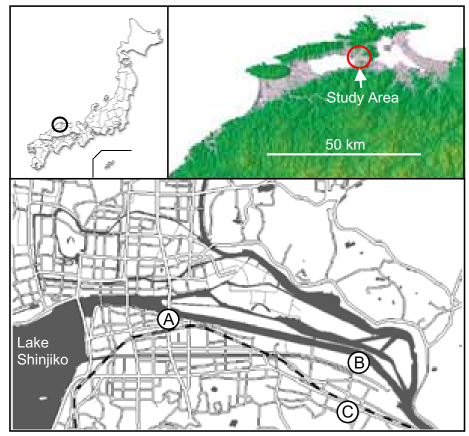

Figure 1 The localities of environmental observation points and exposure testing points.

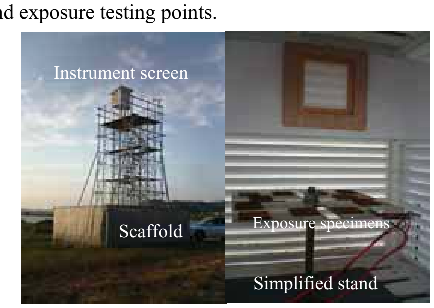

Photo 1 Exposure testing position and environments observation instruments at construction site (Point B).

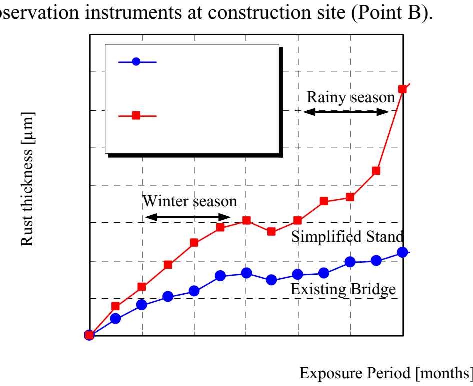

Figure 2 Relationship between rust thickness and exposure period (JIS-SMA specimens).