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Commentaries

Status report on damages of bridges and management efforts in Kagawa prefecture municipalities

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Keywords: deterioration problem of old bridges, bridges managed by municipality, on-site investigation, long-life bridge rehabilitation plan

Deterioration of the old bridges managed by local governments has become a problem. For municipal road administrators in Kagawa Prefecture, I have held a practical bridge maintenance and management course to improve their skills. Through this course, the current status of the bridges managed by municipalities in Kagawa Prefecture has become clear by on-site investigation. I will explain this status and the municipal measures against aging bridges.

In 2007, a truss bridge fell down in Higashikagawa City in Kagawa Prefecture. Photo 1 is an image of the bridge before removed. The fracture of its truss lower chord member obviously shows that no maintenance had been done on this bridge. This accident triggered my doubts about the safety of the bridges managed by municipalities.

Photo 1 Truss bridge which fell down in 2007

Photo 2 shows a slab bridge damaged due to concrete neutralization. The concrete has felt away and some reinforcing bars are exposed. This bridge is in front of the side gate of a junior high school and students cross it in the morning and afternoon. It is not the civil engineering division but the education board that manages this bridge, and I am afraid that the current state of the bridge is not properly reported to the board.

Photo 2 Slab bridge damaged due to concrete neutralization

Photo 3 is a RCT-beam bridge with salt damage in Shodoshima Island. At the time of construction, the concrete was not adequately distributed throughout the beams due to densely-arranged reinforcing bars, and strong sea winds corroded the rebars.

Photo 3 RCT-beam bridge with salt damage

The national and prefectural governments maintain and manage bridges under long-life bridge rehabilitation plans, making necessary repairs before bridges suffer from serious problems. However, municipal governments that do not have sufficient budgets and engineers need different maintenance and management measures. I will offer a direction in those measures in this paper.

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Commentaries

Performance Evaluation of Silane-Based Hydrophobic Impregnation

—Comparison with the European standard (EN 1504-2) —

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Keywords: repair, protection, European standard, surface protection, hydrophobic impregnation

A performance evaluation of silane based hydrophobic impregnation (here after refer to as "SBHI", Table 1) according to both the Japanese (JP) and European (EN) standards was conducted. The measured value and these grading were subsequently compared.

It was found that the performance of water tightness and the prevention of chloride penetration by the SBHI treatment were greatly improved, but it was ineffective in the inhibition of carbonation (see Fig.1). In addition, improved performance was not observed when excessively coating was employed.

Comparisons of the results obtained from the performance evaluation based on the JP and EN standards are shown Table 2. It was confirmed that SBHI evaluated in this study conforms to both the specifications of the EN standard (EN1504-2) and the JP standard which is provided by JSCE.

When the EN standard was compared with the claims postulated by the JP standard, it was confirmed that direct comparisons of the results obtained from the evaluation were difficult because the number of common items for the evaluation is too small and their test conditions differ significantly.

Table 1 Silane-based hydrophobic impregnation

Externals	White paste	
Active ingredient	≦80 wt% (Silane compound)	
Density	around 0.9g/cm^3	
pH	around 8.0	
VOC density	≦77 g/lt	
Infiltration performance	Class Ⅱ: ≧10 mm	(EN1504-2)
Water absorption	<7.5% <10.0% (After alkali treatment)	(EN1504-2)

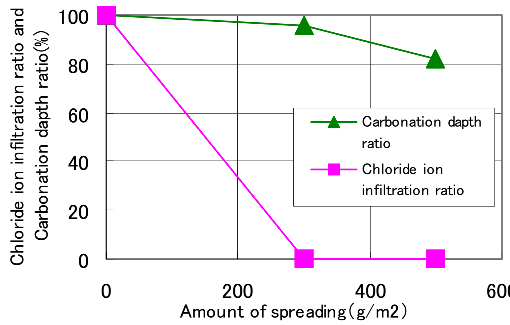

Fig.1 Relation between permeability and the amount of spreading

Table 2 Comparisons of the results obtained from the performance evaluation based on the JP and EN standards

Evaluation item	Test Results		Evaluation results	
	European standard	JP standard	European standard	JP standard
Freezing and thawing *	⊿C≒23	—	Satisfied	—
Impregnated depth	11mm (300g/m^2)	6.7mm (300g/m^2) 9.4mm (500g/m^2)	Rated to Class Ⅱ	—
Water absorption	5.1% 5.3% (After alkali treat.)	8%	Satisfied	Rated to Grade A
Moisture vaper permeability	39%	63%	Rated to Class I	Rated to Grade B
Permeability	—	14%	—	Rated to Grade A
Resistance of carbonation	—	96%	—	Rated to Grade C
Chloride ion permeability	—	0%	—	Rated to Grade A

＊: ⊿C : F&T cycles when weight begins to decrease (Treated specimen) — F&T cycles when weight begins to decrease (Non treated specimen)

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Technical reports

Study on X-Ray Fluorescence Analysis of Silica Fume Using Sample by Press Forming

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Keywords: Silica fume, X-ray fluorescence analysis, Press forming, Grinded mixing, Wax, Chemical analysis

X-ray fluorescence (XRF) is expected to enable rapid chemical analysis of silica fume However, if glass beads, which are used in the XRF analysis of cement, are applied to the analysis of silica fume, volatile components in the beads may affect the test results. In this study, XRF analysis of silica fume using a press-formed sample was investigated experimentally to obtain basic data on the sample preparation method, which is one of the most important problems associated with using XRF to perform chemical analysis of silica fume.

Preparation of a pressurized powder sample by mixing one part by mass of wax to four parts by mass of silica fume for 20 s under a load of 20 tons was found to be an appropriate press-forming condition (Photo. 1). XRF analysis results of the standard reference material of silica fume (NIST SRM 2696) agree well with the certified values of the standard material under the present sample preparation conditions (Table 1).

These results demonstrate that XRF can be applied to chemical analysis of silica fume by using samples prepared by pressure forming under suitable sample preparation conditions; in particular, the results are not affected by volatile components, which are problematic in glass bead samples.

Photo.1 Press-formed Sample (*d* = 35 mm)

Table.1 XRF Analysis Results of NIST Standard Reference Material 2696, Silica Fume (%)

Calibration curve	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Na_2O	K_2O	P_2O_5	Cl
JIS(1)	96.29	-	-	-	0.149	0.142	-	-	-	0.165
JIS(2)	96.36	-	-	-	0.148	0.144	-	-	-	0.167
JIS(2)*	96.02	-	-	-	0.154	0.138	-	-	-	0.162
XRF(1)	96.74	0.195	0.026	0.440	0.201	0.085	0.149	0.653	0.099	0.185
XRF(2)	96.80	0.193	0.031	0.441	0.200	0.088	0.153	0.652	0.099	0.187
XRF(2)*	96.50	0.186	0.018	0.413	0.206	0.084	0.154	0.631	0.096	0.185
Standard Reference Material 2696	95.61	0.208	0.055	0.426	0.235	0.160	0.129	0.652	0.086	0.172

Note) JIS; Calibration curve based on data by JIS A 6207, XRF; Calibration curve based on data from the manufacturer's test report, The numbers in parentheses; Times of repetition
*; Correction coexisting elements

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