Immersion Test on Silane Coated Concrete

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Abstract:

The performance of silane coated concrete samples was tested by immersing the coated samples in water and 15 % NaCl solution for 21 days. Silane coated concrete had a 32 percent less water uptake than uncoated concrete and a 52 percent less NaCl uptake than uncoated concrete.

Introduction:

Concrete bridge structures are undergoing accelerated deterioration caused by corrosion of the embedded reinforcing steel. This deterioration can affect such bridge members as the piles, walls, piers, caps, girders, diaphragms as well as the top and bottom surfaces of the bridge decks. The corrosion is caused primarily by the gradual intrusion of chloride ion into the concrete from deicing salts and from salt water exposure in the coastal regions. The steel corrosion is accelerated when the protective concrete cover over the embedded bars is inadequate and/or when there are cracks in the concrete. Several methods are used in protecting concrete surfaces including coating concrete. Coating materials used in protecting the concrete from corrosive environments include epoxies, methacrylate, urethane, silicate, siloxane and silanes.

Objective:

The main objective of this study was to investigate the effectiveness of silane coating in reducing the diffusion of water and salt solution into the concrete used in structural elements.

Materials and testing program:

The concrete specimens used were cylinders of 3 inch diameter and 6 inch height. The concrete specimens were classified as Class H by the Texas DOT cooperation and had an early strength of 7800 psi after 7 days and a strength of 10,400 psi after 28 days. Specimens were water blasted at 1500 psi before coating. The specimens were weighed accurately to 0.01 gms and a total of 8 specimens were used in this study. The specimens were dried at room condition for one day before applying the silane coating to it. The coated specimens were cured at room condition for 21 days before immersing in water and 15 % NaCl solution. Based on the manufacture's literature, the silane used had a specific gravity 0.95, flash point 77 F, coating V.O.C 2.63 lb/gal, and was characterized as a clear yellow liquid soluble in water.

Specimens were used in duplicates as the changes in weight with immersion time are shown in Figs. 1 and 2. It can also be noted that the largest change in weight occurred after one day of immersion.

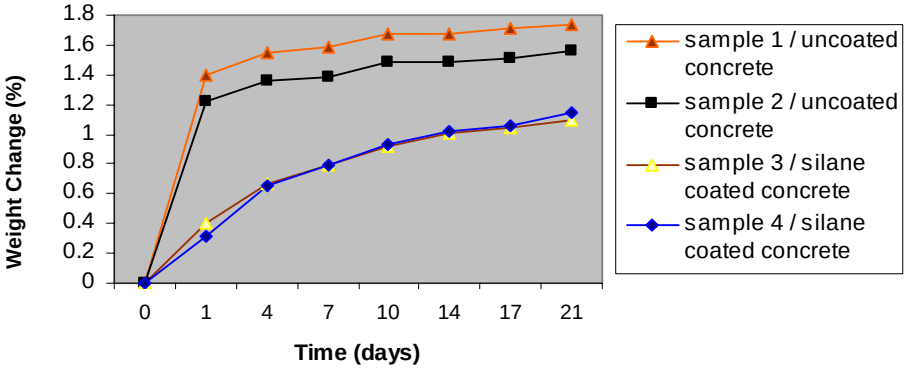

Figure 1.Comparison between silane coated concrete and uncoated concrete immersed in water

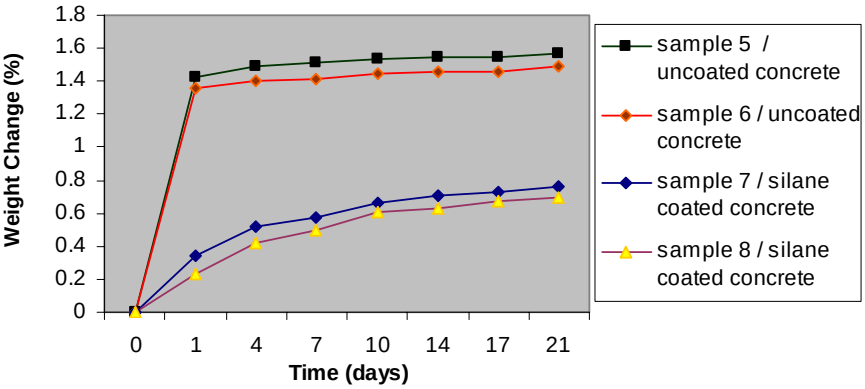

Figure 2. Comparison between silane coated concrete and uncoated concrete immersed in a 15 % NaCl solution

Conclusions:

The average water uptake values were 1.65 % and 1.12 % for uncoated and silane coated specimens respectively. The average uptake in 15 % NaCl solution were 1.53 % and 0.73 % for uncoated and silane coated specimens respectively. Silane coated concrete had a 32 percent less water uptake than uncoated concrete. Silane coated concrete had a 52 percent less NaCl uptake than uncoated concrete.

Acknowledgement:

This project was supported by the Center for Innovative Grouting Materials and Technology (CIGMAT) under grants from Texas Department of Transportation and various industries.

Reference:

Pfeifer, D. W. and Scali, M. J. (1981), “Concrete Sealers for protection of bridge structures.” National Cooperative Highway Research Program Report 244.