Caltite Performance In A 50 Year Old Concrete Roof

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Abstract: This study investigates the performance of concrete (dosed with) incorporating a hydrophobic pore-blocking admixture (Caltite) in 50 year old, Class B2-exposed concrete roof slabs of the Pan Pacific (formerly Sheraton) Hotel in Perth, Western Australia. In this study, 37 concrete cores were extracted from the roof of this structure (The cores were split) and separated into two groups: concrete containing Caltite and concrete absent of Caltite, with the latter to be used as controls. A thorough testing regime was performed which (included tests to confirm) including for admixture & cement content, depth of carbonation, chloride (depth) profiling, water absorption and volume of permeable voids (VPV). Petrographic analysis and scanning electron microscopy were also conducted (on cores from each group). Caltite samples showed significant resistance to water & chloride ingress when compared with controls from the same structure. Microstructural differences were found and waterproofing characteristics were observed to persist despite age.
Keywords: keyword, keyword, keyword, keyword, keyword.

1. Introduction

This study investigates the long-term durability of an exposed concrete roof structure incorporating a hydrophobic and pore-blocking ingredient (HPI – "Caltite"), after 50 years in-service. The Pan Pacific Hotel (formerly, the Sheraton Hotel) located in Perth, Western Australia, was designed by Hobbs, Winning, Leighton & Partners Architects and Engineers and construction was completed in 1971. At the time of construction, the decision was made to incorporate Caltite, a hydrophobic and pore-blocking admixture, within the concrete of the level 9 and level 23 roof slabs in lieu of the application of a waterproof membrane. The level 9 and level 23 roof slabs have been in place for 50 years and have provided satisfactory in-service duty, without any leakage or apparent concrete deterioration despite poor rainwater outlet location and long-term deflection causing significant ponding on the level 9 roof. Concrete samples were obtained from the roof of the hotel, with permission from hotel management to enable the first study of this kind; the evaluation of 50-year performance of weather-exposed concrete containing Caltite in real-world exposed conditions.

Cast at the same time as the roof slabs at level 23, were several concrete plinths, used to support air-conditioning units. The plinths were exposed to a similar level of airborne salt deposits as the roof slabs and have given poor in service duty. The concrete plinths did not contain Caltite, but were of a similar concrete mixture and were therefore able to serve as a control sample to compare against concrete samples obtained from the roof which contained Caltite. This allowed a direct comparison of Caltite samples vs non-Caltite samples to be made

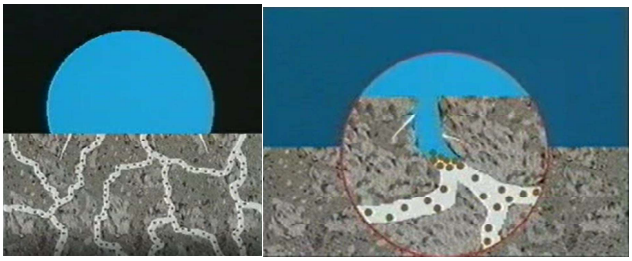

Figure 1. Illustration of the waterproofing mechanism of action of Caltite through (a) decreased contact angle of water due to increased surface tension and (b) polymer particles lining pores and mechanically blocking water ingress (Source Caltite Website – with permission) ..

1.1 "Caltite" Hydrophobic and Pore-blocking (admixtures); mechanism of action

The Caltite Hydrophobic (and) Pore-blocking Ingredient is described by the manufacturer to provide resistance to water ingress through (a hypothesized) dual mechanism, whereby the concrete capillaries are (coated) lined with a hydrophobic compound to reverse capillary action and "primed" with physical polymeric particles, which coalesce to plug capillaries & physically block water entry when subject to hydrostatic pressure [1]. Water and chloride repellent construction solutions in flat concrete roofs broadly fall into two categories; concrete admixtures and more traditional membranes and coatings (including