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Efflorescence Phenomenon on Concrete Structures

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Abstract. Since the introduction of modern pigmented concrete products in the early 1950's, coloured concrete products have opened new possibilities in the field of building and landscape design and ironically to a new visible phenomenon called efflorescence. Unfortunately, despite careful selection of raw materials and conscientious compliance with the production parameters, colour changes of the finished products are always the enemy. In many cases, these colour irregularities often described as fading is attributed to calcium carbonate efflorescence. One might question how efflorescence can still occurs after presumably, manufacturers have done everything right such as utilized quality materials, had a good mix design, exceeded strength requirements and met production schedule. By studying in depth the mechanism of efflorescence one might answer this mind-boggling question. Although, a great deal of work has been done in investigating the phenomenon of efflorescence and agreement has been reached to a large extent by researchers worldwide on the mechanism behind the formation of efflorescence, there is still no effective methods that can be used by concrete manufacturers to prevent the formation of efflorescence on finished concrete products. This paper has the purpose of providing some direction for future work to mitigate this phenomenon.

Introduction

In the past, when architects and designers mentioned concrete, people rarely got excited. It usually meant a dull, grey, visually unappealing appearance. Since the introduction of modern pigmented concrete products in the early 1950's, coloured concrete products have opened new possibilities in the field of building and landscape design. Today, concrete can be cast into a variety of finishes and colours offering architects and the construction industry a material that is both practical and aesthetically pleasing. The currently available inorganic colour pigments, for example iron oxide pigments, are lightfast and weather-stable[1]. The strong colour they impart to concrete will stand up to decades of rough wear and tear.

Unfortunately, despite careful selection of raw materials and conscientious compliance with the production parameters, colour changes of the finished products are always the enemy. In many cases, these colour irregularities often described as fading is attributed to calcium carbonate efflorescence. It is important to point out that the pigments used to colour concrete have no influence on the development of efflorescence [2].

Efflorescence, which used to be ignored due to its relatively harmless effect structurally, has suddenly become a big and costly problem to the manufacturer, the pigment and the concrete producers. The primary efflorescence as opposed to secondary efflorescence is creating more problems since it occurs immediately after production since the manufacturer usually has to bear the cost of unsatisfied customers. By studying in depth the mechanism of efflorescence we might understand this phenomenon better. Although, a great deal of work has been done in investigating the phenomenon of efflorescence and agreement has been reached to a large extent by researchers worldwide on the mechanism behind the formation of efflorescence, there is still no effective methods that can be used by concrete manufacturers to prevent the formation of efflorescence on finished concrete products.

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