PROJECT PROFILE

Bridge and Highway Barriers

Calcined Dolomite Contamination of Concrete | United Kingdom

CLIENT

Multiple international engineering, construction, and management services firms

BACKGROUND

Coarse aggregate used in the manufacturing of precast and cast-in-place concrete was contaminated with calcined (dead-burned) dolomite. The contamination of the aggregates was not discovered at the source, leading to the manufacturing of precast and other concrete products containing the deleterious dolomite particles. Shortly after installation the affected products began to exhibit progressive surface popouts. The popouts were typically no greater than 10 mm deep and 50 mm in diameter, and their frequency relative to the products surface area was found to be generally small.

WJE was requested to provide engineering and material testing services to investigate the effects of aggregate contamination with calcined (dead-burned) dolomite particles on the performance and durability of precast concrete structures. Specifically, WJE was asked to assess the structural integrity and durability of concrete deemed to be defective based on past experience, structural assessment, material testing, and the established testing protocol.

SOLUTION

Previously projects related to concrete contamination with expansive aggregates resulted in the development of a mathematical model that helped understand the behavior of expansive particles embedded in concrete. These studies conservatively predicted a damage threshold concentration of contaminant by volume of concrete where structural distress should not be a concern. The objective was to determine the concentration of aggregate contaminant in concrete and assess the effect of resulting popouts on the structural integrity of the precast concrete elements. The results concluded the following:

- Physical characteristics of the contaminant, such as observed porosity, friability, and some pre-hydration of particles, indicated a reduction in the generated expansion.
- The concentration of the contaminant was estimated to be less than the suggested threshold and found not to be a concern to the overall structural durability of the concrete elements.
- Structural assessment of the expanding calcined dolomite particles and effect of popouts on the capacity of structural elements predicted essentially no effect on the integrity of the structure. Effective repairs could be implemented.

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS