

Thaumasite form of sulfate attack (TSA)

Introduction

The unexpected discovery of a rare form of sulfate attack (thaumasite sulfate attack or TSA) on buried concrete in highways structures in Gloucestershire raised concern that this form of concrete deterioration may be more widespread. This concern was compounded by the lack of visibility of deterioration in the above ground parts of the affected structures.

What is TSA and what are its consequences?

TSA is a form of sulfate attack but it requires the presence of carbonates in the concrete (usually in the aggregates) as well as sulfates in the groundwater. It only occurs at low temperatures (below 15°C) and in very wet ground. Thaumasite gradually replaces the cement paste matrix of the concrete, causing the concrete surface to soften and eventually to disintegrate. TSA can attack concretes containing a wide range of different cements including those that are resistant to the more well known form of sulfate attack. The rate of attack on good quality concrete is relatively slow. Structural failure as a result of TSA is unlikely and would be preceded by early warning signs, such as cracking and deflection.

What is the scale of the problem?

Currently only about 60 instances of TSA have been uncovered in bridges and other structures, mainly in identifiable high risk areas. Simultaneous occurrence of all the known risk factors will be unusual and the majority of identified cases have been restricted to concrete buried in the Lower Lias or Kimmeridge clays of the West Country. Some cases have also been identified in the North East, where concrete is in contact with pyrite-containing colliery waste ('red shale').

What is being done?

Soon after the initial identification of TSA in Gloucestershire, Government formed an expert group to consider the problem and to produce guidelines for risk analysis, diagnosis, remedial work and new construction. BCA was represented on the expert group. Subsequently BCA collaborated with the BRE in the production of *Special Digest 1, Concrete in aggressive ground*. This document forms the basis of the recommendations intended to reduce the risk of future TSA in the UK. In most cases carbonate-containing aggregates can still be used in combination with appropriate cement types.

Where can I find out more?

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Thaumasite Expert Group, *The thaumasite form of sulfate attack: Risks, diagnosis, remedial works and guidance on new construction. DETR 1999*

Building Research Establishment, *Concrete in aggressive ground. Special Digest SD1, Third Edition, 2005*

Document No: ST/FS/2	Revision No: 0
Author: C A Clear	Drafted: 21 April 06 Last revised: