

Aggregate Concrete Blocks Use in Sulphate Soil Conditions

Sulphate Soil Classification (BRE Special Digest 1)	CBA Block Specification
DS-1	Aggregate concrete blocks meeting the requirements for use below dpc as given in Data Sheet 4 or BS 5628 : Part 3 : Table 12.
DS-2 and DS-3	Aggregate concrete blocks meeting the following requirements: <ul style="list-style-type: none"> a Specified block strength 7.3N/mm². b Aggregate to BS EN 12620 and/or FBA to BS EN 13055-1

Introduction

Aggregate concrete blocks have been used successfully below ground level for many years. A significant proportion of these will have been used on sites where sulphates are present, and no failures of precast aggregate concrete blocks from sulphate attack have been reported.

Requirements

Guidance

The Guidance on the use of aggregate concrete blocks in sulphate soil conditions which was first introduced into the BRE Digest 363:1991 remains essentially the same in the new BRE Special Digest 1: 2005 Concrete in Aggressive Ground: Part F Design guides for specific precast concrete products, F5 Design guides for precast concrete masonry units, which has now replaced Digest 363.

Aggregate blocks for general use below ground i.e. those meeting the requirements set out in BS 5628: Part 3: 2005 Table 12, may be used in Design Sulphate Classes DS-1, 2 and 3 although criteria given for suitability in the higher sulphate classification soils are considered by CBA to be more onerous than the long term empirical evidence and subsequent research⁽¹⁾⁽²⁾ have indicated.

Current practice

Current building practice is such that where masonry is used below ground level it is usually limited to the top one metre depth. At the same time, sulphate levels in the top one metre of UK soils are rarely more severe than Class DS-1. It follows that the depth at which samples are taken to enable the sulphate soil classification to be determined should be indicative of the depth where the masonry is being used. BRE Special Digest 1 now draws attention to this.

The CBA has undertaken an extended programme of testing concrete cubes cut from blocks, made from different binders in conjunction with commonly occurring natural aggregates to BS EN 12620 and furnace bottom ash (FBA) to BS EN 13055-1. Cubes which were totally immersed for 3 years in sulphate solutions maintained to Class DS-4 equivalent soil classification, have shown exemplary performance.

Research

The CBA research work supports the BRE statement that surface carbonation enhances sulphate resistance. Consequently the requirement in Digest 363 for aggregate concrete blocks to have 50% of the least cross-sectional area to be carbonated for sulphate soil classifications DS-2 and 3 has been replaced by a requirement for blocks to be surface carbonated for a minimum of 10 days.

Such exposure to air and surface carbonation will normally take place without any special provisions between the time of manufacture and back-filling after construction.

CBA research has also shown that by virtue of its particular manufacturing process, block concrete, despite its high entrapped air content and open texture has aggregate particles bonded together by a dense cementitious paste.⁽²⁾

References:

- 1 Pettit G J L, Harrison W H and Littleton I, Sulphate Resistance of Aggregate Concrete Blocks BIBM Congress, Paris 1996.
- 2 Pettit G J L, Harrison W H. Understanding the durability of aggregate concrete masonry units through a comparison of cement matrices of wet and semi-dry mix concrete. BIBM Congress, Venice 1999.

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