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Irish Standard
I.S. 465:2018+A1:2020

Assessment, testing and categorisation of damaged buildings incorporating concrete blocks containing certain deleterious materials and Amendment 1:2020

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Department of Housing ,Planning and Local Government has sponsored the distribution of this Standard

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I.S. 465:2018+A1:2020

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I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation - recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

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DECLARATION

OF

SPECIFICATION

ENTITLED

ASSESSMENT, TESTING AND CATEGORISATION OF DAMAGED BUILDINGS

INCORPORATING CONCRETE BLOCKS

CONTAINING CERTAIN DELETERIOUS MATERIALS AND AMENDMENT 1:2020

AS

THE IRISH STANDARD SPECIFICATION FOR

ASSESSMENT, TESTING AND CATEGORISATION OF DAMAGED BUILDINGS

INCORPORATING CONCRETE BLOCKS

CONTAINING CERTAIN DELETERIOUS MATERIALS AND AMENDMENT 1:2020

NSAI in exercise of the power conferred by section 16 (3) of the National Standards Authority of Ireland Act, 1996 (No. 28 of 1996) and with the consent of the Minister for Business, Enterprise and Innovation, hereby declare as follows:

1. This instrument may be cited as the Standard Specification (Assessment, testing and categorisation of damaged buildings incorporating concrete blocks containing certain deleterious materials and Amendment 1:2020) Declaration, 2020.

2. (1) The Standard Specification set forth in the Schedule to this declaration is hereby declared to be the Standard Specification for Assessment, testing and categorisation of damaged buildings incorporating concrete blocks containing certain deleterious materials and Amendment 1:2020.

(2) The said Standard Specification may be cited as Irish Standard 465:2018+A1:2020 or as I.S. 465:2018+A1:2020.

3. (1) The Standard Specification (Assessment, testing and categorisation of damaged buildings incorporating concrete blocks containing certain deleterious materials) Declaration 2018 is hereby revoked.

(2) Reference in any other standard specification to the Instrument hereby revoked and to Irish Standard 465:2018 thereby prescribed, shall be construed, respectively, as references to this Instrument and to Irish Standard 465:2018+A1:2020.

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Foreword

This Irish Standard was developed by the NSAI Concrete Blocks Committee (NSAI/TC 063).

Arising from the Report of the Expert Panel on Concrete Blocks (June 2017) [1] this Irish Standard has been developed for use by those who intend to provide assessment and testing services for dwellings that are suspected of being affected by defective concrete blocks.

This is the first edition of this Irish Standard. A1 Amendments are indicated by the TAGs A1 A1 A1

This Irish Standard is not intended for:

a) the specification, manufacture and testing for compliance of new concrete blocks (aggregate concrete masonry units) in accordance with I.S. EN 771–3 (and associated testing Standards) or as a replacement to the guidance provided in Standard Recommendation S.R. 325; and

b) dwellings not exhibiting structural damage consistent with defective concrete blocks, see Clause 4.

A1 This document, I.S. 465:2018+A1:2020 has been prepared by the NSAI concrete Blocks Committee (NASI/TC 063).

This document is an amendment to I.S. 465:2018 - Assessment, testing and categorisation of damaged buildings incorporating concrete blocks containing certain deleterious materials.

The Expert Panel on concrete blocks in Donegal and Mayo was reconvened by the Department of Housing, Planning and Local Government (DGPLG) to provide clarification in respect of Option 1 in Table 5.2 of the Report of the expert panel on concrete blocks.

On foot of a clarification issued by the Expert panel to the DHPLG in relation to Option 1 in Table 5.2 of their report in December 2019 it is necessary to include this clarification in I.S. 465:2018 as Table 5.2 has been reproduced verbatim in Table D.2 in Annex D of this standard.

A new Annex F which contains the text of the clarification is included in this amendment along with an additional note in Clause 8.3 referring the reader to the new Annex F.

A further footnote is included in Table D.2 referring the reader to the new Annex F. A1

Compliance with this Irish Standard does not of itself confer immunity from legal obligations.

In line with international standards practice the following representation of numbers and numerical values apply:

- The decimal point is shown as a comma (,) throughout this Irish Standard.
- Each group of three digits reading to the left or to the right of a decimal sign are separated by a space from the preceding digits or following digits respectively.

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0 Introduction

0.1 General

The Report of the Expert Panel on Concrete Blocks (June 2017) [1], commissioned by the Minister of Housing, Planning and Local Government, to investigate the problems emerging in the concrete blockwork of certain dwellings in County Donegal and County Mayo concluded that "the nature of the problem is manifested primarily by the disintegration of concrete blocks used in construction of affected dwellings in Counties Donegal and Mayo which in turn results in a pattern of cracking in the external render of these dwellings".

The Expert Panel was of the opinion that "the reason for the widespread pattern cracking in private dwellings in Counties Donegal and Mayo is primarily due to the excessive amount of deleterious materials in the aggregate used to manufacture the concrete blocks. The deleterious material in County Donegal was primarily muscovite mica, while in County Mayo it was primarily reactive pyrite".

Deleterious materials (undesirable constituents [2]) are those constituents of an aggregate that may comprise or include materials which could have an adverse effect on the properties of any concrete into which that aggregate was incorporated. The adverse effects mainly include:

1) chemical interference with the setting of cement;

2) physical prevention of good bond between the aggregate and cement paste;

3) modification of the properties of the fresh concrete to the detriment of the durability or strength of the hardened material;

4) interaction between the cement paste and the aggregate which continues after hardening, sometimes causing expansion and cracking of the concrete; and

5) weakness and poor durability of the aggregate particles themselves.

Concrete blocks manufactured from aggregates containing certain potentially deleterious materials, and subject to substantial ingress of moisture and/or freeze thaw conditions can have reduced strength and durability resulting in disintegration. Concrete masonry which remains in a dry state will not suffer from freeze thaw effects.

0.2 Mica

The minerals muscovite mica and biotite mica are "common constituents of many rock types, including granites, gneisses and sandstones, forming distinctive platy crystals. When mica occurs as discrete (or 'free') flaky grains in fine aggregates, it usually increases the water demand of concrete and also reduces the cohesiveness of the mix, which can adversely affect the final strength and durability of the hardened concrete" [2]. In particular cases, these disadvantageous effects of mica can be adequately compensated by slightly increasing the contents of cement in the mix design or by using an admixture. Excessive quantities of free muscovite mica in aggregate can render the blocks susceptible to freeze thaw degradation when saturated.

0.3 Pyrite

Pyrite, Iron Sulfide (FeS_2), is a naturally occurring mineral commonly found in most rock types. When some forms of pyrite are exposed to moisture and oxygen, a series of chemical reactions can occur. In such conditions, pyrite will oxidise to form sulfuric acid (H_2SO_4) and other products. The acid may in turn react with other minerals found in the aggregate. Calcium sulfate in the form of gypsum ($CaSO_4.2H_2O$)

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may be produced when calcium carbonate ($CaCO_3$), commonly known as calcite, is present in the aggregate, typically calcareous mudstones, and is available to react with the sulfuric acid. Gypsum has a significantly greater volume than the original pyrite and calcite, thus the growth of its crystals can cause expansion.

Internal sulfate attack in concrete does not require an external source of sulfate and is caused by the inclusion of materials containing sulfide minerals in the concrete mix. Typically, this can be where non-compliant aggregate with excessive quantities of reactive pyrite is used, which over time may, in unfavourable conditions oxidise to produce sulfate. The degradation of concrete blocks in Mayo appeared to occur from the oxidation of fine pyrite and bulk expansion of the mudstone aggregate. The expansion is caused by the growth of secondary minerals (gypsum) in veinlets parallel with bedding and/or cleavage in the mudstone and the interface between the aggregate and cement.

0.4 Expert panel recommendations

The Report of the Expert Panel on Concrete Blocks [1] made a number of recommendations for the development of technical documents and strengthening of existing regulations. The first of these recommendations was for NSAI to develop a simple standardised protocol to:

(a) assess and categorise the damage;

(b) establish the extent of the problem;

(c) identify the scope of any testing required; and

(d) aid selection of an appropriate remedial solution.

NOTE All concrete blocks currently manufactured in Ireland are required to meet the requirements of I.S. EN 771-3, and the relevant guidance is included in S.R. 325. The aggregate used in the manufacture of these concrete blocks are required to comply with I.S. EN 12620 [3], and the guidance for use in Ireland is in S.R. 16. These standards contain limits which control properties affecting end use performance, along with a requirement for geological and petrographic assessment of the aggregates.

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Schedule

Assessment, testing and categorisation of damaged buildings incorporating concrete blocks containing certain deleterious materials and Amendment 1:2020

1 Scope

This Irish Standard:

a) establishes a protocol for assessing and determining whether a building has been damaged by concrete blocks containing excessive amounts of certain deleterious materials (aggregate containing free or unbound muscovite mica or potentially deleterious quantities of pyrite);

b) describes methods for establishing the extent of the problem and categorises dwellings;

c) describes the scope of any testing required and evaluation of the findings; and

d) provides the Chartered Engineer with guidance on the selection of appropriate remedial works to be undertaken.

This Irish Standard is not intended for:

a) the specification, manufacture and testing for compliance of new concrete blocks (aggregate concrete masonry units) in accordance with I.S. EN 771-3 (and associated testing Standards) or as a replacement to the guidance provided in Standard Recommendation S.R. 325; and

b) dwellings not exhibiting structural damage consistent with defective concrete blocks, see Clause 4.

The protocol addresses the issue of defective concrete blocks but does not rule out other potential defects in a dwelling which may for other reasons require remedial attention.

The use of this Irish Standard is limited to concrete block-built dwellings exhibiting signs of distress consistent with damage caused by blocks containing certain deleterious materials.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

I.S. EN 197-1, *Cement – Part 1: Composition, specifications and conformity criteria for common cements*

I.S. EN 771-3, *Specification for masonry units – Part 3: Aggregate concrete masonry units (Dense and lightweight aggregates)*

I.S. EN 772-1, *Methods of test for masonry units – Part 1: Determination of compressive strength*

I.S. EN 1744-1:2009+A1:2012, *Tests for chemical properties of aggregates – Part 1: Chemical analysis*

I.S. EN 12504-1, *Testing concrete in structures – Part 1: Cored specimens – Taking, examining and testing in compression*

S.R. 325, *Recommendations for the design of masonry structures in Ireland to Eurocode 6*

BS 1881-124:2015, *Testing concrete – Part 124: Methods for analysis of hardened concrete*

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