



DPC: 24/30466278 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 10 September 2024

Origin: International

Latest date for receipt of comments: 03 November 2024

Project No. 2022/02757

Responsible committee: B/517 Concrete

Interested committees:

Title: Draft BS ISO 22965-2 Concrete. Part 2: Specification of constituent materials, production of concrete and compliance of concrete.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 22965-2

Concrete —

Part 2: Specification of constituent materials, production of concrete and compliance of concrete

Béton —

*Partie 2: Spécification des matériaux constitutifs, de la
production du béton et de la conformité du béton*

ICS: 91.100.30

ISO/TC 71/SC 3

Secretariat: **SN**

Voting begins on:
2024-09-10

Voting terminates on:
2024-12-03

This document is circulated as received from the committee secretariat.

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ISO/DIS 22965-2:2024(en)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Symbols and abbreviated terms	4
5 Requirements for constituents	4
5.1 General	4
5.2 Cements	5
5.3 Additions	5
5.3.1 General suitability for type I additions	5
5.3.2 General suitability for type II additions	5
5.4 Aggregates	5
5.4.1 All-in aggregate	5
5.4.2 Reclaimed aggregate	6
5.4.3 Recycled concrete aggregate	6
5.5 Mixing water	6
5.6 Admixtures	6
5.7 Fibers	6
6 Requirements for concrete	6
6.1 Requirements for constituents	6
6.1.1 General	6
6.1.2 Selection of cement	7
6.1.3 Selection of aggregates	7
6.1.4 Use of mixing water	8
6.1.5 Use of additions	8
6.1.6 Use of admixtures	8
6.1.7 Use of fibers	8
6.1.8 Chloride content	8
6.2 Requirements for fresh concrete	9
6.2.1 General	9
6.2.2 Consistence	10
6.2.3 Viscosity	10
6.2.4 Passing ability	10
6.2.5 Resistance to segregation	10
6.2.6 Concrete temperature	11
6.3 Requirements for hardened concrete	11
6.3.1 Compressive strength	11
6.3.2 Tensile splitting strength	13
6.3.3 Density	13
6.3.4 Resistance to water penetration	13
6.3.5 Durability	13
6.3.6 Reaction-to-fire	13
6.4 Requirements for mix proportions	13
6.4.1 Cement content and water/cement ratio	13
6.4.2 Air content	14
6.4.3 Fiber content	14
7 Production control of concrete	14
7.1 General	14
7.2 Production-control systems	14
7.2.1 Requirements for the production-control system — Compliance based on individual control method	15

7.2.2	Requirements for the production-control system — Compliance based on family control method	15
7.3	Testing.....	16
8	Delivery of fresh concrete	16
8.1	Delivery ticket for ready-mixed concrete.....	16
8.2	Delivery information for site-mixed concrete.....	17
8.3	Transport of concrete.....	17
8.3.1	Transport to the point of delivery.....	17
8.3.2	Time of transport.....	17
8.4	Mix adjustments after the main mixing process and prior to discharge	18
9	Compliance control and compliance criteria	18
9.1	General.....	18
9.2	Sampling and testing plan.....	18
9.3	Compliance of an individual batch or load.....	19
9.4	Compliance over an assessment period	19
9.4.1	General.....	19
9.4.2	Individual control method — Compliance criteria.....	19
9.4.3	Family control method — Compliance criteria.....	20
10	Evaluation of compliance	20
10.1	General.....	20
10.2	Assessment, surveillance and certification of production control.....	20
	Annex A (informative) Guidance on a “benchmark” production-control system	21
	Annex B (informative) Concrete families	31
	Annex C (informative) Provisions for assessment, surveillance and certification of production control	32
	Annex D (informative) Additional provisions for high-strength concrete	35
	Annex E (informative) Compliance criteria for an individual batch for consistence and properties other than consistence	37
	Annex F (informative) Guidance for the use of the <i>k</i>-value concept	39
	Annex G (informative) Requirements for cement	41
	Annex H (informative) Guidance on the national annex	43
	Bibliography	45

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives). Provisions for environmental management for concrete is given in ISO 13315-1, 2 and 8.

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO *had not* received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, Subcommittee SC 3, *Concrete production and execution of concrete structures*.

This second edition cancels and replaces the first edition (ISO 22965-2:2007), which has been technically revised.

The main changes are as follows:

- The recommended minimum rate of sampling for assessing compliance of compressive strength was changed to be dependent on manufacturing stage of initial or continuous.
- The *k*-value for fly ash recommended [Annex F](#) (informative) was changed to be dependent on cement type, that is, Portland cement or Portland composite cement.
- [Annex G](#) (informative) for requirements for cement was added.

A list of all parts in the ISO 22965 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This International Standard is intended for nations that have no national concrete standard and it sets out a framework of principles for nations revising their national standards. To be operable, this International Standard needs a national annex or a reference to the national complementary provisions. This International Standard can also be applied on specific projects where a project specification supplements the standards in lieu of a national annex applicable at the place of use.

This International Standard is applied under various climatic and geographical conditions, various levels of protection and under different established regional traditions and experience. Consequently, this International Standard includes classes for concrete with different properties to cover the most frequent and normal situations. For certain uses of concrete, additional or deviating rules can be necessary. The national provisions, preferably given in a national annex to this International Standard, or the project specification can specify any additional or deviating requirements.

During the development of this International Standard, consideration was given to detailing a performance-related approach to the specification of durability. It was concluded that such an approach is not yet sufficiently developed to be detailed in an International Standard. ISO/TC 71/SC 3 recognizes that some ISO member bodies have developed local tests and criteria for performance-based specifications. This International Standard does not exclude the continuation and development of such practices valid in the place of use of the concrete as an alternative to the prescriptive approach. It is necessary that these requirements be specified in the national annex or national complementary provisions. The Model Code for Service Limit Design (MC-SLD) was published as ISO 16204 in 2012.

This International Standard incorporates rules for the use of constituents that are covered by International Standards. For materials for which International Standards have not yet been published, the standards cited in the national annex (often the regional or national standards) apply; see [5.1](#). In particular, documents in current use for by-products of industrial processes, recycled materials, etc. are based on local experience. Until international specifications for these materials are available, this International Standard does not provide rules for their use, but instead refers to the national annex.

This International Standard defines the two parties involved in the ordering and the supply of concrete, which are hereinafter referred to as specifier and supplier. In practice, there can be several parties specifying requirements at various stages of the design and construction process, e. g. the client, the designer, the quantity surveyor, the constructor and the concreting subcontractor. Each is expected to pass the specified requirements, together with any additional requirements, to the next party in the chain until they reach the supplier. In the terms of this International Standard, this final compilation of requirements is known as the “concrete specification”. In some cases, the specifier and the supplier is the same party (e.g. a constructor doing design, production and execution). In the case of ready-mixed concrete, the purchaser is the specifier.

This part of ISO 22965 also gives rules for the exchange of information between the parties. Contractual matters are not addressed.

This International Standard is intended for use with ISO 22965-1 and with ISO 22966, which will give the requirements associated with the level of quality specified and the methods to be employed for the execution of concrete structures.

If the concrete is in conformity with the limiting values, the concrete in the structure is deemed to satisfy the durability requirements for the intended use in the specific environmental condition, provided:

- the appropriate exposure classes were selected;
- the concrete has the minimum cover to reinforcement in accordance with the relevant design standard required for the specific environmental condition;
- the concrete is properly placed, compacted and cured, e. g. in accordance with ISO 22966 or other relevant standards;
- the appropriate maintenance is applied during the service life.

Performance based concepts as alternatives to the concept of limiting values are under development.

ISO/DIS 22965-2:2024(en)

Concrete conforming to this International Standard may be assumed to satisfy the basic requirements for materials to be used in all three execution classes as defined in ISO 22966.

Concrete —

Part 2:

Specification of constituent materials, production of concrete and compliance of concrete

1 Scope

This document applies to concrete for structures cast in situ, pre-cast structures and structural pre-cast products for buildings and civil engineering structures.

The concrete under this document can be

- normal-weight, heavy-weight and light-weight concrete;
- mixed on site, ready-mixed or produced in a plant for pre-cast concrete products, compacted or self-compacting to retain no appreciable amount of entrapped air other than entrained air.

Other International Standards for specific products, e.g. pre-cast products, or for processes within the field of the scope of this standard can require or permit deviations from this document.

This document specifies

- the properties of constituents;
- the production of concrete;
- the compliance system of concrete.

This document does not apply to

- concrete with a maximum aggregate size equal to or less than 4 mm or 5 mm (mortar),
- aerated concrete,
- foamed concrete,
- concrete with an open structure ("no-fine aggregate" concrete),
- concrete with a density less than 800 kg/m³,
- refractory concrete.

This document does not cover health and safety requirements for the protection of workers during production and delivery of concrete.

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.

ISO 679, *Cement — Test methods — Determination of strength*

ISO 9001, *Quality management systems — Requirements*

ISO 1770, *Solid-stem general purpose thermometers*

ISO 1920-1, *Testing of concrete — Part 1: Sampling of fresh concrete*

ISO 1920-2, *Testing of concrete — Part 2: Properties of fresh concrete*

ISO 1920-3, *Testing of concrete — Part 3: Making and curing test specimens*

ISO 1920-4, *Testing of concrete — Part 4: Strength of hardened concrete*

ISO 1920-5, *Testing of concrete — Part 5: Density and water penetration depth*

ISO 1920-13, *Testing of concrete — Part 13: Properties of fresh self compacting concrete*

ISO 18985, *Recycled aggregates for concrete*

ISO 19595, *Natural aggregates for concrete*

ISO 19596, *Admixtures for concrete*

ISO 22904, *Additions for concrete*

ISO 22965-1, *Concrete — Part 1: Methods of specifying and guidance for the specifier*

ISO 29581-1, *Cement — Test methods — Part 1: Analysis by wet chemistry*

ISO 29581-2, *Cement — Test methods — Part 2: Chemical analysis by X-ray fluorescence*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22965-1 and the following apply.

3.1

agitating equipment

equipment generally mounted on a self-propelled chassis and capable of maintaining fresh concrete in a homogeneous state during transport

3.2

aggregate size

designation of aggregate in terms of lower (d) and upper (D) sieve sizes expressed as d/D

3.3

all-in aggregate

aggregate comprising a mixture of coarse and fine aggregates with D greater than 4 mm and d = 0

3.4

concrete family

group of concrete compositions for which a reliable relationship between relevant properties is established and documented

3.5

cubic meter of concrete

quantity of fresh concrete which, when compacted, occupies a volume of one cubic meter

3.6

high-strength concrete

concrete with a compressive strength class higher than B50 in the cases of normal-weight or heavy-weight concrete and LB50 in the case of light-weight concrete

Note 1 to entry: Other limits may be set in the national annex.

3.7

recycled aggregate concrete

RAC

concrete made using recycled aggregates where all or partial fractions of the natural aggregates are replaced by recycled concrete aggregates and/or recycled mix aggregates

3.8

recycled concrete aggregate

recycled aggregate produced by processing waste concrete

3.9

recycled mix aggregate

recycled aggregates that include both recycled concrete aggregates and recycled aggregates produced from source materials other than concrete

3.10

self-compacting concrete

concrete with high deformability, good segregation resistance, and moderate viscosity (necessary to ensure uniform suspension of solid particles during transportation, placement (without external compaction), and thereafter until the concrete sets)

3.11

initial test

test or tests before the production starts to check how a new concrete or concrete family shall be composed in order to meet all the specified requirements in the fresh and hardened states

3.12

non-agitating equipment

equipment used for transporting concrete without agitation in the sense of [3.1](#), e.g. dump truck or transport hopper

3.13

production day

<for strength testing>

day in which 20 m³ or more of concrete has been produced or, on days when less than 20 m³ of concrete has been produced, the day on which a cumulative 20 m³ of these concretes has been produced

Note 1 to entry: The sequence is restarted on a new day for each occasion when a production day is counted. Limits other than 20 m³ may be set in the national annex.

3.14

production week

period of seven consecutive days comprising at least five production days or the period taken to complete five production days, whichever is the longer period

3.15

truck mixer

concrete mixer mounted on a self-propelled chassis capable of mixing and delivering a homogeneous concrete

3.16

project specification

project-specific document describing the requirements applicable for the particular project, giving all information and requirements necessary for the execution of the works, including documents, drawings, etc.

3.17

statistical quality control

that part of quality control in which statistical methods are used (such as estimation and tests of parameters and sampling inspection)

Note 1 to entry: The concrete specification drawn up by the specifier (see ISO 22965-1) should include all relevant requirements for the concrete as given in the project specification.

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviations given in ISO 22965-1 and the following apply.

$f_{ck,cyl}$	characteristic compressive strength of concrete determined by testing cylinders, expressed in newtons per square millimetre
$f_{c,cyl}$	compressive strength of concrete determined by testing cylinders, expressed in newtons per square millimetre
$f_{ck,cube}$	characteristic compressive strength of concrete determined by testing cubes, expressed in newtons per square millimetre
$f_{c,cube}$	compressive strength of concrete determined by testing cubes, expressed in newtons per square millimetre
f_{cm}	mean compressive strength of concrete, expressed in newtons per square millimeter
f_{tsm}	mean tensile splitting strength of concrete, expressed in newtons per square millimeter
f_{tsk}	characteristic tensile splitting strength of concrete, expressed in newtons per square millimeter
σ	estimate for the standard deviation of a population
s_n	standard deviation of n consecutive test results
$R_{w/c}$	water/cement ratio
$R_{w/(c,ka)}$	ratio of water to the sum of the cement plus k times the addition, designated as the “effective cementitious material”

5 Requirements for constituents

5.1 General

Only constituents with established suitability for the particular intended use in the concrete conforming to this document shall be used.

Where there is no International Standard for a particular constituent which refers specifically to the use of this constituent in concrete conforming to this document, or where there is an existing International Standard which does not cover the particular concrete product or where the constituent deviates significantly from the International Standard, the establishment of suitability may result from provisions in the standards cited in the national annex (often regional or national standards) which refers specifically to the use of the constituent in concrete conforming to this standard.

Constituents shall not contain harmful ingredients in such quantities as can be detrimental to the strength, consistence, setting time and durability of the concrete, or cause corrosion of the reinforcement, and shall be suitable for the intended use in concrete.

Constituents that conform to the relevant International Standards cited in this document shall be deemed to meet the requirement that they do not contain harmful ingredients in such quantities as can be detrimental to the durability of the concrete or cause corrosion of the reinforcement provided that the concrete conforms to any specified limits placed on it, e.g. maximum chloride content.

Only constituents with established suitability for the specified application shall be used in concrete conforming to this part of ISO 22965.

NOTE 1 Where general suitability is established for a constituent, this does not indicate suitability in every intended use of the concrete and for every concrete composition.

NOTE 2 This document lists constituents conforming to International Standards that have general suitability. The national annex extends these lists of constituents with approved general suitability.

Where types and classes of constituents are not detailed in the specification, the producer shall select constituents for the specified requirements only.

5.2 Cements

General suitability is established for cements conforming to [Annex G](#).

Suitability of calcium aluminates cement and supersulfated cement may be established in the national annex for cements conforming to a standard listed in the same annex.

5.3 Additions

5.3.1 General suitability for type I additions

General suitability is established for type I additions of the following types:

- filler aggregate conforming to ISO 19595 or a standard listed in the national annex;
- pigments conforming to a standard listed in the national annex.

5.3.2 General suitability for type II additions

General suitability is established in the national annex for additions conforming to ISO 22904.

5.4 Aggregates

General suitability is established for;

- natural normal-weight aggregates and heavy-weight aggregates conforming to ISO 19595;
- manufactured aggregates and lightweight aggregates conforming to a standard listed in the national annex.

The maximum aggregate size shall not be greater than the value specified.

Light-weight aggregates shall conform to the following requirements.

- a) The acid-soluble sulfate content shall be not more than 0,1 % by mass (see the national annex for the test method);
- b) For furnace-bottom ash or clinker, the loss-on-ignition shall be not more than 10 % by mass (see the national annex for the test method).

Where freezing- and thawing-resistant, light-weight aggregates are specified, the producer shall hold data demonstrating that the chosen light-weight aggregates produce concrete with adequate freezing and thawing resistance.

NOTE Freezing and thawing resistance is deemed to be adequate if the aggregates have a successful track record of use for at least 10 years in similar or worse environments with concrete of the quality specified or lower than the quality specified. An alternative method for determining freezing and thawing resistance is by relative freezing and thawing testing of concrete in water or a salt solution, as appropriate. Where this latter method is to be used, it is necessary that the test method and compliance criteria be specified in the national annex.

Manufactured aggregates may be used as aggregate for concrete if the suitability is established by provisions in a standard listed in the national annex.

5.4.1 All-in aggregate

All-in aggregate with a size range greater than 0/8 conforming to ISO19595 shall be used.

5.4.2 Reclaimed aggregate

Aggregate recovered from wash water or fresh concrete may be used as aggregate for concrete. General suitability is established for reclaimed aggregate conforming to ISO19595.

Unless otherwise permitted by the national annex, undivided reclaimed aggregate shall not be added in quantities greater than 5 % of the total aggregate. Where the quantities of the reclaimed aggregates are greater than 5 % of the total aggregate, they shall be of the same type as the primary aggregate and shall be divided into separate coarse and fine fractions and shall conform to the aggregate specification.

5.4.3 Recycled concrete aggregate

Recycled concrete aggregate should not include harmful substances more than allowance quantity. The example of required quality for recycled concrete aggregate is shown in ISO 18985.

5.5 Mixing water

General suitability is established in the national annex for mixing water conforming to ISO 12439.

Recycled water from concrete production shall be used in accordance with the conditions specified for its use in a mixing-water standard of established suitability or in accordance with the provisions given in the national annex.

5.6 Admixtures

General suitability is established in the national annex for admixtures conforming to ISO 19596.

5.7 Fibers

General suitability is established for regional or national standard.

6 Requirements for concrete

6.1 Requirements for constituents

6.1.1 General

The concrete composition and the constituents shall be selected to satisfy the requirements specified for fresh and hardened concrete, including consistence, density, strength, durability, taking into account the production process and, if informed, the intended method of execution of the concrete works.

The concrete composition and the constituents also shall be selected to satisfy the requirements specified for environment.

Where not detailed in the specification of concrete, the producer should select types and classes of constituents from those with established suitability according to the National Annex for the specified environmental conditions.

The concrete should be designed so as to minimize segregation and bleeding of the fresh concrete.

NOTE Unit water content should be reduced as much as possible, as long as the required consistency is available.

In the case of designed concrete, the limiting values shall be specified in terms of minimum or maximum values and in the case of prescribed concrete, the composition shall be specified by target values.

For standardized prescribed concretes, the National Annex shall specify the prescription and list the types and categories of constituents with established suitability. These prescriptions shall satisfy the criterion for adoption of initial tests given in [Annex A](#).

6.1.2 Selection of cement

Cement shall be selected from those for which the suitability is established, taking into account the:

- execution of the work;
- intended use of concrete;
- curing conditions (e.g., heat treatment);
- dimensions of the structure (the heat development);

NOTE Suitability for concrete for massive structures (e.g., dams) is established for very low heat special cement such as slow hardening cement conforming to [Annex G](#).

- environmental conditions to which the structure is to be exposed (specified in ISO 22965-1);
- potential reactivity of aggregate to the alkalis from the constituents.

6.1.3 Selection of aggregates

6.1.3.1 General

Aggregate type and categories, e.g., grading, flakiness, freeze/thaw resistance, abrasion resistance, fines, shall be selected taking into account the:

- execution of the work;
- intended use of concrete;
- environmental conditions to which the concrete is to be exposed;
- any requirements for exposed aggregate or aggregate for tooled concrete finishes.

$D_{\max}$ shall be $\geq D_{\text{lower}}$ and $\leq D_{\text{upper}}$

6.1.3.2 All-in aggregate

All-in aggregate shall be used only in concrete with compressive strength classes $\leq B12/15$.

6.1.3.3 Reclaimed aggregate

Reclaimed aggregate may be used as aggregate for concrete provided it is only used internally by the producer or a group of producers.

6.1.3.4 Recycled concrete aggregate and recycled mix aggregate

Recommendations for the use of recycled concrete aggregates and recycled mix aggregate are given in ISO/CD 18985 and TS 21056.

NOTE No recommendations for the use of fine recycled aggregate are given in this document.

6.1.3.5 Resistance to alkali-aggregate reaction

Where aggregates contain varieties of silica susceptible to attack by alkalies (Na_2O and K_2O originating from cement, de-icing chemicals, or other sources) and the concrete is exposed to humid conditions, actions shall be taken to prevent deleterious alkali-silica reaction using procedures specified in the national annex or the project specification.