

SS 544-2:2019+A1:2021
BS 8500-2:2015+A1:2016, IDT
(ICS 91.100.30)

SINGAPORE STANDARD

**Concrete – Complementary Singapore Standard
to SS EN 206**

– Part 2 : Specification for constituent materials and
concrete

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Contents

	Page
National Foreword _____	7
0 Introduction _____	9
1 Scope _____	9
2 Normative references _____	9
3 Terms, definitions, symbols and abbreviations _____	11
4 Complementary requirements for constituent materials _____	13
5 Complementary basic requirements for concrete _____	23
6 Designated concrete _____	24
7 Designed concrete _____	29
8 Prescribed concrete _____	30
9 Standardised prescribed concrete _____	30
10 Proprietary concrete _____	33
11 Delivery of fresh concrete _____	33
12 Conformity testing and conformity criteria _____	34
13 Production control _____	36
14 Transport of concrete _____	38
 Annexes	
A Conformity procedure for combinations (normative) _____	39
B Minimizing the risk of damaging alkali-silica reaction in concrete (normative) _____	42
C Example of the conformity procedure given in Annex A (informative) _____	48
D SS 544 provisions linked to SS EN 206 requirements (informative) _____	51
ZA Singapore guidelines on concrete specified to SS EN 206 (informative) _____	53
ZB Singapore guidelines on aggregates specified to SS EN 12620 (informative) _____	56
ZC Singapore guidelines on cement specified to SS EN 197-1 (informative) _____	60
ZD Singapore guidelines on admixture specified to SS EN 934-2 (informative) _____	63
 Tables	
1 General purpose cements and combinations _____	14
2 Requirements for coarse crushed concrete aggregate _____	18
3 Limitations on the use of coarse CCA _____	19

	Page
4	Requirements for coarse recycled aggregate _____ 21
5	Method for determining the chloride content of constituent materials _____ 23
6	Requirements for designated concretes for general applications _____ 25
7	Requirements for designated cement-bound concretes _____ 27
8	Range of aggregate grading for cement-bound concrete _____ 28
9	Limiting values of composition and properties for concrete where a DC-class is specified 30
10	Mix proportions for standardised prescribed concretes using class 32.5 cements and combinations _____ 31
11	Mix proportions for volume batching of ST1, ST2 and ST3 _____ 33
12	Additional compressive strength classes to those given in SS EN 206 _____ 35
13	Tolerances for constituents when batching less than one cubic metre of concrete ^{A)} _____ 37
14	Materials control for CCA ^{A)} _____ 38
A.1	Requirements for the compressive strength of combinations _____ 40
B.1	Proportion of declared mean alkali content of ggbs, natural pozzolana, natural calcined pozzolana, high reactivity natural calcined pozzolana or fly ash to be taken into account in the calculation of alkali content of concrete _____ 44
B.2	Reactivity of constituents of aggregates used in concrete in the UK _____ 45
C.1	Mass fraction of addition ^{A)} in CEM I in combinations for strength testing _____ 48
C.2	Mass fraction of addition ^{A)} to CEM II/A-L or CEM II/A-LL combinations for strength testing 49
D.1	Guidance on where to find SS 544 provisions that cover SS EN 206 requirements that defer to provisions in the place of use _____ 51
ZA.1	Guidance for the specifier _____ 53
ZA.2	Testing temperature _____ 55
ZB.1	Minimum test frequencies for general properties _____ 56
ZB.2	Minimum test frequencies for properties specified to end use _____ 58
ZB.3	Minimum test frequencies for properties appropriate to aggregates from particular sources / quarries _____ 59
ZC.1	Testing temperature and relative humidity _____ 60
ZC.2	Density of mercury, viscosity of air (η) and $\sqrt{0.1\eta}$ at given temperature _____ 61
ZC.3	Recommended sampling plan for imported cement _____ 61
Figures	
C.1	Determination of conformity limits for combinations _____ 50
Bibliography _____ 64	

National Foreword

This Singapore Standard was prepared by the Technical Committee on Building Structures and Substructures under the purview of BCSC.

This standard is a revision of SS 544-2:2009. It is an identical adoption of BS 8500-2:2015+A1:2016 Complementary British Standard to BS EN 206-1, Part 2: Specification for constituent materials and concrete' and is implemented with the permission of the British Standards Limited.

SS 544 – 'Concrete – Complementary Singapore Standard to SS EN 206' comprises two parts:

- Part 1: Method of specifying and guidance for the specifier;
- Part 2: Specification for constituent materials and concrete.

This revision introduced the following principal changes:

- Changes necessary to align with the publication of SS EN 206:2014;
- Changes resulting from new or revised EN standards published since 2006;
- Alignment with conformity assessment and accreditation policy on Singapore;
- Introduction of designated cement-bound concrete;
- Modification of requirements for concrete to resist freezing and thawing;
- Corrections and minor clarifications;
- A new annex (Annex D) has been added which sets out where to find the SS 544 provisions that cover SS EN 206 requirements that defer to provisions in the place of use; and
- All references have been updated.

The changes are predominantly concerned with the increased range of cementitious materials covered. These include: natural pozzolana, natural calcined pozzolana or high reactivity natural calcined pozzolana as an addition, Portland-pozzolana and pozzolanic cements, as well as a range of ternary cements which include up to 20% limestone fines. The recommendations for the use of natural, natural calcined and high reactivity natural calcined pozzolana, as part of cement or combination, are based on the assumption that their performance in concrete is similar to fly ash. The recommendations for ternary cements, which include up to 20% limestone fines, are for applications where their use is considered safe and durable. The option to use the equivalent concrete performance concept (ECPC) to demonstrate equivalence for the use of additions is clarified.

*As amended,
May 2021*

Additional guidance is provided on the preparation and transport of cube specimens for strength testing. Minor editorial changes are not tagged, such as the change of nomenclature from N/mm² to MPa for stress.

SS 544 contains additional Singapore provisions to be used in conjunction with SS EN 206. Together they form a complete package for the specification, production and conformity of fresh concrete.

Singapore guidelines are provided in informative Annexes ZA to ZD. They concern circumstances which are typical for Singapore such as climatic conditions (testing temperatures) for concrete, aggregates, cement and admixture.

The following guidelines are to guide local users:

1. Introduction – Exposure classes related to environmental conditions

For the tropical climate in Singapore, it is recommended that the provision for resisting the same exposure conditions be raised by at least one class higher than the corresponding level for use in UK (see SS 544-1, Local guidelines are highlighted for the adoption of BS 8500-1: Annex A (informative) 'Guidance for the specifier'.

2. Clause 5.4 Concrete temperature

The temperature of fresh concrete at the time of delivery should not exceed 38°C unless specified.

3. Clause 7 Designed concrete

- Strength development should be based on curing temperature of (27 ± 2) °C
- Constituent materials and cubes are stored at (27 ± 5) °C and (27 ± 2) °C respectively.

4. Clause 6 Designated concrete and Clause 9 Standardised prescribed concrete

Designated concrete and standardised prescribed concrete are derived based on UK experience and materials. Local users are advised to make appropriate judgment on the relevance / suitability of their use in the specific environmental condition (see Introduction).

5. Clause 12.2 Conformity control for compressive strength

Local guidelines are highlighted in SS 544-1 and the conformity criteria for 100 mm cubes and 150 mm cubes as provided for in SS 544-2 is adopted.

6. Although performance based testing has been introduced in standards for testing materials, they follow prescribed testing procedures and environmental conditions hence test results may or may not be directly related to actual applications on site.

It has been assumed in the preparation of this Singapore Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "Mature Standards". Mature Standards will not be subject to further review, unless there are requests to review such standards.*
2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore and the Singapore Standards Council shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR. Although care has been taken to draft this standard, users are also advised to ensure that they apply the information after due diligence.*
3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

Concrete – Complementary Singapore Standard to SS EN 206 – Part 2 : Specification for constituent materials and concrete

0 Introduction

The requirements in this part of SS 544 are given for defined materials with an established or accepted adequate performance in Singapore conditions. These requirements might not be appropriate for use in exposure conditions different from Singapore. The use of constituents not listed in this standard should be by agreement between the producer and specifier on a case-by-case basis. Some guidance on the performance of these materials can be obtained by relative performance testing, as discussed in Concrete Society publication CS 109 [1].

SS 544 and SS EN 206 take account of the distinct and different technical responsibilities of the specifier, producer and user. Where a body is responsible for more than one of these roles, internal procedures within that body should allocate responsibilities for the various actions.

NOTE - See National Foreword for additional Singapore provisions.

1 Scope

This part of SS 544 specifies constituent materials and concrete. This part of SS 544 complements SS EN 206. It provides Singapore national provisions where required or permitted by SS EN 206. It also covers materials, methods of testing and procedures that are outside the scope of SS EN 206, but within national experience.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 812-104:1994	<i>Testing aggregates – Part 104 : Method for qualitative and quantitative petrographic examination of aggregates</i>
BS 812-123	<i>Testing aggregates – Part 123 : Method for determination of alkali-silica reactivity – Concrete prism method</i>
BS 1704	<i>Specification for solid-stem general purpose thermometers</i>
BS 1881-124	<i>Testing concrete – Part 124 : Method for analysis of hardened concrete</i>
BS 1881-129	<i>Testing concrete – Part 129 : Method for determination of density of partially compacted semi-dry fresh concrete</i>
BS 6068-2.37	<i>Water quality – Part 2 : Physical, chemical and biochemical methods – Section 2.37: Method for the determination of chloride via a silver nitrate titration with chromate indicator (Mohr's method)</i>
BS 6068-2.42	<i>Water quality – Part 2: Physical, chemical and biochemical methods – Section 2.42: Determination of sodium and potassium: determination of sodium by atomic absorption spectrometry</i>

BS 6068-2.43	<i>Water quality – Part 2: Physical, chemical and biochemical methods – Section 2.43: Determination of sodium and potassium – Determination of potassium by atomic absorption spectrometry</i>
BS 6068-2.44	<i>Water quality – Part 2: Physical, chemical and biochemical methods – Section 2.44: Determination of sodium and potassium – Determination of sodium and potassium by flame emission spectrometry</i>
BS 7943	<i>Guide to the interpretation of petrographical examinations for alkali-silica reactivity</i>
BS 7979	<i>Specification for limestone fines for use with Portland cement</i>
BS 8000-2.1	<i>Workmanship on building sites – Part 2: Code of practice for concrete work – Section 2.1: Mixing and transporting concrete</i>
BS 8615-1	<i>Specification for pozzolanic materials for use with Portland cement – Part 1: Natural pozzolana and natural calcined pozzolana</i>
BS 8615-2	<i>Specification for pozzolanic materials for use with Portland cement – Part 2: High reactivity natural calcined pozzolana</i>
BS EN 196-1	<i>Methods of testing cement – Part 1: Determination of strength</i>
BS EN 196-2	<i>Methods of testing cement – Part 2: Chemical analysis of cement</i>
BS EN 450-1:2012	<i>Fly ash for concrete – Part 1: Definition, specifications and conformity criteria</i>
BS EN 480-1	<i>Admixtures for concrete, mortar and grout – Test methods – Part 1: Reference concrete and reference mortar for testing</i>
BS EN 480-10	<i>Admixtures for concrete, mortar and grout- Test methods – Part 10: Determination of water soluble chloride content</i>
BS EN 480-11	<i>Admixtures for concrete, mortar and grout – Test methods – Part 11: Determination of air void characteristics in hardened concrete</i>
BS EN 480-12	<i>Admixtures for concrete, mortar and grout – Test methods – Part 12: Determination of the alkali content of admixtures</i>
BS EN 933-11	<i>Tests for geometrical properties of aggregates – Part 11 : Classification test for the constituents of coarse recycled aggregates</i>
BS EN 1008	<i>Mixing water for concrete – Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in concrete industry, as mixing water for concrete</i>
BS EN 1097-3	<i>Tests for mechanical and physical properties of aggregates – Part 3: Determination of loose bulk density and voids BS EN 1367-4, Tests for thermal and weathering properties of aggregates – Part 4: Determination of drying shrinkage</i>
BS EN 1744-1: 2009+A1: 2012	<i>Tests for chemical properties of aggregates – Part 1: Chemical analysis</i>
BS EN 12350-6	<i>Testing fresh concrete – Part 6: Density</i>
BS EN 12390-2	<i>Testing hardened concrete – Part 2: Making and curing specimens for strength testing</i>
BS EN 12390-3	<i>Testing hardened concrete – Part 3: Compressive strength of test specimens</i>

BS EN 12390-7	<i>Testing hardened concrete – Part 7: Density of hardened concrete</i>
BS EN 12878:2014	<i>Pigments for the colouring of building materials based on cement and/or lime – Specifications and methods of test</i>
BS EN 13055-1	<i>Lightweight aggregates – Part 1: Lightweight aggregates for concrete, mortar and grout</i>
BS EN 13263-1	<i>Silica fume for concrete – Part 1: Definitions, requirements and conformity criteria</i>
BS EN 13286-51	<i>Unbound and hydraulically bound mixtures – Part 51 : Method for the manufacture of test specimens of hydraulically bound mixtures using vibrating hammer compaction</i>
BS EN 14216	<i>Cement-Composition, specifications and conformity criteria for very low heat special cements</i>
BS EN 45011	<i>General requirements for bodies operating product certification systems</i>
SS 544-1:2019	<i>Concrete – Complementary Singapore Standard to SS EN 206 – Part 1: Method of specifying and guidance for the specifier</i>
SS EN 197-1	<i>Cement – Part 1: Composition, specifications and conformity criteria for common cements</i>
SS EN 206:2014	<i>Concrete – Specification, performance, production and conformity</i>
SS EN 934-2	<i>Admixtures for concrete, mortar and grout – Part 2: Concrete admixtures - Definitions, requirements, conformity, marking and labelling</i>
SS EN 12620	<i>Aggregates for concrete</i>
SS EN 15167-1	<i>Ground granulated blastfurnace slag for use in concrete, mortar and grout – Part 1: Definitions, specifications and conformity criteria</i>
SS ISO 9001	<i>Quality management systems – Requirements</i>
SS ISO/IEC 17021-1	<i>Conformity assessment – Requirements for bodies providing audit and certification of management systems – Part 1: Requirements</i>

Other publications

British Cement Association *Alkali-silica reaction – Testing protocol for greywacke aggregates – Protocol of the BSI B/517 /1/20 ad hoc group on ASR. Crowthorne, Berkshire. 1999*