ACCREDITATION SCHEME FOR
PRODUCT CERTIFICATION BODIES

CT 06
SAC CRITERIA FOR READY-MIXED CONCRETE PRODUCERS

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1 Introduction

1.1 This document specifies the minimum requirements for ready-mixed concrete producers to be listed under this certification scheme.

2 Scope of Application

2.1 This certification scheme is applicable to all plants (i.e. plants may be located on the construction site or off-site) supplying ready-mixed concrete for structural use, including those used in casting of precast structural elements manufactured both locally and overseas.

2.2 All these plants under the scheme are to be certified for conformity to SS EN 206, and its Singapore complementary standards SS 544-1 and SS 544-2, and the requirements of this document.

3 Definitions

3.1 ACI - American Concrete Institute

3.2 BCA - Building and Construction Authority

3.3 Cement – Denotes any of the 5 main cement types as described in SS EN 197-1, i.e. Portland cement, Portland-composite cement, blastfurnace cement, pozzolanic cement and composite cement

3.4 Certification body – A certification body accredited by SAC under the Accreditation Scheme for Product Certification Bodies (Ready-Mixed Concrete)

3.5 HDB – Housing and Development Board

3.6 ILAC – International Laboratory Accreditation Cooperation

3.7 MRA – Mutual Recognition Arrangement

3.8 Plant - Plant for the production and supply of concrete for structural use which can be located on the construction site or off-site

3.9 Producer - Person or body producing fresh concrete for structural use

3.10 Ready-mixed concrete - Concrete in a fresh state that is manufactured in a batching plant either off- site or on- site, and supplied for use in an unhardened form.

3.11 SAC -Singapore Accreditation Council

3.12 SAC-SINGLAS - SAC-Singapore Laboratory Accreditation Scheme.

3.13 Wet batch mixer facility - A plant that incorporates a separate drum that mixes concrete components before loading them into a mixer truck for transport.

4 Technical Qualifications

4.1 Personnel

4.1.1 The producer shall engage the following:

a) Quality Control manager with recognised degree/diploma in Civil or Structural Engineering or Building with at least 3 years' experience in the concrete production industry (or equivalent qualification as assessed by the Certification Body); and

b) batching plant operator with at least an ACI Technician Grade 1 certification (or equivalent qualification as assessed by the Certification Body) for each plant.

Note: The certification programme for the ACI Technician Certification (or its equivalent), shall be modified to reflect local practice including the use of local codes.

4.2 Batching plant and other facilities

4.2.1 The producer shall batch concrete in a wet batchmixer facility and the batching process shall be controlled using a computerised system. Computerised batching records shall also be generated for each batch of concrete produced.

4.2.2 Adequate stockpile facilities shall be provided to ensure that aggregates are stored on clean surface in separate stockpiles or bunkers. These facilities shall be sheltered with adequate roof and side covers.

4.2.3 In general, the methods used for material storage and handling, concrete production and supply, is to ensure that risks for non-compliance, intermingling, contamination, segregation, errors, loss of materials or concrete, and the influence of weather are minimised.

4.2.4 Each producer shall have a test laboratory. However, if these test results are to be recognised for compliance with SS EN 206 (including SS 544-1 and SS 544-2), the test laboratory has to be accredited by the Singapore Accreditation Council (under SAC-SINGLAS) or an ILAC MRA partner for the relevant tests.

5 Quality Requirements

5.1 The producer shall ensure that the following quality requirements in the following sections are adequately addressed.

5.2 Constituent materials

5.2.1 Materials shall be in accordance with SS EN 206 and SS 544-2 Test frequencies shall be in accordance with the standards specified in Section 4 of SS 544-2, while tests on aggregates shall be carried out at frequency not lesser than the minimum specified in SS EN 12620.

5.2.2 To address the possible contamination of sea water on aggregates (i.e. coarse and fine aggregates) transported by sea, the producer shall conduct in-house checks on chloride content of the aggregates using rapid test methods at minimum frequency of once a production week. The rapid test methods shall be based on SS 73: Part 17 (Appendices A or B) or EN 1744-1 (Clauses 8 or 9). Conformity test on chloride content based on EN 1744-1, Clause 7 shall be conducted at minimum frequency of once a calendar month.

5.2.3 For the determination of grading and fines content which are to be conducted on a weekly basis, RMC producers could rely on the accredited test reports from the aggregates producers, if available.

5.2.4 All tests shall be carried out in laboratories accredited by the Singapore Accreditation Council (under SAC-SINGLAS) or an ILAC MRA partner for the relevant tests, unless otherwise indicated.

5.3 Resistance to alkali aggregate interaction

5.3.1 Alkali-silica reaction (ASR)

5.3.1.1 When imported aggregate is used and where the source of aggregate is new to Singapore, the aggregates shall be tested before use for potential alkali reactivity.

5.3.1.2 In order to minimise the risk of ASR in structural concrete (including those used in the casting of precast structural elements manufactured either locally or overseas), control on alkali content[1] is required by means of :

a) use of low alkali cement with equivalent $Na_2O \leq 0.6$ %; or

b) limit the total alkali content of concrete to 2.5 kg equivalent Na_2O/m^3, if the equivalent Na_2O content of cement is over 0.6%.

[1] Control of alkali content as means to minimise the risk of ASR is prescribed in the Building Control Regulations and further guidance on the calculation of alkali content can be obtained from BRE Digest 330 (2004) “Alkali-silica reaction in concrete”.

5.3.1.3 In conjunction with para 5.3.1.2, confirmation of actions taken to minimise the risk of ASR shall be maintained for verification.

5.3.2 Alkali-carbonate reaction (ACR)

5.3.2.1 When imported aggregate is used and where the source of aggregate is new to Singapore, this form of alkali-aggregate reaction shall be assessed for its potential reactivity and appropriate measures be taken to minimise the risk of deleterious expansion due to such reaction.

5.3.3 All tests shall be carried out in laboratories accredited by the Singapore Accreditation Council (under SAC-SINGLAS) or ILAC MRA partner for the relevant tests.

5.4 Spot tests by certification body

5.4.1 The certification body shall perform spot tests on concrete and constituent materials during the initial assessment of production control and also during routine inspection by taking spot samples from the running production.

5.4.2 The following are the minimum tests to be included in the spot tests and shall be carried out by laboratories which are accredited by the Singapore Accreditation Council (under SAC-SINGLAS) or ILAC MRA partner and which are independent from the producer.

a) chloride content of concrete[2];

b) compressive strength test on moulded concrete specimen; and

c) alkali-silica reactivity of aggregates[3].

6 Certification of New Plant

[2]The sum of the contribution from the constituent materials shall be determined using one of, or a combination of methods referred in Clause 5.2.8, SS EN 206. However, the use of test report (certified true copy) from an accredited laboratory or declared value by the producer of each constituent material can be considered as acceptable in lieu of spot tests on the constituent materials. For constituent materials procured through HDB's managing agent, faxed or electronic copies of these test reports can be considered as being true copies.

[3]Each source of aggregate supply shall be tested once a year. However, test report (certified true copy) from an accredited laboratory, not older than 1 year for each source of aggregate supply can be considered as acceptable in lieu of spot tests. Test reports sent through fax, email or from internet from HDB appointed managing agent(s) will be considered as certified true copies.

6.1 A newly commissioned plant would be subjected to an initial inspection and issued a conditional certificate with one year validity, provided the inspection is satisfactory.

Note: For the above inspection to be satisfactory, all applicable requirements of SS EN 206 standard, the complementary standards and SAC CT 06 have to be met. In addition, there shall be no non-conformity raised. Any non-conformity raised shall be addressed as described in SAC CT 05 – SAC Criteria for Certification Bodies (Ready-Mixed Concrete) Clause 3.

6.2 The plant would then be allowed to produce the concrete under a conditional certificate subjected to a surveillance once every 2 months by the certification body. The plant shall also be required to submit production / QC records towards full compliance of Clauses 8, 9 & 10 of SS EN 206 and related requirements of the complementary standards.

6.3 Upon availability of at least 35 test results (obtained over a period of 3 months, but not exceeding 12 months), the plant would be issued with a full certificate, subject to satisfactory inspection by the certification body.

Note 1: Since the plant is already producing concrete under a conditional certificate, it would mean that the production control, etc are in order. The only reason why a full certificate is not issued is because the plant has not generated enough test results. Hence by furnishing the necessary test results, a full certificate can be issued after satisfactory inspection. The duration of the inspection is left to the certification body, and the certification body has to justified the duration of the inspection.

Note 2: For the above inspection to be satisfactory, all applicable requirements of the SS EN 206 standard, the complementary standards and SAC CT 06 have to be met. In addition, there shall be no non-conformity raised. Any non-conformity raised shall be addressed as described in SAC CT 05–SAC Criteria for Certification Bodies (Ready-Mixed Concrete) Clause 3.

6.4 If a plant is unable to obtain the full certification at the end of 12 months of the conditional certification, the certification shall be withdrawn. The plant shall not be allowed to produce and supply ready-mixed concrete. It has to re-submit an application for certification and will be treated as a new applicant.

6.5 All additional, replaced and relocated plants shall be treated as new plants.

7 Extension of scope

7.1 An existing certified plant may extend its scope of certification to include new concrete composition.

7.2 Based on initial test data provided by the producer, the certification body can issue a conditional scope with one year validity for the new concrete composition.

Note: Annex A, SS EN 206 provides details of initial testing.

7.3 Upon availability of at least 35 test results (obtained over a period of 3 months, but not exceeding 12 months) the plant would be issued with a full scope to include the new concrete compositions, subject to satisfactory inspection by the certification body.

Note 1: Since the plant is already producing concrete under a conditional certificate, it would mean that the production control, etc are in order. The only reason why a full certificate is not issued is because the plant has not generated enough test results. Hence by furnishing the necessary test results, a full certificate can be issued after satisfactory inspection. The duration of the inspection is left to the certification body, and the certification body has to justify the duration of the inspection.

Note 2: For the above inspection to be satisfactory, all applicable requirements of SS EN 206, the complementary standards and SAC CT 06 have to be met. In addition, there shall be no non-conformity raised. Any non-conformity raised shall be addressed as described in SAC CT 05 – SAC Criteria for Certification Bodies (Ready-Mixed Concrete) Clause 3.

7.4 If a plant is unable to obtain a full scope for the new concrete composition within 12 months, the conditional scope shall be withdrawn. The plant shall not be allowed to produce and supply ready-mixed concrete of this new concrete composition. It has to re-submit an application for extension of scope.

8 Closure / Re-opening of Plant

8.1 Plants which are closed on a temporary basis may be retained on the certification body's listing of certified plants for a period not exceeding 6 months.

8.2 A production control system has to be in place to ensure that when the plant restarts to operate, it is able to produce the concrete that meets the requirements. If the producers are able to achieve this after short duration of no production (not exceeding 6 months), then certification can be maintained for the period of no production.

Special inspection may need to be conducted, depending on the plants and assurances given by the producers.

8.3 If the closure exceeds 6 months, the certification shall be suspended and the plant shall not be allowed to produce and supply ready-mixed concrete until it undergoes a complete inspection and obtain the status of full certification again.

9 Quality System Requirements

9.1 The producer shall have a quality system based on the requirements specified in the Appendix.

APPENDIX – QUALITY SYSTEM REQUIREMENTS

A.1 INTRODUCTION

This document specifies the quality system requirements for ready-mixed concrete producers.

A.2 QUALITY MANAGEMENT SYSTEM

A.2.1 Management commitment

Top management shall provide evidence of its commitment to the development and implementation of the quality management system and continually improving its effectiveness by :

a) communicating to the organisation the importance of meeting customer as well as statutory and regulatory requirements;

b) ensuring that quality objectives are established;

c) conducting management reviews; and

d) ensuring the availability of resources.

A.2.2 Quality Policy

Top management shall ensure that the quality policy :

a) is appropriate to the purpose of the organization;

b) includes a commitment to comply with requirements and continually improve the effectiveness of the quality management system;

c) provides a framework for establishing and reviewing quality objectives;

d) is communicated and understood within the organization; and

e) is reviewed for continuing suitability.

A.2.3 Documentation Requirements

A.2.3.1 General

The documentation shall include :

a) a quality manual which addresses the requirements of SS EN 206 and its Singapore complementary standards SS 544-1 and SS 544-2;

b) process flow chart;

c) documented procedures required by SS EN 206 and its Singapore complementary standards SS 544-1 and SS 544-2;

d) documents needed by the producer to ensure the effective planning, operation and control of its processes; and

e) records required by this document and SS EN 206 and its Singapore complementary standards SS 544-1 and SS 544-2.

All documented requirements, procedures and activities shall also be implemented and maintained.

A.2.3.2 Control of Documents

Documents required by SS EN 206 and its Singapore complementary standards SS 544-1 and SS 544-2 shall be controlled.

A documented procedure shall be established for the control of documents.

All documents shall be prepared, approved, signed and dated by an appropriate authorised person(s), and any change in person(s) permitted to carry out this task requires authorisation.

Documents shall be reviewed regularly and kept up-to-date. When a document has been revised, a control system shall be established to prevent the unintended use of the superseded version.

A.2.3.3 Control of Records

Records shall be established and maintained to provide evidence of conformity to requirements of SS EN 206 and its Singapore complementary standards SS 544-1 and SS 544-2. Records shall be legible, readily identifiable and retrievable.

A documented procedure shall be established to define the controls needed for the identification, storage, protection, retrieval, retention time and disposition of records.

The producer shall retain the records for a period of time as specified by SS EN 206 and its Singapore complementary standards SS 544-1 and SS 544-2.

A.3 RESOURCE MANAGEMENT

A.3.1 Personnel

A.3.1.1 General

Key personnel who manage, perform and verify work affecting the quality of ready-mixed concrete shall possess the necessary competence in terms of education, training, skills and experience, prior to performing their work.

A.3.1.2 Training

The producer shall

a) determine the necessary competence for the key personnel;

b) provide training to satisfy these needs;

c) evaluate the effectiveness of the training; and

d) maintain training records.

A.3.1.3 Responsibility and Authority

The producer shall ensure that responsibilities and authorities are defined, documented and communicated within the producer. The producer shall establish the interrelation between all personnel who manage, perform and verify work that affects quality, and shall ensure the independence and authority to perform these tasks.

A.3.1.4 Management Representative

The producer shall appoint a member of the management who, irrespective of other responsibilities, shall have the ultimate responsibility of

a) ensuring that processes needed for the quality management system are established, implemented and maintained;

b) reporting to top management on the performance of the quality management system and any need for improvement; and

c) ensuring the promotion of awareness of customer requirements throughout the producer.

NOTE: The responsibility of a management representative can include liaising with external parties on matters relating to the quality management system.

A.4 CALIBRATION

Equipment used to monitor critical processes and measuring equipment shall be calibrated or verified at specific intervals, or prior to use, against measurement standards traceable to *the International System of Units* (SI units), where applicable.

The producer shall assess and record the validity of the previous measuring results when the equipment is found not to conform to requirement. The producer shall take appropriate action on the equipment and any product affected.

A.5 CONTROL OF NONCONFORMING PRODUCT

The producer shall ensure that product which does not conform to product requirements is identified and controlled to prevent its unintended use of delivery. A documented procedure shall be established to define the controls and related responsibilities and authorities for dealing with nonconforming product.

Where applicable, the producer shall deal with nonconforming product by one or more of the following ways

a) by taking action to eliminate the detected nonconformity;

b) by authorising its use, release or acceptance under concession by a relevant authority and, where applicable, by the customer;

c) by taking action to preclude its original intended use or application; or

d) by taking action appropriate to the effects, or potential effects, of the nonconformity when nonconforming product is detected after delivery or use has started.

A.6 COMPLAINTS

The producer shall establish a documented procedure for handling of complaints regarding ready-mixed concrete.

Records of the complaint, investigation and any subsequent actions taken shall be maintained.

In the event that the producer is aware of any incident or complaint regarding ready-mixed concrete resulting from contravention of any relevant government statutes or regulations, the relevant regulatory authority / agency shall be notified of the incident/complaint as soon as practicable.

A.7 CORRECTIVE ACTION

The producer shall take action to eliminate the causes of nonconformities in order to prevent recurrence. Corrective actions shall be appropriate to the effects of the nonconformities encountered.

A documented procedure shall be established to define requirements for :

a) reviewing nonconformities (including customer complaints);

b) determining the causes of nonconformities;

c) evaluating the need for action to ensure that nonconformities do not recur;

d) determining and implementing action needed;

e) records of the results of action taken; and

f) reviewing the effectiveness of the corrective action taken.

A.8 PREVENTIVE ACTION

The producer shall determine action to eliminate the causes of potential nonconformities in order to prevent their occurrence. Preventive actions shall be appropriate to the effects of the potential problems.

A documented procedure shall be established to define requirements for

a) determining potential nonconformities and their causes;

b) evaluating the need for action to prevent occurrence of nonconformities;

c) determining and implementing action needed;

d) records of results of action taken; and

e) reviewing the effectiveness of the preventive action taken.

A.9 INTERNAL AUDITS

The producer shall conduct internal audits at least once a year to monitor the implementation of and compliance with the requirements of SS EN 206 and its Singapore complementary standards SS 544-1 and SS 544-2.

The producer shall define in a documented procedure, the responsibilities and requirements for planning and conducting audits and reporting of the results and maintenance of the audit records.

Actions to eliminate detected nonconformities and their causes shall be taken without undue delay. Verification of the actions taken and the reporting of verification results shall be recorded.

A.10 MANAGEMENT REVIEW

The top management shall review its quality management system at least once a year, to ensure its continuing suitability, adequacy and effectiveness. This review shall include assessing opportunities for improvement and the need for changes to the quality management system.

Records from management reviews shall be maintained.