TECHNICAL GUIDE FOR THE OPERATION OF READY MIXED CONCRETE PLANTS

REVISION HISTORY

Issue Date	Revision	Revision Description
30/05/2011	**01**	**Issue for use**
11/02/2018	02	– Changes have been made in clauses 1.1, 2.5, 2.7, 2.10, 3.1.2, 3.1.3, 3.2, 3.3.1, 3.3.3, 3.4, 3.5.1, 3.5.2, 3.6 and 4.4.4. – Clauses 1.2 ,2.4, 2.8 ,2.12, 2.13,5.4 & 6 have been added new reference standards have been added
16/05/2024	03	– Sub- Clauses (1.2, 4.2.6, bullet 13 in clause 4.6) were added. – New format and new logo – Added some statements in the Foreword to make it consistent with other Technical Guides as well as some minor changes in terminology.
17/07/2024	04	ISSUE FOR USE

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FOREWORD

To ensure the health and safety of all the stakeholders as the primary aim of the government, the Dubai Municipality-Dubai Central Laboratory Department (DM-DCLD), in addition to other regulatory departments within DM, are working jointly for the creation, formulation, and development of a comprehensive set of unified Technical Guides (TG), and ensuring their suitability with the local environmental conditions, drawing guidance with some International and Regional Norms to consistently meet the local, regional, and international standards.

The Technical Guide (TG) describes the Technical Requirements for the Operation of Ready Mixed Concrete Plants and may be used as basis for certification of the organization as a supplier of conformity assured products/services.

This document prepared by the Dubai Municipality - Dubai Central Laboratory Department and issued after consultation, feedback, and validation involving various stakeholders, including the industry, government regulators, and other interested persons/organizations. It combines essential features and specification requirements of international practices and has been developed in such a way as to provide as much information about the Technical Requirements for the Operation of Ready Mixed Concrete Plants. Attempts have been made to make the content user-friendly.

This Technical Guide publication does not cover all the necessary provisions of a contract and the users are responsible for its correct application.

Compliance with this DM requirements cannot confer immunity from legal obligations, neither it does allow the use and/or delivering the fresh concretes or pre-cast products directly to the construction sites within the emirate of Dubai; unless all other set DM requirements are fully met and complied with.

1 GENERAL PROVISIONS

1.1 Compliance with ISO 9001 Quality Management Systems and these technical requirements shall be the primary bases for certifying ready-mixed concrete plants, Central Batching Units (Including Batching Units in Precast Concrete Plant) under the DCL Certification Scheme.

1.2 Concrete being produced shall comply with the requirements of the Dubai Building code Clause (F.6.2 - Structural concrete), (F.11 Annex: Dubai sustainable concrete baseline (DSCB) and DM - Building Permit Department Concrete Circular No 7-2-1 and all relevant Annexes.

1.3 These technical requirements relate to the following:

1) Production facilities,
2) Product realization and factory production control,
3) Transport and Delivery.
4) Performance and conformity of the ready-mixed concrete (to the user-supplied specifications).

1.4 Such requirements are generic and shall be used in combination with the applicable concrete specifications as defined below [2.3].

1.5 All the measuring devices shall be calibrated as per the required frequency.

1.6 Wherever software is used, it shall be validated.

1.7 All the required testing facilities shall be made available to meet the Technical Guide test method and specification requirements.

2 DEFINITIONS

2.1 CONCRETE

Material formed by mixing cement, coarse and fine aggregate, and water, with or without the incorporation of admixtures and additions, which develops its properties by hydration of cement.

2.2 READY-MIXED CONCRETE

Concrete delivered in a fresh state by a person or body other than the user. The concrete may be produced off-site or on-site.

2.3 READY MIXED CONCRETE PLANT

Plant for mixing, storing, and supplying measured quantities of concrete.

2.4 CENTRAL BATCHING UNIT – CBU (INCLUDING PRECAST BATCHING PLANTS)

Refers to temporary ready mixed concrete plants located in a construction site. The CBU may operate only under the license of a permanent plant. It can also be a fixed batching plant located inside a precast factory.

2.5 CONCRETE SPECIFICATIONS

Applicable concrete specifications as agreed between the purchaser and the ready-mix plant and conform to the requirements of Dubai building code, including but not limited to part F.6.2 and ACI 318-19, including standards referenced therein:

- ACI 305R
- ACI 305.1
- User-defined specifications subjected to DM approval.
- Regional (GCC), national (UAE), or local standards, if available.

2.6 PURCHASER

Refers to the purchaser/user of the concrete and the specifier of the concrete specifications and other project-specific requirements.

2.7 CONSTITUENT MATERIALS

Refers to the main components of ready-mixed concrete, which are cements and cementitious materials, aggregates, admixtures, and water.

2.8 CEMENTITIOUS MATERIALS

Pozzolans and hydraulic cement. (See also fly ash, silica fume, and slag cement.)

2.9 ADMIXTURE

Material added during the mixing process in small quantities related to the mass of cement to modify the properties of fresh or hardened concrete.

2.10 ADDITIVES

Finely divided material used in concrete in order to improve certain properties or to achieve special properties, such as pigments, fibers, etc...

2.11 BATCH

Quantity of fresh concrete produced in one cycle of operation of a mixer.

2.12 RETURNED FRESH CONCRETE

Fresh concrete which has not yet been discharged from a ready-mixed concrete transportation unit (Transit Mixers), when it is returned to the manufacturer.

2.13 RE-GRADED CONCRETE

A combination of the returned concrete with newly batched fresh concrete.

3 REFERENCES

This guide incorporates provisions from other references, which are cited and updated at the appropriate points in the text, but the latest edition applies (including amendments). If any reference is shown as dated, then that specific edition shall be used. The titles of these references are listed on the last page of this guide.

4 REQUIREMENTS FOR PRODUCTION AND TRANSPORT FACILITIES

4.1 MATERIAL STORAGE AND HANDLING

4.1.1 Cement

Cement and other cementitious materials shall be stored in weather-tight bins or silos protected from external- and cross-contamination and allowing free movement to discharge openings.

4.1.2 Aggregates

4.1.2.1 The plant shall have a system for unloading and stockpiling aggregates, such as to prevent harmful segregation and breakage.

4.1.2.2 Each size and type shall have separate bins or compartments with provisions against inter-mixing.

4.1.2.3 Bins and stockpiles shall be protected from contamination and shall have appropriate identification to prevent the inter-mixing of different materials.

4.1.2.4 Aggregate stockpiles should be shaded.

4.1.3 Water

The plant shall have adequate supply of water complying with the plant followed specifications and local regulations under constant or regulated pressure to ensure accurate measurement of discharged volume.

4.1.4 Admixtures

The plant shall provide adequate storage and handling of admixtures to prevent contamination and appropriate to the manufacturer's handling instructions for the admixture.

4.2 REQUIREMENTS FOR HOT WEATHER CONCRETING

The temperature of the placed concrete shall not exceed 35°C. However, wherever the project specifications are more stringent, the project specifications shall prevail with the following measures inter alia (among other things) may be required to control the temperature:

4.2.1 Shade aggregate, cement silos, water tanks and admixture tanks

4.2.2 Paint concrete plant and transit mixers with light color.

4.2.3 Run concrete plant with flaked ice before mixing or transporting concrete. Add flaked ice as a proportion of the water.

4.2.4 Use chillers to cool the mixing water.

4.2.5 The time between adding the water to the concrete mix and placing it at the construction site shall be controlled in such a way to keep the fresh concrete inside the mixers in good workable condition.

4.2.6 Concrete for mass concrete members may have temperature limits specified or stated in the thermal control plan by project consultant /designer.

All the precautions to be taken shall be subject to Engineer's or client's approval. The ready-mix supplier shall demonstrate all approved precautions.

4.3 BATCHING EQUIPMENT

4.3.1 Weighing equipment calibration

4.3.1.1 Weighing scales may be mechanical or electronic (load cell) with accuracy within ± 0.15% of total capacity or ±0.4% of the applied load, whichever is greater, through the scale range of use.

4.3.1.2 The load indication of the scale shall be readable from the batching control room, either directly or through remote indicating devices.

4.3.1.3 The scales shall undergo full calibration at least once every year; and each time the scale is moved or relocated by an accredited independent third-party calibration firm'.

4.3.1.4 The regular checking/verification shall be done on a weekly basis.

4.3.1.5 Field standard weights used for full calibration of the scale's accuracy shall be at least 10% of the scale capacity and shall be accurate to 0.01% of the indicated value.

4.3.1.6 For purposes of regular checking/verification of the accuracy of the weighing scales, the plant shall have set of standard test weights of at least 250 kg. These standard weights should be accurate to 0.01% of the indicated value.

4.3.1.7 Weigh batchers shall be equipped with precision charging and discharging mechanisms to ensure accuracy of the quantity of the material to within the tolerance required by the applicable concrete specifications.

4.3.2 Volumetric equipment

4.3.2.1 Volumetric batching devices (can be through a water meter or through a calibrated volumetric tank) for water shall be equipped with cut-off mechanism capable of stopping the flow within the tolerances required by the applicable concrete specifications .

4.3.2.2 The volume indicating device shall be readable from the batching control room, either directly or through a remote indicating device.

4.3.2.3 Dispensers for admixtures - Dispensers for admixtures shall be capable of dispensing the correct quantity of the admixture to the accuracy as specified in the applicable concrete specification.

4.3.3 Batching control system

4.3.3.1 The weigh batchers and volumetric batchers shall have an automatic control mechanism for stopping the flow of materials when the desired quantity has been reached. The discharged quantity shall be accurate to within the tolerances given in the applicable concrete specifications.

4.3.3.2 The system shall have provisions for ensuring that materials are secured and safely discharged into the mix.

4.3.3.3 Data Loggers and Recorders - The plant shall be equipped with automatic data loggers and recorders to keep records of the data during the batching process. Batch reports, delivery tickets and materials consumption reports shall be retained for a minimum of one year in soft copy (in their original form) either in the batching system itself or an external storage.

4.4 PLANT MIXER

4.4.1 The plant mixer shall be capable of mixing the concrete completely (central mixing).

4.4.2 Central mixing shall be capable of producing uniform distribution of the constituent materials and a uniform consistency of the concrete within the specified mixing time and at the mixing capacity.

4.4.3 Plant mixers' capacity and mixing speed shall be clearly identified.

4.4.4 Plant mixer shall be equipped with a timing device that will prevent the premature discharge of the batch before the mixing time has elapsed.

4.5 TRUCK MIXERS

4.5.1 Truck mixers shall be so equipped as to enable the concrete to be delivered in a homogenous state. In addition, if water or admixtures are to be added on site under the responsibility of concrete producer as agreed by the engineer or client but under no circumstances water shall be added in transit.

4.5.1.1 The truck mixers shall be provided with suitable measuring and dispensing equipment.

4.5.1.2 Re-mixing of concrete which has commenced to set shall not be allowed and in no case shall such concrete be used in works.

4.5.1.3 Pumping concrete through delivery pipes may be permitted but only with prior approval of the Engineer and client.

4.5.1.4 The method of Transport and Delivery and placing concrete shall be to the approval of the Engineer or Client.

4.5.2 Truck mixers shall be identified to indicate the gross volume of the drum, the loading capacity, and the minimum and maximum mixing speeds of rotation of the drum.

4.6 TICKETING SYSTEM

The plant shall have a ticketing system that is able to issue a delivery ticket with the following information:

1) Name of ready-mixed concrete plant
2) Serial number of tickets
3) Truck number or vehicle identification
4) Name of purchaser
5) Name and location of the project/site
6) Reference to concrete specifications /designation
7) Amount of concrete in cubic meters
8) Date and time when batch was loaded.
9) Types and strength class of cements / cementitious materials
10) Additional information, when requested, or as required by the project specification *e.g.: Strength class, Exposure class, Chloride content, Type of admixtures and addition, special properties, etc.*
11) Weights/volumes of all materials batched (Target and Actual) in addition to the batching errors of each material.
12) "Source Plant" or "Plant Number"
13) The time limit to complete the discharge.

5 REQUIREMENTS FOR PRODUCT REALIZATION

5.1 PLANNING

The plant shall develop and prepare a "quality plan" for all processes needed to ensure that the concrete is supplied having the quality and, in the quantity, agreed with the purchaser. The quality plan shall include the following:

1) Specifications for the input and output of the process.
2) Resources required and personnel responsible.
3) Required verification and/or measurement.
4) Required records to provide evidence that the product meets the requirements.

5.2 ORDER PROCESSING

The plant shall establish a system for order processing that shall cover the following:

5.2.1 Review of verbal or written enquiries in order to:

1) Record the enquiry.
2) Identify and record purchaser's requirements (i.e., Concrete specifications)
3) Identify and allocate materials and other resources.
4) Prepare batch instructions (note: batch instructions are the summary of information that identifies materials and concrete mix requirements, together with any project-specific requirements)
5) Prepare and issue quotation with identified alternatives, if applicable.

5.2.2 Review of (purchase) orders in order to:

1) Verify the orders against the quotations.
2) Resolve anomalies if any
3) Clarify terms and conditions.
4) Prepare/issue batch instructions.

5.2.3 Purchaser communication

The plant shall provide all necessary information to the purchaser related to the supply of the concrete; and shall obtain purchaser's agreement in case of deviations from the terms of the purchase order. The plant shall investigate complaints related to compliance with the purchaser's specifications.

5.3 CONCRETE DESIGN AND INITIAL TESTING

This requirement relates to the initial testing in order to determine the characteristics, in respect to fresh and hardened concrete, of a particular combination of materials across a range of cement contents, in order to be able to provide concrete of the desired characteristics.

5.3.1 The plant shall establish procedures and implement initial testing for new concrete composition (new materials and combinations of materials) before use.

5.3.2 The initial test shall be repeated if there has been a change, either in the constituent materials or in the specified requirements.

5.3.3 Initial tests and acceptance of results shall be carried out in accordance with the provisions of the applicable concrete specifications.

5.4 PURCHASING AND CONTROL OF CONSTITUENT MATERIALS

The plant shall establish and implement and document a system for purchasing and control of materials that shall include the following:

5.4.1 Evaluation of suppliers

The plant shall establish an effective system to ensure that its suppliers have the capability to continue to meet its quality requirements.

5.4.2 Establishment of specifications for constituent materials

Materials shall be as per applicable concrete specifications.

5.4.3 Inspection and verification of purchased materials.

All incoming materials shall be subject to assessment for conformity to the specifications agreed with the materials' supplier.

5.4.4 Storage of materials

Materials shall be stored in an appropriate way to ensure protection from contamination and deterioration over time.

5.4.5 Control of non-conforming materials

Procedures shall be established to ensure that non-conforming materials are not used unintentionally.

5.5 CONCRETE PRODUCTION

5.5.1 Batching of constituent materials

5.5.1.1 A documented batching instruction giving details of the type and quantity of the constituent materials shall be made available where the batching is carried out. The actual batched quantity of each constituent material shall be within the tolerances given in the applicable concrete specifications.

5.5.1.2 The batching equipment shall conform to the requirements stated in [4.3] and shall be operated in accordance with the applicable concrete specification.

5.5.1.3 Cements, aggregates, and additions in the form of powders shall be batched by mass. Mixing water, lightweight aggregate, admixtures, and liquid additions may be batched by mass or by volume.

5.5.1.4 Mixing of concrete - Mixing of the constituent materials shall be carried out in a mixer conforming to [4.4]. Mixers shall not be loaded and operated more than their rated mixing capacity.

5.6 PRODUCTION CONTROL TESTING

Production control testing shall be carried out during the production process in accordance with the:

5.6.1 Tests required,

5.6.2 Location of testing, and

5.6.3 Frequency of testing given in the applicable concrete specifications.

5.7 IDENTIFICATION AND TRACEABILITY

5.7.1 Concrete shall be described in documentation by one of the following, as applicable:

1) In accordance with the applicable concrete specifications
2) In accordance with customer specifications
3) In accordance with other descriptions as defined in recognized specifications.

5.7.2 The system of description of materials and finished product shall provide traceability of all constituent materials, admixtures, and additions, between suppliers' description and those used in the product realization.

5.7.3 The documentation shall provide traceability of the entire process from verbal or written enquiry up to the delivery tickets for the finished product (i.e., enquiry, quotations, orders, batching instructions, delivery tickets).

6 REQUIREMENT FOR PERSONNEL

6.1 Personnel affecting product quality shall be competent on the basis of appropriate education, training, skills and experience.

6.2 The plant shall identify and document the level of knowledge, training, and skills required for personnel involved in different levels of operation.

6.3 The plant shall:

1) Ensure that relevant staff are competent to perform their functions and are aware of the effects of those functions on quality.
2) Ensure that personnel have been adequately trained to carry out their assigned duties and responsibilities.

3) Ensure that the testing of materials, design and control of concrete mixes, and their constituents, are under the supervision of an experienced concrete technologist who has adequate educational background and training.

6.4 The plant shall meet the minimum technical staff requirements to be approved by the DM Building Permit Department as per the Concrete Circular No 7-2-1 and all relevant Annexes 7-2-1-1 and 7-2-1-2.

7 THE MINIMUM REQUIREMENTS FOR RE-USE OF RETURNED FRESH CONCRETE

7.1 The purpose of these requirements is to ensure that returned fresh concrete to be used in new batch/load is of adequate quality and meets the concrete mix specifications requirements of the project to which this concrete is redirected to.

7.2 Permission to use returned concrete in any new concrete batch/load shall be agreed on between the ready mixed concrete supplier and his client in purchase documents and project specifications. (These requirements do not by itself allow the use of returned fresh concrete in new concrete).

7.3 In any case where the requirements of the purchaser are more stringent than those covered below, the purchaser's specification shall govern.

7.4 Returned fresh concrete less than 0.5 m^3 shall not be used in a new batch/load of concrete.

7.5 Returned Fresh Concrete shall comply with below:

7.5.1 The time of original loading and indication on the use of returned concrete shall be shown on the new ticket when redelivered.

7.5.2 Aggregate used shall be in accordance with any agreement with the specifier/user and shall be described on the delivery ticket.

7.5.3 The cement type and quantity used shall be as specified.

7.5.4 The specified strength of the returned fresh concrete shall be equal to or greater than that of the new batch of concrete.

7.5.5 The temperature of the concrete load containing the returned concrete shall comply with the project specifications, however; in no case the returned concrete of an age more than 8 hours after the original loading shall be used in any new load of concrete.

7.5.6 Only automated constituent materials are allowed to be added, however; the limits of addition shall be identified and recorded. The maximum allowed cement content in the regarded concrete shall not exceed 500 kg/m³

7.5.7 Any performance criteria specified by the specifier/user shall be met.

7.5.8 Where the concrete to be delivered is significantly different from that originally ordered, the specifier/user's agreement to the actual proportions shall be obtained and recorded.

7.5.9 Adequate records (batch weights of the new load, weigh bridge tickets, delivery tickets, returned concrete form (RCF) shall be maintained and provided to DM auditors upon request.

7.5.10 Slump test and concrete bleeding shall be tested for the regraded concrete. Additional concrete specimens for compressive strength shall be tested at the ages specified by the purchaser.

7.6 *Note: Returned concrete form (RCF) should reflect as a minimum the loading times, mix grades, temperatures, reason for returned concrete, volume measurements, weighbridge tickets....)*

8 PUBLICATIONS REFERRED TO.

ACI	ACI CONCRETE TERMINOLOGY
ACI 305R-20	GUIDE TO HOT WEATHER CONCRETING
ASTM C 94/C94M	STANDARD SPECIFICATION FOR READY-MIXED CONCRETE
ASTM C150/C150M	STANDARD SPECIFICATION FOR PORTLAND CEMENT
ASTM C260/C260M	STANDARD SPECIFICATION FOR AIR-ENTRAINING ADMIXTURES FOR CONCRETE
ASTM C331/C331M	STANDARD SPECIFICATION FOR LIGHTWEIGHT AGGREGATES FOR CONCRETE MASONRY UNITS
ASTM C618	STANDARD SPECIFICATION FOR COAL ASH AND RAW OR CALCINED NATURAL POZZOLAN FOR USE IN CONCRETE
ASTM C989/C989M	STANDARD SPECIFICATION FOR SLAG CEMENT FOR USE IN CONCRETE AND MORTARS
ASTM C1798/C1798M	STANDARD SPECIFICATION FOR RETURNED FRESH CONCRETE FOR USE IN A NEW BATCH OF READY- MIXED CONCRETE.
BS 8500-1	CONCRETE. COMPLEMENTARY BRITISH STANDARD TO BS EN 206 - METHOD OF SPECIFYING AND GUIDANCE FOR THE SPECIFIER
BS 8500-2	CONCRETE. COMPLEMENTARY BRITISH STANDARD TO BS EN 206 – SPECIFICATION FOR CONSTITUENT MATERIALS AND CONCRETE
BS EN 206	CONCRETE. SPECIFICATION, PERFORMANCE, PRODUCTION AND CONFORMITY
NRMCA CHECKLIST	PLANT CERTIFICATION CHECK LIST FOR CERTIFICATION OF READY MIXED CONCRETE PRODUCTION FACILITIES UNDER NRMCA

QSRMC QUALITY AND PRODUCT CONFORMITY REGULATIONS – THE QUALITY SCHEME FOR READY MIXED CONCRETE