भारतीय मानक **IS 18685 : 2024**

Indian Standard

पैकेजबंद सूखा मिश्रित कंक्रीट — विशिष्टि

Packaged Dry Mix Concrete — Specification

ICS 91.100.30

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October 2024 **Price Group 10**

Cement and Concrete Sectional Committee, CED 02

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

The standard requirements for ingredients used for making cement concrete such as binder (cement), aggregates (coarse and fine), admixtures (mineral and chemical) and mixing water have already been established in Indian Standards. Good practices of concreting have also been standardized in the following publications:

IS 456 : 2000 Plain and reinforced concrete — Code of practice (*fourth revision*)

IS 4926 : 2003 Ready-mixed concrete — Code of practice (*second revision*)

IS 10262 : 2019 Concrete mix proportioning — Guidelines (*second revision*)

These days, the concrete making materials are such that they are being traded between the supplier and purchaser through packs/drums, etc. Considering the need for laying down the standard requirements for such concrete making materials packaged in dry form, this standard has been formulated.

For effective implementation of the provisions of this standard, it is desirable that the dry mix concrete plants operate their system under a third party certification scheme to ensure operation of a well structured system and to build confidence in the users of such concrete.

This standard contains clauses **4.5.5**, **6.1**, **8.3.5.2**, **9.2.1.1**, **9.3.2.4**, **10**, **11.1** and **11.2.1** which call for agreement between the producer and the purchaser.

This standard relates to the United Nations Sustainable Development Goal SDG 9: 'Industry, innovation, and infrastructure' particularly '9.2 Promote inclusive and sustainable industrialization'.

The composition of the Committee responsible for the formulation of this standard is given in Annex F.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PACKAGED DRY MIX CONCRETE — SPECIFICATION

1 SCOPE

1.1 This standard covers the requirements for the production and supply of ready-mixed concrete in dry condition, where in, the ready-mixed concrete is produced, packed and supplied in dry form either in small bags in the order of 25 kg to 100 kg each or in bulk form in the order of 0.25 t to 1.0 t. It does not cover the placing, compaction, curing or protection of concrete after delivery but however, covers, in general, the mixing of concrete at site.

1.2 The packing of the dry mix concrete shall be acceptable in the form when all the concrete making materials, the binder component inclusive of cement and cement replacement materials, dried aggregates as well as the dry admixtures in powder form shall be packed in a single bag.

NOTE — Instructions for mixing of the dry mix concrete along with specified water content shall be clearly provided in printed form.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Characteristic Strength — The strength of material below which not more than 5 percent of the test results are expected to fall.

3.2 Design Dry Mix — Mix for which the purchaser is responsible for specifying the required performance in terms of compressive strength, slump, slump retention time and durability related requirements. And the producer is responsible for selecting the mix proportions to produce the required performance.

3.3 Free Water-Cement Ratio — Ratio of the mass of free water (that is excluding the water absorbed by the aggregate in a saturated surface dry condition) to the mass of cement including mineral admixtures as per **4.3** in a concrete mix.

3.4 Grade of Concrete — Numerical value of characteristic compressive strength (in N/mm^2) of 150 mm cube of concrete at 28 days.

3.5 Minimum Cement or Cementitious Content — The minimum mass of cement or cement including mineral admixtures as per **4.3** required by the purchaser to be present in unit volume of specified mix (*see also* Note 2 under Table 5 of IS 456).

3.6 Packaged Dry Mix Concrete — A mixture of aggregate (coarse and fine) and cementitious materials with or without admixtures in dry form for all uses but excluding all mortars.

NOTE — Unless otherwise stated, the term ready-mixed concrete in this standard shall refer to ‘packaged dry mix concrete’.

3.7 Producer (*also* Supplier) — Person or authority entering into a contract to supply packaged dry mix concrete.

3.8 Purchaser (*also* Consumer) — Person or authority entering a contract to buy dry ready-mixed concrete.

3.9 Standard Dry Mix — Standard mixes produced and sold by producer for selected specific performance requirements in terms of strength, workability and durability exposure conditions. For these mixes, the producer is responsible for selecting the mix proportions to produce the declared performance. It should be packed and supplied in the bags of 25 kg to 50 kg with the minimum slump as 100 mm and minimum retention time as 45 min.

4 MATERIALS

4.1 Selection of Materials

Materials used should satisfy the requirements for the safety, structural performance, durability and appearance of the finished structure, taking full account of the environment to which it will be subjected. The selection and use of materials shall be in accordance with IS 456. Materials used shall conform to the relevant Indian Standards applicable. Where chemical admixtures are used which are not covered by the provisions of IS 9103, there should

be satisfactory data on their suitability and assurance of quality control. Records and details of performance of such materials should be maintained. Account should be taken of possible interactions and compatibility between materials used. Also, prior permission of the purchaser shall be obtained before use of such materials.

4.2 Cement

Cement used for concrete shall be in accordance with the requirements of IS 456. It shall be ensured that the cement utilized in the manufacture of concrete shall be dated less than a month from its date of manufacture.

4.3 Mineral Admixtures

Use of mineral admixtures shall be permitted in accordance with the provisions of IS 456.

4.4 Aggregates

Aggregates used for concrete shall be in accordance with the requirements of IS 383.

4.5 Chemical Admixtures

4.5.1 Use of chemical admixtures shall be permitted in dry form in accordance with the provisions of IS 456.

4.5.2 It shall be the responsibility of the producer to establish compatibility and suitability of any admixture with the other ingredients of the mix and to determine the dosage required to give the desired effect.

4.5.3 Admixtures should be stored in a manner that prevents degradation of the product and consumed within the time period indicated by the supplier of admixture. Any vessel or dry storage bag containing an admixture in the plant or taken to site by the producer shall be clearly marked as to its content.

4.5.4 When offering or delivering a mix to a purchaser it should be indicated if such a mix contains an admixture or combination of admixtures or not. The admixtures may be identified generically and should be declared on the delivery ticket as given in Annex E.

4.5.5 The amount of admixture added to a mix shall be recorded in the production record. In special circumstances, if necessary, additional dose of liquid chemical admixture if provided by the supplier in the bag, may be added at project site to enhance the workability of concrete with the mutual agreement between the producer and the purchaser. Instruction of addition of the admixture shall also be supplied by the manufacturer.

NOTE — In case liquid admixtures are used, extreme care shall be taken to ensure that it should not be mixed with the other components of dry mix concrete. Also, the liquid admixture shall be packed in an air tight container/packets and enclosed within the dry mix concrete bag.

4.6 Water

4.6.1 Water used shall be in accordance with the requirements of IS 456. Since this system pertains to the supply of concrete in dry form, the amount of water to be added to a particular batch of material supplied to a site shall be commensurate to the quantity of dry mix concrete material in the bag, and shall be in accordance with the recommended mix design pertaining to that batch. This shall be such that the desired workability is achieved and the strength satisfies the criteria for the decided grade given in IS 456, when tested as per the relevant applicable part of IS 516 and IS 1199. It is the responsibility of the supplier to clearly mention on the bag, the exact quantity of water to be added into the mix, taking into account, the necessary corrections pertaining to water absorption of the raw materials.

4.6.2 As far as possible, this system encourages the consumer to adopt potable water conforming to the requirements of IS 456 into the production of concrete mix at site. In the absence of availability of water of such quality, other sources of water may be explored, but the quality of concrete made with such sources of water shall be in accordance with IS 456.

4.6.3 The addition of the exact amount of prescribed water shall be under the scope of the consumer. However, it is the duty of the producer to ensure that the consumer shall be properly educated in this regard and wherever applicable, the producer may supply a system which devises a perfect quality control with respect to water addition at the site, in agreement with the consumer. It is recommended that the consumer shall utilize calibrated water tank with the arrangement of cut off valve in order to exercise a perfect quality control. In case of availability of trained manpower in execution of the job, the importance of the addition of prescribed amount of water into the concrete mix through any such means that ensures perfect quality control shall be enforced by the consumer.

4.6.4 The producer shall not deem directly responsible for exercise of poor quality control at site, especially with respect to water addition, but shall be deemed so, in case of absence of the declaration of necessary data through disclaimers in the form of printed information on the supplied bags, with respect to the quantity of water to be added at

the construction site, and other necessary technical information.

5 BASIS OF SUPPLY

5.1 Dry mix concrete shall be supplied having the quality and quantity in accordance with the requirements mutually agreed with the purchaser or his agent. Notwithstanding this, the concrete supplied shall generally comply with the requirements of IS 456.

5.2 All concrete will be supplied and invoiced in terms of mass of dry mix concrete supplied in bags plus the water supplied to the construction site, if any. The supply of water at the construction site shall usually be under the scope of consumer, unless there is an agreement between the producer and the consumer, with respect to the supply of water. However, the yield of concrete, when the prescribed amount of water is added at the site, shall almost be accurately mentioned by the producer as a printed information on the supplied bags. All proportioning is to be carried out by mass.

6 INFORMATION TO BE SUPPLIED BY THE PURCHASER

6.1 The purchaser shall provide to the producer the details of the concrete mix or mixes required by him/her, all pertinent information on the use of the concrete and the specified requirements. Prior to supply, it is recommended that a meeting should be held between the purchaser and the producer to clarify operational matters, such as notice to be given prior to delivery, delivery rate, the name of the purchaser's authorized representative who will coordinate deliveries, any requirements for additional services such as pumping, on site testing or training, etc.

6.2 Design Dry Mix

Where the purchaser specifies a design dry mix to be supplied, it is essential that all relevant information as per the format given in Annex B is conveyed to the producer at the time of enquiry.

7 INFORMATION TO BE SUPPLIED BY THE PRODUCER

7.1 When requested, the producer shall provide the purchaser, the following information before any concrete is supplied:

a) Nature and source of each constituent material;
b) Source of supply of cementitious materials;
c) Proposed proportion or quantity of each constituent/m^3 of dry mix concrete; and
d) The exact amount of water to be administered at site, either in relation to 1 m^3 of concrete or as per packaging size.

7.2 When requested, the producer shall provide the purchaser, the following information on admixtures:

a) Generic type(s) of the main active constituent(s) in the admixture;
b) Whether or not the admixture contains chlorides and if so, the chloride content of the admixture expressed as a percentage of chloride ion by mass of admixture;
c) Whether or not the admixture leads to the entrainment of air when used at the adopted dosage;
d) Where more than one type of admixture is used, confirmation of their compatibility; and
e) Initial and final setting time of concrete when admixture is used at adopted dosage [tested as per IS 1199 (Part 7)].

8 PRODUCTION AND DELIVERY

8.1 General

There shall be a proper system and process in place for production of dry mix concrete. The overall plant layout shall be custom designed in accordance with the system and process. However, the dry mix concrete production plant configuration shall consist of appropriate storage units for all the concrete making materials (except water, which is not used for dry mix concrete production) but for other auxiliary uses in the plant operation. However, if water supply for concrete making is also taken up by producer as per **5.2**, storage facility for water for concrete making shall also be created by the producer.

8.2 Moisture Content

The production of dry mix concrete is entirely based on packaging of premixed concrete material at a minimum moisture level; and hence a benchmark moisture level of the premixed material shall be used by producer before packaging is done. In no case, the moisture content of the dry mix concrete product shall not be more than 0.3 percent by mass of the material. A proper drying system shall be in place to bring the moisture levels of all the relevant concrete making materials to such levels, that the overall moisture content of the premixed material is under the prefixed benchmark moisture level. In case such materials which are dried to appropriate

moisture levels need to be stored temporarily, the storage system for such dried materials shall be designed appropriately to maintain the moisture levels under acceptable limits under the established quality assurance plan by the producer.

It shall be ensured that the quality assurance plan takes into account, all the variables which deem the premixed material to violate the benchmark moisture levels, and contain necessary steps to ensure the proper correction of such variables to bring the moisture levels of the premixed material to acceptable limits before packaging of such materials is done.

8.3 Plant and Equipment

8.3.1 *Materials Storage and Handling*

8.3.1.1 *Cement*

Separate storage for different types and grades of cement shall be provided. Containers may be used to store cements of different types provided these are emptied before loading a new cement. Bins or silos shall be weatherproof and permit free flow and efficient discharge of the cement. Each silo or compartment of a silo shall be completely separate and fitted with a filter or alternative method of dust control. Each filter or dust control system shall be of sufficient size to allow delivery of cement to be maintained at a specified pressure, and shall be properly maintained to prevent undue emission of cement dust and prevent interference with weighing accuracy by build-up of pressure.

Cement stored and stacked in bags shall be kept free from the possibility of any dampness or moisture coming in contact with them and where cement can be stored and retrieved without undue damage to the bags. The bags are to be protected from becoming damp either from the ground or the weather. (*see also* IS 4082).

8.3.1.2 *Dry pulverized fuel ash and other mineral admixtures*

Suitable separate arrangement for storage of dry pulverized fuel ash and other permitted mineral admixtures shall be provided (as in case of cement) in the plants utilizing these materials.

8.3.1.3 *Aggregates* (*Coarse and Fine*)

Stockpiles shall be free draining and arranged to avoid contamination and prevent intermingling with adjacent material. Handling procedures for loading and unloading aggregates shall be such as to reduce segregation to a minimum. Provision shall be made for separate storage for each nominal size and type of aggregate, and the method of loading of storage bins shall be such as to prevent intermingling of different sizes and types. Fine aggregates shall be stacked in a place where loss due to the effect of wind is minimum (*see also* IS 4082 and IS 456).

Dried aggregate storage areas should be moisture free. Measures should be taken to maintain the moisture levels of all the concrete making materials to be well within the benchmark moisture level fixed as per the internal quality assurance plan and this should be maintained until the moisture proof packing of the dry mixed concrete is completed.

8.3.1.4 *Water*

Water is not required for concrete making in a dry mix concrete plant. However, an adequate supply shall be provided for all auxiliary activities requiring water, such as timely cleaning of central mixers, other equipment etc, and when stored in the plant, such storage facilities shall be designed to minimize the risks of contamination.

8.3.1.5 *Chemical admixtures*

Tanks, drums or silos containing admixtures in dry form shall be stored in dry areas and away from direct sunlight or heat. Each such container shall be properly labelled for identification purposes. Tanks or drums containing liquid admixtures shall be clearly labelled for identification purposes and stored in such a way to avoid damage, contamination or the effects of prolonged exposure to sunlight (if applicable). Agitation shall be provided for liquid admixtures, which are not stable solutions.

8.3.2 *Batching Plants and Batching Equipment*

Hoppers for weighing cement, mineral admixtures, aggregates and chemical admixture (if measured by mass) shall consist of suitable containers freely suspended from a scale or other suitable load measuring device and equipped with a suitable discharging mechanism. The method of control of the loading mechanism shall be such that, as the quantity required in the weighing hopper is approached, the material may be added at a controllable rate and shut off precisely within the weighing tolerances specified in Annex C. The weighing hoppers for cement, mineral admixtures, aggregate shall be capable of receiving their rated load, without the weighed material encountering the loading mechanism. The weighing hoppers shall be constructed so as to discharge efficiently and prevent the build-up of materials. A tare adjustment, up to 10 percent of the nominal capacity of the weigh scale, shall be provided on the weighing mechanism so that the scale can be adjusted to zero at least once each day. Dust seals shall be provided on cement

hoppers between the loading mechanism and the weigh hopper, and shall be fitted so as to prevent the emission of cement dust and not to affect weighing accuracy. The hopper shall be vented to permit escape of air without emission of cement dust. Vibrators or other attachments, where fitted, shall not affect the accuracy of weighing. There shall be sufficient protection to cement and aggregate weigh hoppers and weighing mechanisms to prevent interference with weighing accuracy by weather conditions or external build-up of materials.

Where chemical admixture dispensers are used, they shall be capable of measurement within the tolerances in Annex C and a calibrated container or weigh scales shall be provided to check the accuracy of measurement at least once a month.

Where a continuous mixer with ribbon loading is used, the batching procedure specified by the manufacturer of the plant shall be followed.
Each control on the batching console and weigh-dial or display shall be clearly labelled with its function and where concerned with the batching of materials, the material type.

When more than one type or grade of cement is being used, the weighing device and discharge screw or other parts of the transfer system shall be emptied before changing from one type of cement to another.

When pulverized fuel ash and other mineral admixtures are batched through the cement weigh system, the weighing device and discharge screw or other parts of the transfer system shall be empty when the weighing system has returned to zero reading or completed the batch.

Where a back-weighing system is utilized to weigh materials, a system shall be in place so as to prevent materials being loaded during the process of weighing.

In addition to the above requirement, automatic batching plants as in IS 4925 shall be applicable/used.

8.3.3 *Measurement of Materials*

Cement and mineral admixtures shall be measured by mass in a hopper or compartment separate from those used for other materials and on a scale of appropriate sensitivity, measurement being taken from a zero reading. Aggregates shall be measured by mass, only dry materials will be measured. When weighing materials, any build up in the hopper during the day must be made out to zero or allowed for in the batch weights. After measurement, all materials shall be discharged into the mixer without loss. The specified tolerances shall apply to all individual materials.

The accuracy of the measuring equipment shall be within ± 1 percent of the quantity of cement and mineral admixtures being measured, and within ± 2 percent of the quantity of aggregate and chemical admixture being measured. The plant operator shall be provided with a clear display of the quantities of materials to be batched for each mix and batch size, and with information identifying the display to be selected for each designed and prescribed/recommended mix to be produced. Analogue scale displays for the weighing of cement, mineral admixtures and aggregates and shall be discernible from the operating position. For digital readouts, the numerals shall be readily discernible from the operating position.

Fully automatic production systems shall be fitted with control equipment to allow the correct operation of the plant to be monitored during weighing and batching. Automatic control systems on batching plants shall not commence batching until all hoppers have been emptied and/or reading scales made to zero unless such systems are designed to take account of build up in their programming.

All scales shall be tested and calibrated as per Annex C.

8.3.4 *Mixing*

8.3.4.1 *Central mixer*

The central mixer unit adopted at the plant shall be of appropriate capacity and shall be capable of mixing thoroughly the pre-dried concrete making materials in dry form, which is in turn, discharged into a predesigned temporary storage hopper system through an appropriately designed conveying system. The central mixer adopted shall be capable of a uniform blending of all the concrete making materials discharged into it, for producing dry mixed concrete to be supplied in a single bag containing all the concrete making materials, within the prescribed mixing time. Suitable modifications may be made in the design of the overall mixing system, to ensure proper discharge of the calculated proportions of each raw material of the recommended concrete mix into each bag, so as to ensure minimum segregation of the concrete making materials, before being discharged into each bag. The producer shall have a proper system and process in place to control this aspect of the production.

Central mixer shall be designed to capacitate mixing of all the materials in dry form. Any form of moisture shall be completely removed from the

mixer either through a method of running a dummy dry mix in the mixer or through hot air blowing. The whole contents of the dummy dry mix shall be completely discharged and disposed before loading the central mixer again with fresh dry materials.

8.3.4.2 *Loading into the mixer*

Mixers shall not be loaded in excess of the manufacturer's rated capacity. The mixing time shall be measured from the time all the materials required for the batch are in the drum of the mixer. The mixing time shall not be less than that recommended by the manufacturer. Where a continuous mixing plant is used, the complete mixing time shall be sufficient to ensure that the dry mixed concrete is of the required uniformity. Admixtures in dry form shall be discharged into the mixer during or after the discharge of other raw materials. The mixing time shall be so adjusted that a uniform blending of all the dry materials is ensured inside the drum but shall in no case, be less than that recommended by the equipment manufacturer.

8.3.4.3 *Discharge from central mixer*

On completion of the mixing time, the entire contents inside the drum shall be discharged onto a conveying system, which transports the whole material into a temporary storage hopper or silo or bin. As far as possible, a close conveyer system shall be adopted for this procedure, to protect the freshly mixed dry mix concrete from any ingress of external moisture. The temporary storage unit shall be completely moisture proof.

8.3.4.4 *Discharge from temporary storage hopper*

A system shall be developed to discharge calculated amounts of mixed materials from the temporary storage hopper through the provision of an appropriate load cell with required precision over a conveying system which carries the discharged material to a packing unit, where the required quantity to fill up a bag of known or decided capacity is discharged into the bags. As far as possible, the system shall be mechanized and accuracy of all discharged materials shall be ascertained at all levels.

8.3.5 *Packing Unit*

8.3.5.1 The premixed material shall be discharged in calculated weight controlled through a system of precise load cells from the storage hopper over a properly designed conveying system and such material shall be discharged into each bags. The load cell shall be capable of exactly discharging the required amount of premixed material to fill up the desired bag of desired quantity by mass, with allowable errors as given below.

The error shall not be more than ± 0.5 percent by mass of the total mass of the premixed material in the bag, when the desired packaged weight of the bag is less than or equal to 50 kg. For bags having higher weight capacities, say 100 kg and above, the maximum error which may be allowed shall be ± 0.75 percent by mass of the total mass of the premixed material in the bag.

NOTES

1 If the bags are packed in sizes exceeding 100 kg, it shall be ensured that provisions for mechanical mixing of dry mix is available at site and the mix shall be remixed before use.

2 Supplier can give additional dry admixture in sachet/pouch for the user to add for increasing workability than specified for some thin structural sections, if the requirement arises.

8.3.5.2 The premixed dry mix concrete shall be packed in moisture proof bags. In any case, the packing quality shall not be less than the quality of packing adopted for cement.

Dry mix concrete shall be packed in any of the following bags:

a) Multi-wall paper sacks conforming to IS 11761;

b) HDPE/PP woven sacks conforming to IS 11652 with lamination in them;

c) PP woven, laminated, blocks bottom valve sacks conforming to IS 16709; or

d) Flexible intermediate bulk containers conforming to IS 14738 for bulk packaging.

Bags shall be in good condition at the time of inspection.

Supplies of bags in bulk may be made as per mutual agreement between the purchaser and the producer.

The materials discharged in calculated weights from the temporary storage hopper shall be directly discharged into each corresponding bag of known or decided capacity. It is desirable for the whole system to be mechanized or robotized in such way that the timing between the discharge from storage hopper onto the conveyor system, the discharge from the conveyor system and the frequency of feeding of bags of desired capacity should exactly complement each other. Any other suitable system can also be employed, which ensures both the efficacy and accuracy of packing as well as the speed of the whole process. As far as possible, the whole process shall be administered under closed/semi-closed conveying system to prevent ingress of outside moisture. The bags shall be most preferably open mouthed, to facilitate easy

discharge of dry mix concrete. If other type of bags is used, then the discharge system shall be capable of efficient fill up of each bag to the required accuracy level.

8.3.6 *Shelf Life*

The shelf life of the packaged dry mix concrete shall be established by the producer such that mean strength on completion of shelf life is not less than the target strength; and shelf life in no case will be more than 2 months from the date of packaging. Dry mix concrete bag which has exceeded its shelf life may be utilized only for non-structural purposes after retesting before use.

8.4 Transport of Dry Mix Concrete

8.4.1 Dry mix concrete shall be transported from the batching/packing plant to either a temporary storage area in the vicinity of the plant premises, from where it is further transported either directly to construction sites or channel networks, or the packed bags may be directly transported from the packing plant to construction sites or channel networks.

8.4.2 Dry mix concrete bags shall be transported in wagons of appropriate capacity, taking appropriate precautions during multiple handling of the bags. It shall be ensured that hooks are not used during any stage of handling of the packed bags.

8.5 Storage of Packaged Dry Mix Concrete

The packaged dry mix concrete bags shall be stored in such a manner as to permit easy access for proper inspection and identification, and in a suitable weather-tight building to protect the bags from dampness and to minimize warehouse deterioration similar to that done for cement

8.6 Plant Safety and Maintenance

At all times, all guardrails and machinery guards shall be fixed securely in position and walkways kept clean and tidy with clear access. All plant and equipment shall be maintained in a clean and efficient working condition and regular, routine maintenance checks shall be carried out as detailed in Annex D. Check lists, including weekly, monthly and quarterly routines, shall be prepared to cover general storage, handling, batching and mixing and transporting plant, as well as the routine maintenance recommended by manufacturers for specific items of equipment. The name and/or position of the person responsible for ensuring that the maintenance schedules are carried out shall be included on each checklist and a provision made for their signature.

8.7 Environmental Considerations

The design, management and operation of a dry mixed concrete plant should be with due regard for the environment. The broad criteria given in **8.7.1** to **8.7.9** should be borne in mind when establishing a dry mixed concrete plant (wherein the following the term minimize is used, it is understood to mean to reduce to the lowest realistic level using technologies which are proven, reasonable and economic).

8.7.1 *External Appearance*

The producer should endeavour to ensure that plant operations are landscaped and screened from the surrounding industrial, commercial, residential or rural community so that impact on the environment is minimized.

8.7.2 *Plant, Office Buildings and Staff Facilities*

The producer shall ensure that plant buildings are suitably maintained, kept clean and that all required records are appropriately kept.

8.7.3 *Site Safety*

The producer shall provide working conditions which have regard to the health and safety of employees.

8.7.4 *Air Pollution*

The producer should utilize appropriate technology to prevent or minimize dust emissions in line with local or national regulations.

8.7.5 *Noise and Vibration*

The producer should take steps to ensure that plant and vehicle noise are minimized through plant design, the use of appropriate technology and the location of the plant.

8.7.6 *Water Management*

The producer should take action to improve effluent quality where necessary and reduce volumes of discharge. It should be aimed to minimize water usage and wastage and to meet national and local regulations concerning effluent discharges.

8.7.7 *Fuel, Oil and Chemical Spillage*

The producer should take appropriate measures to prevent pollution of surrounding surface and ground waters from accidental effluent discharges and fuel, oil or chemical spillage.

8.7.8 *Waste Management*

The producer should introduce processes and working practices that minimize the production of waste. Where waste cannot be avoided, to provide environmentally sound treatment and disposal, or find markets for its use as a resource.

8.7.9 *Training*

The producer should undertake to train employees to make them aware of the responsibility to the environment. High priority should be given for site care and good housekeeping, and to encourage participation in the local community.

8.8 Delivery Ticket

A pre-printed delivery ticket for each consignment of concrete shall be provided to the customer, on which is printed, stamped or written the minimum information detailed in Annex E. The delivery ticket will form the basis of invoicing.

9 QUALITY CONTROL

Quality control of dry mix concrete may be divided into three components, forward control, immediate control and retrospective control.

9.1 Forward Control

Forward control and consequent corrective action are essential aspects of quality control. Forward control includes the following.

9.1.1 *Control of Purchased Material Quality*

A control system shall be operated to provide assurance that all materials purchased for and used in the production of concrete conform to the Indian Standards agreed with the material supplier and the requirements of the producer's mix design methodology and quality control procedures. This shall include visual checks, sampling and testing, certification from material suppliers and information from material suppliers may also be obtained wherever possible.

9.1.2 *Control of Materials Storage*

Materials should be stored in such a way as to prevent the risk of contamination. The producer should utilize suitable transfer and feed systems. Feed aggregate storage areas should be free draining. Dried aggregate storage areas should be moisture free. Measures should be taken to maintain the moisture levels of all the concrete making materials to be well within the benchmark moisture level fixed as per the internal quality assurance plan and this should be maintained until the moisture proof packing of the dry mixed concrete is completed. Admixtures should be clearly identified and protected from sunlight (where applicable) and the risk of contamination.

9.1.3 *Mix Design and Mix Design Modification*

The producer shall maintain a record of all mix designs and modifications current on the plant. Since the dry mixed concrete system entirely relies upon drying the aggregates, etc, the concrete mixed designs shall be 'total water content based', instead of 'free water content based' conventional system.

NOTE — It is evident that this system of making dry mixed concrete requires no water/moisture correction to be adopted at site in any case, and the consumer has to exactly administer the 'total water' to be added into the concrete mix.

9.1.4 *Plant Maintenance*

The producer shall be able to demonstrate that a documented plant maintenance procedure is in place. Regular plant inspections should be carried out with faults reported and rectified.

9.1.5 *Transfer and Weighing Equipment*

The producer shall be able to demonstrate that a documented calibration procedure is in place. Calibration records should contain details of any corrective action required, the date of the next calibration, confirmation that any required corrective action has taken place and the signature of the designated manager for that plant. The producer shall also maintain a daily production record for that plant, including details of which customers were supplied, which mixes were supplied and which delivery dockets were dispatched. There should be a record of what materials were used for that day's/shift's production including admixture. The use of electro-mechanical weighing and metering systems, that is, load cells, flow meters, ammeters, etc, is preferable over purely mechanical systems, that is, knife edge and lever systems.

9.1.6 *Plant Mixers*

Plant mixers shall be in an operational condition. The producer should ensure that regular maintenance is performed as per requirements.

9.1.7 *Stock Control of Materials*

The producer shall operate a materials stock control procedure to enable verification of total quantities used and to confirm that only approved materials have been received.

9.2 Immediate Control

Immediate control is concerned with instant action to control the quality of the concrete being produced or that of deliveries closely following. It includes the production control and product control.

9.2.1 *Production Control*

9.2.1.1 The production of concrete at each plant shall be systematically controlled. This is to ensure that all the concrete supplied shall be in accordance with these requirements and with the specification that has formed the basis of the agreement between the producer and purchaser.

9.2.1.2 The plant laboratory shall have a system in place to periodically collect samples from the packing unit (packed bags) for a particular batch of production representing one grade or type of dry mixed concrete produced, to ensure the workability and strength parameters to be in accordance with the dry concrete mix design.

9.2.1.3 The mixing time of the materials in the plant mixer and the overall timing mechanism until packing of the dry mixed concrete completes shall be controlled and monitored on a continuous basis during production and any corrective action necessary taken. Necessary automatic alarming systems may be adopted to give off warning signals wherever there is an aberration in the process of timing mechanism detected.

9.2.1.4 For each load of production, written/printed/graphical records shall be made of the mass of the materials batched, time of batching with date, time at which the mixed material was discharged from the central mixer into the temporary storage hopper, time when other ancillary raw materials were added in any part of the process further, and the time when the concrete (in combined or separate form) was packed into a moisture proof bag. The whole process described above shall be controlled with a robotic time lapse mechanism and along with the week, month and year of the production, it is most advisable to print further information such as the date and shift of batching. This is to ensure the traceability of the particular batch which has been packed to the associated batching as near as possible, in case of conflicts, discrepancies, quality related complaints, and also as a measure of internal quality control.

9.2.1.5 Regular routine inspections shall be carried out on the condition of plant and equipment.

9.2.2 *Product Control*

Dry concrete mixes shall be randomly sampled and tested for workability, and where appropriate, plastic density, temperature and air content as per the quality assurance plans. Where significant variations from target values are detected, corrective action shall be taken.

9.3 Retrospective Control

Retrospective control is concerned with those factors that influence the control of concrete quality that cannot be assessed at the time of production. Retrospective control may cover any property of materials or concrete, slump achieved after desired retention time at site, but is particularly associated with 28 day cube strength because by its very nature it is not a property which can be measured ahead of, or at the time of manufacture. It involves looking back by later age testing, monitoring, analysing and correcting/modifying system and or taking corrective action

9.3.1 *Mix Performance*

The producer shall be responsible for ensuring that suitable control procedures are in place to ensure the following.

9.3.1.1 *Designed mixes*

A quality control system shall be operated to control the strength of designed mixes to the levels required and shall be based on random tests of mixes as per prescribed frequency which form the major proportion of production. The system shall include continuous analysis of results from cube tests to compare actual with target values together with procedures for modifying mix proportions to correct for observed differences to ensure that most of achieved periodical (monthly) mean values are not less than target mean values. Compressive strength testing shall be carried out using a machine that meets the requirements of IS 14858. The strength testing machines shall be computerized wherein all test records are stored systematically and machine software should be such that results cannot be altered by producer in the machine database.

9.3.1.2 *Standard dry mixes*

Periodic and systematic checks shall be made to ensure that the cementitious material contents of the standard dry mixes comply with their mix descriptions.

9.3.2 *Control of Water at Site*

9.3.2.1 It is important to maintain the designed water to binder ratio as well as the aggregate/binder ratio constant at its correct value at the site. Since the whole system and process relies upon the fact that

the mixed concrete inside moisture proof bags are almost completely dry, it is evident that the system of making dry mixed concrete requires no water/moisture correction to be adopted at site in any case, and the consumer has to exactly administer the 'total water' to be added into the concrete mix, which includes the water corresponding to the water absorption of the aggregates used. If any measures are taken to alter the absorption characteristics of the aggregates, then this phenomenon shall be well determined at the plant level and suitable corrections shall be made to the total water content to be added at the site in accordance with the established data.

9.3.2.2 It forms the duty of the producer to accurately mention the amount of total water to be added to a dry concrete mix inside a mixer at the site, and such information shall be clearly, boldly and legibly printed on each bag containing the dry concrete mix with appropriate disclaimer statements if necessary.

9.3.2.3 In the presence of such printed information on each bag, it forms the duty of a consumer to administer proper quality control measures to add the prescribed amount of water at the site, against each bag of concrete containing a known weight of the dry mixed concrete material.

9.3.2.4 As far as possible, an automatic mixer with a water cut off system shall be employed while administering a work with dry mixed concrete, to ensure perfect quality control at site with less manual interference. The supply of such a mixer to a construction site shall be usually under the scope of the consumer, but the producer may have an alternate strategy in place to supply such specially designed mixers to a construction site and it shall be in accordance with a mutual agreement between the two parties.

9.3.2.5 In case of absence of such automatic mixers with water cut off system, the consumer shall ensure usage of measures of appropriate size, quantity and accuracy to manually administer water addition into the mixer as is applicable to the accuracy desired.

9.3.2.6 In any case, no extra water shall be added at site into the concrete mixer by any concerned parties other than the prescribed water printed on the bags.

9.3.3 *Mixing Time*

9.3.3.1 The producer shall clearly mention the mixing pattern at site, legibly, either pictographically or graphically printed on the bags, and such information shall necessarily include the minimum time of mixing required at site, for a particular batch of dry mix concrete, to facilitate the proper initiation of the action of additives added in the dry concrete mix.

9.3.3.2 *Complaints and non-conformances observed*

The producer shall have a procedure in place to enable the diagnosis and correction of faults identified from complaints and non-conformances observed whatsoever while analysing and monitoring the various test results.

10 ORDER PROCESSING

A competent person to interpret the specified requirements and relate these to mix design criteria shall systematically review specification and orders supplied by the purchaser. These shall be formally recorded together with any modification to the specification resulting from subsequent agreed documentation to ensure that the plant operator is given the correct instructions for batching and mixing.

When mixes or materials are offered as alternatives to requested mixes or where there is incomplete specification supplied by the purchaser, orders whether received verbally or in writing, shall be agreed with the purchaser and the fact recorded. Alternatives to the mix description or compliance requirements in the purchaser's specification shall be clearly identified in the quotation.

11 SAMPLING AND TESTING OF DRY MIX CONCRETE

Dry mix concrete plant shall have test facilities at its premises to carry out routine tests as per the requirement of the standard and records of testing shall be at maintained for each batch. Apart from that, if any user intends to subject a consignment for testing as per relevant Indian Standard test method, the following shall govern.

11.1 Point and Time of Sampling

For the assessment of compliance of dry-mixed concrete, the point and time of sampling shall be at the producer's storage unit, or the storage unit of channel partners/distributors, or at the delivery site itself. While sampling from the producer's storage unit, there shall be an agreement between the producer and the consumer regarding the testing of the sampled bags, whether the testing shall be done in-house in the testing facility of the producer or if a third-party evaluation is required. It is critical that the sampling procedure and equipment used enables as representative a sample as possible to be taken of the quantity of concrete delivered. The sampling may be carried out jointly by the purchaser and the supplier with its frequency mutually agreed upon.

However, it will not absolve the supplier of his responsibility from supplying concrete as per the requirements given in this standard or otherwise agreed to where so permitted in the standard.

11.2 Workability

11.2.1 The workability of concrete shall meet the requirements as per IS 456.

The design mix for dry mix concrete shall be such that the desired workability to place or pump the concrete within 15 min to 30 min (or the other time mutually agreed between supplier and purchaser) after adding water at site is achieved. It shall be the responsibility of the consumer to ensure that everything is in order for the readiness of mixing water to the dry mixed concrete at the site mixer, such as readiness of site conditions for the placing of the concrete, readiness of pumping accessories, planned co-ordination, etc. The consumer shall mix water to the dry mix concrete only after ensuring that the above-mentioned criteria are perfectly in order.

11.2.2 In case the workability of the concrete does not satisfy the desired requirements at site, the consumer shall immediately call upon the producer for rectification of the problem. In case of minor adjustments required at site with respect to workability, the purchaser shall be entitled to add liquid chemical admixtures supplied by the manufacturer in such quantities as to suffice the achievement of the required amount of workability at site, and this shall be executed under expert supervision. Adequate extra quantity of admixture thus may be supplied along the dry mix concrete supplied with instructions on limiting amount of extra admixture which can be used. This limiting amount will be decided by supplier after proper testing at the time of mix design trials.

11.2.3 It however, forms the duty of the producer to supply dry mixed concrete with the right amount of desired workability at site, by proper facilitation of the required degree of admixtures being incorporated into the dry mixed concrete. Also, since the addition of the exact quantity of water is under the scope of the consumer, the consumer shall ensure the same.

11.2.4 In cases of workability not being satisfied to the desired quality as mentioned by the producer, even if it is satisfied by either party, then it forms the duty of the producer to provide the right solutions to the consumer to solve the workability issue to the satisfaction of the consumer.

11.3 Specified Strength

11.3.1 Compliance shall be assessed against the requirements of IS 456 or other agreed Indian Standard. The purchaser may perform his own sampling and testing or may enter into an arrangement with the producer to provide his testing requirements. Joint sampling and testing can be as per mutually agreed arrangement. In any case, at least one sample shall be taken per day per batch for every grade of concrete.

11.3.2 Unless otherwise agreed between the parties involved, the minimum testing frequency to be applied by the producer should be one sample for every 100 MT of production. Manufacturers test certificate shall be provided with every lot. Sampling and testing shall be as per IS 456 .

11.3.3 For a faster estimate of the concrete quality, the following optional tests may be carried out in addition to the 28/56 day compressive strength test:

a) 7 days compressive strength test, or

b) Modulus of rupture at 72 h ± 2 h for beams.

For this purpose, the value should be arrived at based on actual testing. In all cases, 28/56 days compressive strength shall alone be the criteria for acceptance or rejection of the concrete.

11.3.4 The purchaser shall inform the producer if his requirements for sampling and testing are higher than one sample every 100 MT. Based on the established standard deviations of supplied concrete, the sampling frequency may be reduced based on mutual agreement but not less than one sample for every 10 m^3.

11.4 Additional Compliance Criteria

Any additional compliance criteria shall be declared to the producer by the purchaser prior to supply and shall be mutually agreed upon in terms of definition, tolerance, frequency of assessment, method of test and significance of result.

11.5 Non-Compliance

The action to be taken in case of non-compliance shall be declared and mutually agreed upon (*see also* IS 456).

12 TRAINING

12.1 All personnel concerned with production, delivery and the function of the producer's quality system shall have received training appropriate to the duties they perform.

12.2 The testing of materials, proportioning of mixes and the production of concrete together with all its control testing shall be under the overall supervision

of an experienced concrete technologist.

12.3 Operator who have received proper instructions on the equipment in use and who are able to comply with the required accuracy of batching shall produce dry mixed concrete.

13 RECORDS

Records shall be maintained by the producer to provide confirmation of the quality and quantity of concrete produced. The records shall be retained for the purposes of these requirements for a period of at least one year.

They shall cover the following aspects:

a) Production and delivery:
   1) Batching instructions;
   2) Batching records;
   3) Delivery tickets; and
   4) Equipment calibration and plant maintenance.

b) Materials and production control:
   1) Concrete production and materials purchase, usage and stocks; and
   2) Certificates or test results for materials.

c) Production quality control — Control test results.

14 MARKING

14.1 Each bag or drum of dry mixed concrete shall be legibly and indelibly marked with the following:

a) Manufacturer's name and his registered trade-mark, if any;

b) Grade of the concrete;

c) Net quantity, in kg;

d) The words 'Use no Hooks' on the bags;

e) Amount of water (in litres) to be added either per m^3 of concrete or as per packaging size;

f) Yield of concrete (in m^3) after addition of prescribed amount of water at site;

g) Batch/control unit number in terms of week, month and year of packing;

h) Best before — Declared shelf life (in no case will be more than 2 months from the date of packaging);

j) Dry mix concrete bag which has exceeded its shelf life may be utilized only for non-structural purposes after retesting of dry mix concrete before use;

k) Address of the manufacturer; and

m) Mixing time as per **9.3.3**.

14.2 Similar information shall be provided in the delivery advices accompanying the shipment of packed or bulk dry mix concrete and on drums.

14.3 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 383 : 2016	Coarse and fine aggregate for concrete — Specification (*third revision*)
IS 456 : 2000	Plain and reinforced concrete — Code of practice (*fourth revision*)
IS 516	Hardened concrete — Methods of test:
(Part 1/Sec 1) : 2021	Testing of strength of hardened concrete, Section 1 Compressive, flexural and split tensile strength (*first revision*)
(Part 2)	Properties of hardened concrete other than strength,
(Sec 1) : 2018	Density of hardened concrete and depth of water penetration under pressure (*first revision*)
(Sec 2) : 2020	Initial surface absorption (*first revision*)
(Sec 4) : 2021	Determination of the carbonation resistance by accelerated carbonation method (*first revision*)
(Part 4) : 2018	Sampling, preparing and testing of concrete cores (*first revision*)
(Part 5)	Non-destructive testing of concrete,
(Sec 1) : 2018	Ultrasonic pulse velocity testing (*first revision*)
(Sec 2) : 2021	Half-cell potentials of uncoated reinforcing steel in concrete (*first revision*)
(Sec 3) : 2021	Carbonation depth test (*first revision*)
(Sec 4) : 2020	Rebound hammer test (*first revision*)
(Part 6) : 2020	Determination of drying shrinkage and moisture movement of concrete samples (*first revision*)
(Part 8/Sec 1) : 2020	Determination of modulus of elasticity, Section 1 Static modulus of elasticity and poisson's ratio in compression (*first revision*)
(Part 11) : 2020	Determination of Portland cement content of hardened hydraulic cement concrete (*first revision*)
IS 1199	Fresh Concrete — Methods of sampling, testing and analysis:
(Part 1) : 2018	Sampling of fresh concrete (*first revision*)
(Part 2) : 2018	Determination of consistency of fresh concrete (*first revision*)
(Part 3) : 2018	Determination of density of fresh concrete (*first revision*)
(Part 4) : 2018	Determination of air content of fresh concrete (*first revision*)
(Part 5) : 2018	Making and curing of test specimens (*first revision*)
(Part 6) : 2018	Tests on fresh self compacting concrete (*first revision*)
(Part 7) : 2018	Determination of setting time of concrete by penetration resistance (*first revision*)
IS 4082 : 1996	Stacking and storage of construction materials and components at site — Recommendations (*second revision*)

IS No.	*Title*
IS 4925 : 2023	Concrete batching and mixing plant — Specification (*second revision*)
IS 9103 : 1999	Concrete admixtures — Specification (*first revision*)
IS 11652 : 2017	Textiles — High density polyethylene (HDPE)/polypropylene (PP) woven sacks for packaging of 50 kg cement — Specification (*third revision*)
IS 11761 : 1997	Multi-wall paper sacks for cement — Specification (*first revision*)
IS 14738 : 2017	Flexible intermediate bulk containers (FIBCs) — Specification (*first revision*)
IS 14858 : 2000	Compression testing machine used for testing of concrete and mortar — Requirements
IS 16709 : 2017	Textiles — Polypropylene (PP) woven, laminated, block bottom valve sacks for packaging of 50 kg cement — Specification

ANNEX B

(*Clause* 6.2)

CONCRETE MIX INFORMATION TO BE SUPPLIED BY THE PURCHASER

DMC Supplier : _____

Contractor : _____

Site : _____

MIX CODE						
Grade (N/mm^2) (Characteristic strength)						
Minimum cement content (kg/m^3)						
Minimum additives (Pulverized fuel ash/slag/others) (kg/m^3)						
Maximum free water – cement ratio						
Nominal maximum aggregate size						
Cement type and grade (if preferred)						
Target workability at site (slump/ flow)						
Maximum temperature of concrete at the time of placing						
Class of sulphate resistance (if applicable)						
Exposure condition (if applicable)						
Class of finish (if applicable)						
Mix application						
Method of placing						
Any other requirements (early strength workability retention, permeability testing, chloride content restriction, maximum cement content, etc)						
Concrete testing (frequency)						
Material's testing (any non-routine requirements)						
Method of curing to be used by contractor						
Quantity (m^3)						

NOTE — Additional proforma for further information may be used, such as for specific test rates to be achieved for concrete or raw materials, exact method statements of the contractors proposed site practice.

ANNEX C

(*Clauses* 8.3.2 *and* 8.3.3)

CALIBRATION AND WEIGHING EQUIPMENT ACCURACY

C-1 At the time of installation, or reconditioning, the accuracy of the indicated mass at any point on the scale shall be within 0.25 percent of the full scale reading:

a) At any other time during operation the accuracy shall be within 0.50 percent of the full scale reading.

b) Chemical admixture dispensers shall have scale increments not exceeding:

Sl No.	*Range of Scale in* kg/*litres*	*Scale Increment in* kg/*litres*
(1)	(2)	(3)
i)	0.1 to 0.5	0.01
ii)	0.5 to 1.0	0.02
iii)	1.0 to 10.0	0.2
iv)	More than 10.0	0.4

c) All weighing and measuring equipment shall be tested and calibrated over its full working range at the following intervals:

1) Mechanical/knife: At least once every two months

2) Electrical/load cell systems: At least once every three months

Adequate and identified facilities shall be provided for the application of the test loads.

d) In the case of batch weighing systems testing and calibration shall be based on the application test loads to the weigh hoppers;

e) Checks on continuous weigh systems shall be based on comparison of preset quantities with those actually produced;

f) To achieve the required accuracy of calibration, a minimum of 500 kg of stamped weights are required, except that for low capacity scales an acceptable limit on the total mass of calibration weights would be 20 percent of the scale capacity; and

g) When calibration of weighing equipment is carried out all personnel involved should be competent and fully trained, the procedures should be fully documented, and special attention should be paid to the health and safety aspects of the procedure.

ANNEX D

(*Clause* 8.6)

ROUTINE MAINTENANCE CHECKS FOR PLANT AND EQUIPMENT

D-1 STORAGE AND HANDLING EQUIPMENT

D-1.1 Weekly Routine:

a) Check area under plant for spillage and trace source;
b) Clean-up yard, checking that all drains and traps are clear;
c) Check all storage bins and doors for efficient operation;
d) Check conveyors, boom scrapers and bucket elevators for free running and wear, and adjust as necessary;
e) Routine checks and servicing on loading shovels;
f) Routine checks and servicing on compressors; and
g) Report any defects.

D-2 BATCHING AND MIXING EQUIPMENT

D-2.1 Daily Routine:

a) Adjust tare weights and clean weigh dials (if applicable);
b) Ensure weighing hoppers empty properly; and
c) Washout central mixer drum or pan.

D-2.2 Weekly Routine:

a) Maintain all hoppers and doors in clean and efficient working order;
b) Check central mixer blades, paddles or arms for wear and tightness and adjust as necessary;
c) Remove any cement or concrete build up in the mixer;
d) Shack out cement silo filter sock (if applicable) and maintain in efficient working order;
e) Check dust seals on cement hoppers for wear;
f) Clean knife edge or load cells on weighing equipment;
g) Check calibration of moisture meter if applicable;
h) Check oil levels on air line lubricators;
j) Drain water traps on air lines;
k) Check rams and air lines for leaks;
m) Check pipe work for leaks and wear;
n) Check wiring and electrical apparatus for correct operation and overheating;
p) Routine greasing of bearings and gears;
q) Routine checks and servicing on central mixers; and
r) Report any defects.

D-2.3 Monthly Routine:

a) Check calibration of all weigh scales;
b) Check calibration of water meter; and
c) Check calibration of admixture dispenser.

D-2.4 Quarterly Routine:

a) Inspection and testing of all weigh scales over their complete operational range; and
b) Routine oil changes in gearboxes and oil baths.

ANNEX E

(*Clauses* 4.5.4 *and* 8.8)

DELIVERY TICKET INFORMATION

E-1 The following information shall be included in the delivery ticket to accompany the load to the purchaser:

a) Name of the dry ready-mixed concrete depot;

b) Serial number of the ticket;

c) Date;

d) Name of the purchaser;

e) Name and location of site;

f) Grade or mix description of the concrete;

g) Workability (slump) to be achieved at the retention time (at 30 min);

j) Minimum cement content;

k) Type of cement and grade;

m) Mineral admixture (name and quantity);

n) Maximum quantity of water to be added per bag

p) Nominal maximum size of aggregate;

q) Generic type or name of any chemical admixtures included;

r) Quantity (net) in MT; and expected yield of concrete that can be produced, in m^3 after mixing of water;

s) Signature of the plant operator;

t) A statement warning the purchaser of the precautions needed to be taken when working with cement and wet concrete; and

u) Manufacturers test certificate (MTC).

NOTE — Any additional information as agreed between the manufacturer and the purchaser.

ANNEX F

(*Foreword*)

COMMITTEE COMPOSITION

Cement and Concrete Sectional Committee, CED 02

Organization	*Representative(s)*
In Personal Capacity (*Grace Villa, Kadamankulam PO, Thiruvalla - 689583*)	SHRI JOSE KURIAN **(*Chairperson*)**
ACC Ltd, Mumbai	SHRI MANOJ JINDAL DR MANISH V. KARANDIKAR (*Alternate*)
Ambuja Cements Limited, Ahmedabad	SHRI UMESH P. SONI SHRI SUKURU RAMARAO (*Alternate*)
Atomic Energy Regulatory Board, Mumbai	SHRI L. R. BISHNOI SHRI SOURAV ACHARYA (*Alternate*)
Cement Manufacturers Association, Noida	DR V. RAMACHANDRA SHRI PRAKHAR SRIVASTAVA (*Alternate*)
Central Public Works Department, New Delhi	SHRI A. K. RAJDEV SHRI SAUROBH KUMAR (*Alternate*)
Central Soil and Materials Research Station, New Delhi	SHRI U. S. VIDYARTHI SHRI B. K. MUNZNI (*Alternate*)
Central Water Commission, New Delhi	DIRECTOR (CMDD) (N & W) DEPUTY DIRECTOR (CMDD) (NW & S) (*Alternate*)
Conmat Technologies Pvt Ltd, Kolkata	DR A. K. CHATTERJEE DR SUBRATO CHOWDHURY (*Alternate*)
Construction Chemical Manufacturers' Association, Mumbai	SHRI SAMIR SURLAKER SHRI NILOTPOL KAR (*Alternate*)
CSIR - Central Building Research Institute, Roorkee	DR SANTHA KUMAR DR JEESHAN KHAN (*Alternate*)
CSIR - Central Road Research Institute, New Delhi	DR RAKESH KUMAR DR V. V. L. KANTA RAO (*Alternate*)
CSIR - Structural Engineering Research Centre, Chennai	DR K. RAMANJANEYULU DR P. SRINIVASAN (*Alternate*)
Delhi Development Authority, New Delhi	SHRI LAXMAN SINGH SHRI VIJAY SHANKAR (*Alternate*)
Department of Science and Technology, Ministry of Science and Technology, New Delhi	SHRI SAJID MUBASHIR SHRIMATI NAMITA GUPTA (*Alternate*)
Engineers India Limited, New Delhi	SHRI ANURAG SINHA SHRI VIKRAM K. GUPTA (*Alternate*)
Hindustan Construction Company Ltd, Mumbai	SHRI SATISH KUMAR SHARMA SHRI MUKESH VALECHA (*Alternate*)

Organization	*Representative*(*s*)
Housing and Urban Development Corporation Limited, New Delhi	SHRI DEEPAK BANSAL
Indian Association of Structural Engineers, New Delhi	PROF MAHESH TANDON SHRI MANOJ K. MITTAL (*Alternate*)
Indian Concrete Institute, Chennai	SHRI VIVEK NAIK SECRETARY GENERAL (*Alternate*)
Indian Institute of Technology Delhi, New Delhi	DR SHASHANK BISHNOI DR DIPTI RANJAN SAHOO (*Alternate*)
Indian Institute of Technology Madras, Chennai	DR DEVDAS MENON DR MANU SANTHANAM (*Alternate*)
Indian Institute of Technology Roorkee, Roorkee	DR V. K. GUPTA DR BHUPINDER SINGH (*Alternate*)
Indian Roads Congress, New Delhi	SHRI S. K. NIRMAL SHRI R. V. PATIL (*Alternate*)
Military Engineer Services, E-in-C's Branch, Army HQ, New Delhi	MAJ GEN S. K. KHANNA SHRI P. K. JAIN (*Alternate*)
Ministry of Road Transport & Highways, New Delhi	SHRI Y. BALAKRISHNA SHRI SANJEEV KUMAR (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	SHRI P. N. OJHA DR S. K. CHATURVEDI (*Alternate*)
National Test House, Kolkata	SHRI D. V. S. PRASAD DR SOMIT NEOGI (*Alternate*)
Nuvoco Vistas Corporation Ltd, Mumbai	DR PRANAV DESAI SHRI RAVINDRA KHAMPARIA (*Alternate*)
Public Works Department, Govt of Tamil Nadu, Chennai	SUPERINTENDING ENGINEER EXECUTIVE ENGINEER (*Alternate*)
STUP Consultants Pvt Ltd, Mumbai	SHRI A. T. SAMUEL
The India Cements Limited, Chennai	REPRESENTATIVE
The Indian Hume Pipe Company Limited, Mumbai	SHRI P. R. BHAT SHRI S. J. SHAH (*Alternate*)
The Institution of Engineers (India), Kolkata	DR H. C. VISVESVARAYA SHRI S. H. JAIN (*Alternate*)
The Ramco Cements Limited, Chennai	SHRI BALAJI K. MOORTHY SHRI ANIL KUMAR PILLAI (*Alternate*)
Ultra Tech Cement Ltd, Mumbai	SHRI RAJU GOYAL DR M. R. KALGAL (*Alternate*)
Voluntary Organization in Interest of Consumer Education, New Delhi	SHRI M. A. U. KHAN SHRI B. MUKHOPADHYAY (*Alternate*)

Organization	*Representative*(*s*)
In Personal Capacity (*House No. 131 Sector 11D Faridabad - 121006*)	SHRI V. V. ARORA
In Personal Capacity [*B-806, Oberoi Exquisite, Oberoi Garden City, Goregaon* (*East*), *Mumbai – 400063*]	SHRI A. K. JAIN
In Personal Capacity (*36, Old Sneh Nagar, Wardha Road, Nagpur – 440015*)	SHRI L. K. JAIN
In Personal Capacity (*EA-92, Maya Enclave, Hari Nagar, New Delhi – 110064*)	SHRI R. C. WASON
BIS Directorate General	SHRI DWAIPAYAN BHADRA, SCIENTIST 'E'/DIRECTOR AND HEAD (CIVIL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretaries

SHRIMATI DIVYA S.
SCIENTIST 'D'/JOINT DIRECTOR
(CIVIL ENGINEERING), BIS

AND

SHRI JITENDRA KUMAR CHAUDHARY
SCIENTIST 'B'/ASSISTANT DIRECTOR
(CIVIL ENGINEERING), BIS

Composition of Concrete Sub-Committee, CED 2:2

Organization	*Representation(s)*
In Personal Capacity (*Grace Villa, Kadamankulam PO, Thiruvalla - 689583*)	SHRI JOSE KURIAN **(*Convener*)**
ACC Limited, Mumbai	SHRI SANJAY ROY SHRI RAKESH GUPTA (*Alternate*)
Afcons Infrastructure Limited, New Delhi	SHRI MANISH MOKAL
Ambuja Cement, Mumbai	SHRI UMESH P. SONI SHRI SUKURU RAMARAO (*Alternate*)
Association of Consulting Civil Engineers India, Bengaluru	SHRI AVINASH D. SHIRODE SHRI K. K. MEGHASHYAM (*Alternate*)
Atomic Energy Regulatory Board, Mumbai	DR L. R. BISHNOI SHRI SOURAV ACHARYA (*Alternate*)
Building Materials and Technology Promotion Council, New Delhi	DR SHAILESH KUMAR AGRAWAL SHRI C. N. JHA (*Alternate*)
Bureau of Design for Hydro and Irrigation Project, Bhopal	SHRI S. K. KHARE SHRI BHAGWATI PRASAD GUPTA (*Alternate*)

Organization	*Representation*(*s*)
Central Public Works Department, New Delhi	SHRI A. K. RAJDEV SHRI SAUROBH KUMAR (*Alternate*)
Central Soil and Materials Research Station, New Delhi	SHRI U. S. VIDYARTHI SHRI M. RAJA (*Alternate*)
Creative Design Consultants and Engineers Private Limited, Ghaziabad	SHRI AMAN DEEP SHRI MANIK CHATTERJEE (*Alternate*)
CSIR - Central Building Research Institute, Roorkee	DR R. SHIVA CHIDAMBARAM DR H. C. ARORA (*Alternate* I) SHRI RAJESH KUMAR (*Alternate* II)
CSIR - Central Road Research Institute, New Delhi	SHRI SATISH PANDEY
CSIR - Structural Engineering Research Centre, Chennai	DR B. H. BHARATKUMAR DR M. B. ANOOP (*Alternate* I) SHRI PRABHAT RANJAN PREM (*Alternate* II)
Elkem South Asia Private Limited, Navi Mumbai	SHRI BRAJESH MALVIYA SHRI SURENDRA SHARMA (*Alternate*)
Engineers India Limited, New Delhi	DR SUDIP PAUL MS MAITRAYEE MAZUMDER (*Alternate* I) MS AKANSHA SACHDEVA (*Alternate* II)
Gammon Engineers and Contractors Private Limited, Mumbai	SHRI RAHUL BIRADAR SHRI SWAPNIL POPHALE (*Alternate*)
Hindustan Consulting Associates Private Limited, New Delhi	SHRI SATISH KUMAR SHARMA
Hindustan Construction Company Limited, Mumbai	SHRI KHATARBATCHA
Indian Concrete Institute, Chennai	DR SAROJ MANDAL SHRI MANOJ KAWALKAR (*Alternate*)
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This Indian Standard has been developed from Doc No.: CED 02 (18877).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi