



READY MIX CONCRETE PLANT INSPECTION

GENERAL

Refer to [IM 527](#) (General, Safety).

The following instruction is to be used when inspecting the operation of a ready mix concrete plant typically used for structural concrete, patching, and other concrete items.

EQUIPMENT

1. ELEVATED, LOW PROFILE, AND GROUND-LEVEL BINS

Refer to [IM 527](#) (Equipment Bins) and the following:

Permanent structural concrete plants often have facilities for storing sizable quantities of a number of different aggregates. There is a tendency for the stockpiles to become too large for the available area and for the bins to be filled beyond their normal capacity. Aggregates thus tend to become intermingled. Aggregates may also become contaminated with foreign material from a number of sources, including the material, which underlies some stockpiles, if proper care is not taken. Materials, which have been intermingled or otherwise contaminated, must not be incorporated into the work.

2. PROPORTIONING EQUIPMENT

Requirements for scales or meters for proportioning aggregates, cement, fly ash, water or air entraining agents or other admixtures are found in [Article 2001.20](#) of the Standard Specifications, as modified by Supplemental Specifications. These requirements are in addition to Section 1 above for elevated bins.

It is the duty of the District Materials Engineer to examine and evaluate all proportioning and plant equipment annually, and maintain a current list of approved structural concrete plants. The Calibration Report, Form #820917, with any appropriate restrictions, conditions, comments, etc., will be posted at the plant site. (See [IM 527](#), [Appendix C](#) for a sample copy and [Appendix D](#) for calibration checklist.) Before concrete work begins on a project, the Project Engineer must communicate with the District Office and determine that the plant to be used has received annual approval.

The PCC Level II certified technician must be familiar with all features of the plant operation before work begins. While the inspector must not personally make any of the manipulations or adjustments, an understanding of the basic machinery operation and the ability to recognize the significance of a malfunction is important.

The proportioning equipment must be examined at regular intervals during a placement for correctness of the amount being delivered and for possible damage or malfunction. Special attention must be given to the empty balance and the position of the poise weights for beam and dial scales.

The normal plant operation causes vibration, which tends to change these adjustments. Accumulation of material clinging to the inside of the hoppers can also cause these adjustments to drift. Small amounts of material accumulation clinging to the inside of a hopper are not considered objectionable. If the amount exceeds one percent of the material batch, however, it must be removed and readjusted to indicate a zero load within 0.5% ([Article 2001.20](#)).

The scale sensitivity shall be checked at least at the beginning of a placement if operations are intermittent, and at the beginning of each day if the operations are continuous in the following manner:

Place a mass equal to 1/10 percent of the batch on the fully-loaded scales while observing the movement of the indicator.

A properly sensitive scale will exhibit a visible indicator movement when tested in this manner. If no indicator movement is visible and immediate corrective action by the owner does not yield successful results, the District Materials Engineer must be informed.

Periodic observation of the measuring operation must be made to determine that the proper amounts of materials are being delivered to the concrete batch. The plant inspector must be able to recognize when the hopper is overloaded or underloaded by one percent of the batch. For a dial scale, these limits are readily recognizable on the graduated dial chart. For scales with a balance indicator, the location of the indicator hand when a one percent over and underload is applied and removed can be noted before work begins.

If an examination reveals that the scales are not properly sensitized or the proper amounts of material are not being furnished to the concrete batch, refer to [IM 527](#), General, for the necessary action.

Document all routine scale sensitivity, delivery tolerance checks and any necessary corrective action taken, in the plant inspection diary.

The following procedure is required for setting or adjusting the various items of proportioning equipment so that they will deliver the proper amount of material to the batch:

- The plant superintendent or other authorized operator representative must make all necessary scale and equipment setting and/or adjustments. The PCC Level II certified technician is specifically directed not to participate in this activity.
- Before the plant operation begins or resumes, the PCC Level II certified technician will independently determine for himself/herself that the settings and/or adjustments are correct and that the amounts of material being delivered to the batch are correct. Errors must be corrected immediately. Strict adherence to the above procedure is necessary to maintain a proper division of authority and responsibility between the contractor and the contracting authority, and to minimize the possibility of operating with erroneous proportions.

Suitable wind protection on all sides of the scales is required by the specification. This protection, if not provided by the plant design, can be fabricated from burlap, masonite, plywood or other suitable material and should provide adequate room for the scale operator to work unobstructed.

An air-entraining admixture is required for all structural concrete, except Class X, and can be proportioned either manually or automatically. Mechanical dispensers must have a transparent measuring chamber so that each batch can be observed as it is measured and dispensed. Mechanical dispensers must be cleaned daily to minimize the possibility of deposits accumulating and causing a malfunction.

The amount of air entraining admixture required is determined by the results of the pressure meter air tests run on the plastic concrete, as described in [IM 318](#). The contractor must decide the quantity to be used and the adjustments necessary, if any, after the pressure meter testing has been completed. Provision shall be made for agitation of the air-entraining agent. (See [Article 4103.01A](#))

An admixture for set retardation may be required. The list of approved retarding admixtures, and recommended dosages, is found in [IM 403](#). An admixture for water reduction may be used at the contractor's option in mixes so designated in [IM 529](#). (See [Article 2301.02,B.](#))

See [IM 527](#) (Materials, Admixtures), regarding dosage, handling and storage of admixtures.

Most air entraining and retarding admixtures, when intermingled with each other tend to neutralize each other and negate the effects of each. Care must therefore, be taken to introduce each admixture into the mixer separately and allow the first to become intermingled into the batch before the second is introduced. A procedure, which has been used successfully, is to introduce the air-entraining agent first along with most of the mixing water and other ingredients, and after these have become intermingled then introduce the balance of the mixing water and the retardant admixture.

3. MIXING EQUIPMENT

Mixing equipment for structural projects will be one of the following types:

- Truck-mounted transit mixers
- Stationary central mixers with in-transit agitation
- Stationary mixers located at the project site
- Concrete-Mobiles

The truck-mounted transit mixers are the most popular with stationary, central mixers increasing in popularity. Stationary site mixers are seldom used.

Refer to [IM 527](#) (Mixing Equipment) for inspection instructions relating to stationary central mixers and truck-mounted transit mixers, and [IM 534](#) for Concrete-Mobiles.

Transit mixers must carry a current certification signed by a responsible company representative stating that the mixer condition has been examined during the previous 30 days, is free of hardened concrete, and is in proper working condition. Mixers not carrying the required certification must not be used.

MATERIAL

Refer to [IM 527](#) (Material) for the necessary inspection instructions relating to material identification, handling and storage.

BATCHING

A PCC Level II certified technician may also act as a batch person for the following items only:

- Non critical items less than 35 cubic yards (30 cubic meters) per week
- Night work patching
- Fence posts and pipe collars
- Less than 15 cubic yards (12 cubic meters) produced per day.

A PCC Level II certified technician shall perform required plant inspection duties prior to start up and a minimum of once per lot. A PCC Level II certified technician responsible for quality control shall be available by cell phone.

SAMPLING & TESTING

Quality Control

1. AGGREGATES

Refer to [IM 527](#) (Sampling & Testing) for related inspection instructions.

Personnel performing aggregate testing shall be Aggregate Level II certified. The PCC Level II certified technician may direct this person performing the testing. The minimum frequencies for testing aggregates for structural concrete are as follows:

Specific Gravity - One sample for both coarse and fine aggregate as described in the table, unless the first two tests indicate variations greater than 0.02 from the tabular value [T203](#), Aggregate Source Information, or from one test to the next. If the above variations are greater than 0.02, inform the Project Engineer and the District Materials Engineer immediately. The District Materials Engineer may adjust the specific gravity used to determine batch weights.

Moisture - One sample for each aggregate as described in the table. If a system with instantaneous moisture content measurement equipment is used to automatically adjust individual batch weights, see section titled Sampling & Testing/Moisture in [IM 527](#) for instructions on approval, use, and monitoring of the system. Frequency shall be increased if stockpile changes occur. When specific gravity is not tested, moisture content may be determined by the mass (weight) difference method ([IM 308](#) Method B).

Gradation – One sample for each aggregate per lot.

For high production, a quality control lot shall consist of one day's run or approximately 250 cubic yards (190 m³) produced on an individual project, whichever is greater. When supplying multiple projects from a single plant, one quality control gradation may be sampled and tested, provided any one individual project does not exceed 250 cubic yards (190 m³). If the plant is supplying both paving and structural concrete, sampling and testing structural concrete separately is not required, since the sampling and testing rate is typically greater for paving. For normal production, less than 250 cubic yards (190 m³) produced in one calendar week, that week shall be considered as one lot. If 35 cubic yards (30 m³) or less are produced in one calendar week, testing may be grouped with previous or subsequent lot. A bridge deck is considered a lot, unless a bridge deck has over a single day's run, then each day's run shall be considered a lot.

For non critical concrete items as described below, a quality control lot shall be one month. Concrete for fence posts, pipe collars, and quantities supplied at 10 cubic yards (7.6 m³) or less for a project will be accepted without gradation testing. The PCC Level II certified technician shall provide materials certifications, batch tickets, and plant reports for these items.

For projects requiring certified plant inspection, the certified inspector will obtain and test one gradation sample per lot, unless operations are prematurely shut down.

Quality Control Sampling, Testing, and Reporting

PRODUCTION Project Basis	Specific Gravity	Moisture	Gradation	Report
High >250 CY/Wk or Deck	1/week first two weeks, 1/ two weeks thereafter	2/week or 1/deck	1/lot or 1/deck	1/lot or 1/deck
Normal <250 CY/WK	1/week first two weeks, 1/ two weeks thereafter	2/week	1/week	1/week
Non Critical <35 CY/Wk	1/Two weeks	1/week	1/month	1/month
Fence Posts, Pipe Collars, Project <10 CY	N/A	1/week	N/A*	1/project

Verification

The engineer will perform verification sampling and testing at the minimum frequency described in the table for each aggregate. IM 205 describes the agency responsibility to randomly select sample location and time, and witness sampling with the contractor providing assistance in obtaining the samples. For production of less than 35 cubic yards (30 cubic meters) per week, verification sampling may be grouped with the previous or subsequent week. A minimum of one sample will be obtained per two week period (grouped as a lot) for each plant.

Non critical concrete items will be sampled and tested as described in the table. Concrete for fence posts, pipe collars, and quantities supplied at 10 cubic yards (7.6 m³) or less for a project will be accepted based on materials certifications, batch tickets, and plant reports.

Verification Sampling and Testing

PRODUCTION Project Basis	Gradation Sampling	Gradation Testing
High >250 CY/Wk or Deck	1/week or 1/deck placement	First lot, then 20%
Normal <250 CY/WK	1/week	First lot, then 20%
Non Critical <35 CY/Wk	1/month	1/project
Fence Posts, Pipe Collars, Project <10 CY	N/A	N/A

Non-Critical Concrete

The following Items of work may be designated as non-critical concrete, when placed at less than 35 cubic yards (30 cubic meters) per week:

- Concrete Base and Widening
- Temporary Pavement
- Curb and Gutters
- Pavement Patching
- Culvert Curtain Wall Concrete
- Sign, Signal and Light Bases
- Slope Protection
- Building Floors
- Catch Basins
- Pile Encasements
- Intakes
- Utility Access
- Sidewalks and Driveways
- Guard Rail Anchorages
- Full PCC Depth Rumble Strip Patch

Test air and slump at the minimum rate for structural concrete or at least once daily.

Non Complying Gradation

When a quality control gradation test does not comply with the gradation requirements of [Article 4109](#), the certified plant inspector shall contact the Engineer. After corrections have been made, the Engineer will obtain and test another verification sample.

When a verification gradation test does not comply with the gradation requirements of [Article 4109](#), the Engineer will contact the contractor, producer and the District Materials Engineer. The District Materials Engineer may investigate sampling and testing procedures, stockpiling, source material, etc. After corrections have been made, the Engineer will obtain and test another verification sample.

Acceptance of lots will be based on complying verification test results. The engineer will retain all samples representing the lots until the lots have been accepted. Since the contracting authority tests are verification, correlation with [IM 216](#) is not required, but may be performed as a check of sampling and testing procedures.

2. WATER/CEMENT RATIO

Whenever the water demand, to achieve the desired workability, exceeds the design water/cement ratio and approaches the maximum water allowed the Project Engineer and the District Materials Engineer Office should be notified. At the same time, aggregate moisture contents, batch amounts, cement scales, water meter, etc., should all be immediately checked. In no circumstance should the maximum water/cement ratio be knowingly exceeded.

If, after the District Materials Engineer investigation and evaluation, additional workability above that which is attainable within the maximum permissible water content is desired, the cement content may be increased in accordance with [Article 2403.02,B](#). This should be done only with the approval of the District Materials Engineer or the engineer representative. The District Materials Engineer will provide the revised and adjusted mix proportions for these situations.

Also, in accordance with [Article 2403.02,B](#), the engineer may authorize the use of a water-reducing admixture to improve workability. When authorized, only the water-reducing admixtures and dosage rates, as shown in [IM 403](#) should be used.

When calcium chloride solution is added for patching M mix, water included in the calcium chloride solution should not be included in calculation of water-to-cement ratio.

3. STRENGTH TESTS

The test for Modulus of Rupture is the only strength test determined in the field. Test specimens are required for each section placed.

A section is defined as a day's placement of structural concrete. [IM 204](#) lists minimum testing requirements.

Abutment backwalls, pier footings, bridge end posts, and culvert curtain walls are not considered critical structural units and therefore, test specimens are not required from these units, unless directed by the engineer.

Test the flexural specimens as prescribed in [IM 316](#), Flexural Strength of Concrete. Testing will be done by contract authority personnel.

PROPORTIONS

Refer to [IM 527](#) (Proportions)

REPORTS & REPORTING

1. PCC PLANT PAGE – FORM #240

The same form is to be used for PCC Paving and PCC Structures. Refer to [IM 527](#) for instructions on completing the form and an example form.

Structural Reports are to be recorded in the computer program or on hand-completed forms both provided by the Iowa Department of Transportation. During high or normal production, a separate, consecutively numbered, report is to be made for each project as required in the Quality Control Sampling, Testing, and Reporting table. A copy of the completed PCC Plant Page shall be faxed or delivered to the District Materials Engineer within four hours on the next working day after the end of the lot. When supplying multiple projects, one quality control gradation may be reported on all test reports, provided any one individual project does not exceed 250 cubic yards (190 m³).

The PCC Level II certified technician shall keep a copy of the PCC Plant Page and send the original to the Project Engineer. At the end of the project, make a copy of the plant book for the Engineer, within ten days.

Report non critical concrete, fence posts, and pipe collars as required in the Quality Control Sampling, Testing, and Reporting table

When computer forms are used, refer to [IM 527](#) for the necessary equipment.

2. READY MIXED CONCRETE, TRUCK TICKET FORM – FORM #830212

Each truckload of concrete must be identified by Form #830212 or an acceptable computer-generated plant ticket. If available, computer generated batch tickets shall be used. Computer generated batch tickets shall include wet and dry batch weights and information on Form #830212. Any information unable to be printed by the computer will be written on the computer generated batch ticket. See [IM 527](#).