PRECAST CONCRETE

GENERAL

The provisions of this IM shall apply to the production, fabrication and construction of precast concrete as defined in Section 1101 of the Standard Specifications. Precast concrete units shall be produced in a plant for which equipment; procedures, Quality Control Program, certified personnel and quality of work and concrete mix design have been approved by the contracting authority. Self Consolidating Concrete (SCC) shall meet the requirements of IM 445 Appendix D. The fabricator shall provide technical personnel, experienced and skilled in the application of the precast system. The requirements are listed in Sections 2419, 2415, 2416, 2425, and 4149 of the Standard Specifications. Requirements for specific precast units are found in the following IMs:

445.01 - Concrete Pipe & Special Sections

445.02 - Precast Box Culverts

445.03 – Mechanically-Stabilized Earth (MSE) Wall Panels

445.04 - Concrete Segmental Modular Blocks, Dry Cast

445.05 - Concrete Segmental Modular Blocks, Wet Cast

445.06 – Precast Concrete Noise Walls

571- Precast Concrete Barrier

Plant Approval – Precast concrete pipe production plant approval shall be dependent on a recommendation by the District Materials Engineer (DME) responsible for inspection of the plant. The producer shall have an approved Quality Control Plan that ensures all materials and finished products conform to the applicable requirements. In all cases, a written Quality Control Plan shall be submitted to the District Materials Engineer for approval. Each Precast plants shall submit the updated quality control plan to Prestressed and Precast Engineer at the end of calendar year. Precast plants without updated quality control plan at January 31st will be delisted from the approve list.

A Quality Control Plan shall be developed for each individual plant. Noncompliance to the approved Producer Quality Control Program shall constitute grounds for the producer to be placed on conditional status by the District Materials Engineer. The conditional status requires the producer to contract with a consultant inspection firm to inspect the producer's entire product for a period of 90 days, to allow the producer to revise the QC production operations so to be able to remove the conditional status. Continued noncompliance shall be considered sufficient grounds to remove the producer from the Approved Producer List.

The Iowa Department of Transportation District Materials Engineer shall perform monitor inspection and testing.

QUALITY CONTROL PLAN

1. **Materials** - All aggregates, cements, admixtures, and reinforcing steel shall comply with the Iowa Department of Transportation Standard Specifications. Only materials from approved sources shall be used. Only preapproved mixes shall be used in the casting of concrete pipe and any related precast units. Approved sources are listed in other applicable Office of Materials Instructional Memorandums. Monitor samples may be taken for testing by the District Materials Engineer. Sources of materials shall be indicated in the Quality Control Plan. The District Materials Engineer shall be notified if a source of material shall be changed.

   A copy of reports of approved materials, aggregate certification, cement certifications, Mill Test Reports for steel reinforcement, etc., shall be kept on file by the producer and be available for examination for one calendar year after the materials are incorporated into a project. The producer and the District Materials Engineer shall establish the testing frequency and procedures that shall be used to test the materials used in production.

   Only preapproved mixes shall be used in the casting of concrete. Any alteration or change made to the approved mix shall require new mix approval.

AGGREGATES

Unless otherwise specified, use Class 2 durability coarse aggregate, or better, as defined in Article 4115.04 and approved fine aggregate for concrete. Coarse and fine aggregate approval is described in IM 409. Aggregates shall be sampled and tested for quality according to Article 4110, and 4115 and 4117. Aggregate for precast products must have samples for quality testing secured or witnessed by Agency Personnel at a minimum frequency of one per year.

For aesthetic concrete cast with form liners or rustication, use crushed stone coarse aggregate. This includes MSE and noise walls. Use crushed stone coarse aggregate for concrete receiving color sealer or texture treatments and precast box culverts for bikeways and pedestrian traffic.

Aggregate gradation requirements may be dictated by strength or constancy requirements. For this reason, individual aggregate gradations for use in precast concrete products may be designated by the precast fabricator. Gradations of individual aggregates do not need to meet the gradations defined in the Aggregate Gradation Table referenced in Section 4109 of the Standard Specifications.

The Approved Producer or Plant Laboratory is required to have an Iowa certified Level 1 and 2 technician to perform sampling and gradation testing at the minimum frequency of one per 1500 tons delivered to the plant. These results are to be reported to the Materials District Office and the Precast Fabricator.

Blending of aggregates from different sources at the precast plant may be allowed if the individual aggregates are geologically similar and meet the applicable quality requirements, if approved by the District Materials Engineer.

Failing verification results may result in rejection of all fabricated precast items in stock and revocation of plant approval.

Portland Cement

Cement shall meet the requirements of 4101 of the Standard Specifications.

Portland Cements sources Identified in IM 401

The precast fabricator may accept Portland cement on the basis of certified tickets or bill of lading.

Fly Ash

Fly Ash shall meet the requirements of 4108 of the Standard Specifications.

Fly Ash Sources Identified in IM 491.17

The precast fabricator may accept fly ash on the basis of certified tickets or bill of lading.

Ground Granulated Blast Furnace Slag (GGBFS)

GGBFS shall meet the requirements of 4108 of the Standard Specifications.

GGBFS Sources Identified in IM 491.14

The precast fabricator may accept GGBFS on the basis of certified tickets or bill of lading.

Chemical Admixtures

Chemical admixtures shall meet the requirements of Section 4103 of the Standard Specifications and shall be from an approved source identified in IM 403.

Reinforcing Steel and Wire Fabric

Reinforcing steel and wire fabric shall meet the requirements of Section 4151 of the Standard Specifications and shall be from an approved source identified in IM 451. The precast fabricator shall accept reinforcing steel with certified mill test reports for each heat delivered.

2. **Facilities & Equipment** - Facilities and equipment for materials handling and storage, proportioning, weighing, mixing, cutting, welding, and placement of reinforcement steel, curing, and pipe testing shall comply with the applicable requirements of the Iowa Department of Transportation Standard Specifications.

   Concrete batching equipment and testing equipment shall be calibrated according to the approved Quality Control Plan. (Once per year, or as often as deemed necessary by the DME.)

NOTE: An approved water-proportioning unit is not required for dry cast operations.

NOTE: If a ready mix plant supplies concrete, then the plant shall be calibrated and approved by the District Materials Engineer.

3. **Production** - For all production, the producer plan shall indicate the quality control inspection procedure to be used in the manufacture of the product, including:

   a. Reinforcing steel fabrication and placement
   b. Concrete mix design and proportioning
   c. Concrete placement and consolidation
   d. Concrete curing

   Precast items shall not be moved until the designated moving strength is obtained. If no moving strength is specified then the producer shall submit lifting detail for review and determination of an accepted moving strength.

4. **Testing** - Process Control testing shall be performed by the producer. The methods and rates shall be indicated in the Quality Control Plan and shall meet the applicable Iowa Department of Transportation requirements.

   NOTE: Producer/fabricator shall forward copies of all test reports to the District Materials Engineer as soon as they become available.

5. **Quality Control Technician** - The Quality Control Technician shall be appointed fulltime by the producer to be responsible for the quality control process and testing at each plant. The Quality Control Technician shall:

   a. Possess knowledge of the plans, shop drawings, and specification requirements.

   b. Possess knowledge of the product manufacturing operations and processes.

   c. Possess a valid IDOT Level 1 PCC Certification or ACI Level I Certification when casting operations require physical testing such as air entrainment or slump testing, etc.

   d. Possess an Aggregate Level II Certification, if performing aggregate gradations.

      NOTE: When aggregate gradation is required, a certified aggregate technician must perform the testing. (Certified gradation from the aggregate source is acceptable.) Aggregates shall meet the quality requirements of concrete aggregate.

   e. Be responsible and have the authority to correct and/or stop any operation that is found to be causing non-conforming attributes, and to reject all products not meeting Iowa DOT requirements.

      NOTE: It is highly recommended that the Quality Control Technician be responsible to the owner or top management, not answer and/or report to production personnel.

   f. Ensure that all requirements that relate to producing pre-approved (certified) products are continuously met.

      This includes, but is not limited to, such activities as ensuring proper placement of steel

reinforcement, material identification, concrete proportioning, handling and consolidation, marking, and curing.

6. **Records** – A copy of all reports of approved/certified materials (aggregate and cement certifications, Mill Test Reports for steel reinforcement, etc.) shall be kept on file at the fabrication plant for one year after project completion, and be available for review by the District Materials Engineer or his representative.

   Records shall include, but not be limited to:

   a. Test results performed during fabrication and on finished products, such as:

      1) Concrete cylinder or core strengths
      2) Load bearing tests
      3) Entrained air content
      4) Slump tests
      5) Concrete absorption tests

   b. Records of manufactured products by:

      1) Manufacture date
      2) Size
      3) Class
      4) Quantity

   c. Equipment calibration reports shall be kept for a minimum of one year.

7. **Stockpiles** - The producer shall keep noncompliant or otherwise deficient products separated from the stock that may be shipped and/or incorporated into a project under the certification program.

MONITOR SAMPLING & TESTING

The District Materials Engineer shall be responsible for establishing and performing the monitor sampling and testing program for each plant. Noncompliant test results shall be considered sufficient cause for rejection of the lot represented, and may be considered sufficient cause to rescind approval to furnish products on a certification basis. The District Materials Engineer reserves the right to change monitor-sampling rates.

CERTIFICATION DOCUMENTS

The producer of certified concrete pipe, special sections, or other precast units shall furnish, on each shipment day, a certified bill of materials or invoice which identifies the county, project number, contractor, and number of pieces of each class, size, and length. The certification of compliance shall be signed by a designated, responsible company representative and shall be stated as follows:

> "The materials itemized in this shipment are certified to be in compliance with the applicable AASHTO and/or ASTM requirements and Iowa Department of Transportation Standard Plans and Specifications."

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Authorized Signature and Date

One copy of the above-described document shall be forwarded to the Project Engineer on the day the item is delivered to the project. In addition, one copy shall be sent to the District Materials Engineer

The fabricator shall also provide summary quantity documentation, as shown in Appendix B, to the District Materials Office responsible for the project and the project engineer at the completion of the shipments to the project.

PROJECT ACCEPTANCE

Units certified and properly marked as per applicable IMs (i.e., 445.01, 445.02, 445.03, 445.04, 445.05, 445.06, 571) may be incorporated into the project. Each shipment should be inspected for damage at the project site due to handling and shipment. Damaged units shall be rejected. Each shipment to Iowa DOT projects shall be accompanied with proper certifications.