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## CHEMICAL ADMIXTURES FOR CONCRETE

### GENERAL

Air entraining admixtures shall meet the requirements of AASHTO M 154. Water reducing and retarding, water-reducing, high range water reducing, and non-chloride accelerating admixtures shall meet the requirements of AASHTO M 194. All chemical admixtures used for Portland Cement Concrete shall meet the requirements outlined in Section 4103 and other applicable Iowa Department of Transportation Standard Specifications.

For all types of admixtures, the source, brand name, and lot/batch number must be identifiable by markings on the container and by description on the invoice. The manufacturer and supplier shall maintain a record of shipment, which identifies the brand, lot/batch number and certified test data for each shipment. This data shall be made available to the contracting authority when requested.

Material suspected of being frozen shall be sampled and tested prior to use. Material older than 18 months shall be sampled and tested prior to use.

### MANUFACTURER, BRAND NAME APPROVAL, USAGE GUIDELINES

To obtain approval for any admixture type, the manufacturer shall submit the following items to the Office of Materials in Ames:

1. Product identification including brand name and product number
2. Complete manufacturer's recommendation for usage
3. Independent test data on admixture showing compliance with appropriate AASHTO specification
4. A current Materials Safety Data Sheet (MSDS)
5. A one-quart (one-liter) representative sample may be required upon request

Specific requirements for each type of admixture are as follows:

#### A. Air Entraining Admixtures

Air entraining admixtures shall meet the requirements of Iowa Department of Transportation Standard Specifications Section 4103 and AASHTO M 154.

Approved brands of air entraining admixtures are listed in Appendix A of this IM.

#### B. Retarding, and Water-Reducing & Retarding Admixtures for Bridge Deck Concrete Required Extended Working Time

Retarding, and water-reducing & retarding admixtures shall meet the requirements of AASHTO M 194; Type B or Type D. These admixtures can be used for water reduction, retardation, or water reduction and retardation for bridge deck concrete when extended working time is

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required.

Approved brands of retarding, and water-reducing & retarding admixtures for bridge deck concrete required extended working time are listed in Appendix B of this IM. Appendix B also contains a guideline for dosage rates and working time limits based on an estimated maximum temperature of the concrete during placement at the point of discharge. Working time limits have been determined by AASHTO T 197 using 200 psi (1.38 MPa) penetration resistance and shall be provided by manufacturer. In addition to the AASHTO M194 requirements, a minimum working time of 4.5 hours is required for the Type I/II cement mix used the maximum normal recommended dosage of an admixture and tested at the normal temperature (between 70 °F and 75 °F).

#### C. Water-Reducing Admixtures

Water-reducing admixtures shall meet the requirements of AASHTO M 194, Type A.

Approved brands of water-reducing admixtures with their proper dosage rates are listed in Appendix C of this IM.

Mid-range water reducers used for bridge overlay concrete (Class HPC-O Mixture) are noted in Appendix C. In addition to the AASHTO M 194 requirements, the use of these admixtures shall provide a maximum water content of 90% of the control at a normal dosage, and shall not result in a less initial set time as compared to the control. The intent of these mid-range water reducers is to achieve a workable, dense, low water to cementitious material ratio concrete for bridge overlay as described in Article 2413.02 of Standard Specifications.

A combination of a water-reducing admixture and a retarding admixture may be used to aid in air entrainment and slump retention.

#### D. High Range Water-Reducing Admixtures

High Range water-reducing admixtures shall meet the requirements of AASHTO M 194; Type F.

Approved brands of high range water-reducing admixtures with their recommended dosage rates are listed in Appendix D of this IM. As indicated, some of these high range water reducers listed can be used to cast self-consolidated concrete. If needed, a viscosity-modified admixture produced by the same manufacturer is allowed to cast self-consolidated concrete.

#### E. Non-Chloride Accelerating Admixtures

Non-Chloride Accelerating Admixtures shall meet the requirements of AASHTO M 194, Type C or E. Total chloride content, which may come from some indirect sources, shall not exceed 0.1% in the admixtures.

Approved brands of Non-Chloride Accelerating Admixtures with their recommended dosage rates are listed in Appendix E of this IM.

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F. Admixtures for Prestressed & Precast Concrete

These admixtures are used for dry-cast concrete. Benefits of these admixtures include increasing production rate, improvement of visual appeal, greater strength, more durable, better compactability, and extension of life of molds and machines parts. In order to get an admixture approval, its producer shall prove that the use of the admixture will not reduce strength of concrete, and provide evidence of the above-mentioned benefits.

Approved brands of admixtures for prestressed and precast concrete with their recommended dosage rates are listed in Appendix F of this IM.

G. Water-Reducing & Retarding Admixtures for Concrete Pavements or Structural Concrete with Normal Working Times

Water-reducing and retarding admixtures for concrete pavement shall meet the requirements of AASHTO M 194; Type D. These admixtures can be used for water reduction, retardation, or water reduction and retardation in concrete pavement.

When use as a retarder is specified or authorized by the engineer, the contractor shall be responsible for its use and application of the proper dosage rate. It may also be necessary to adjust the quantity of air entraining agent. When fly ash is used in the concrete, the dosage rate shall be applied to both the cement and fly ash combined.

Approved brands of water-reducing and retarding admixtures are listed in Appendix G of this IM. Recommended dosage is given for use in concrete pavement.

A hydration stabilizer will be evaluated for approval as a retarder (Type B) or a water reducing & retarding admixture (Type D), and listed and identified in [Appendix B](#) or [Appendix G](#).

If alternative requirements specified in AASHTO M 194 are met, an admixture may be provisionally approved based on six-month test results. Producer shall submit one-year test results from an independent laboratory for final approval as soon as they become available. The failure or delay in submitting one-year results may lead to revoking of provisional approval.

Satisfactory evaluation reports by the National Transportation Product Evaluation Program (NTPEP) may be accepted for approval.

Approval of admixtures may be withdrawn because of deficient test results; product changes made after original approval, or unsatisfactory field performance.

**AGITATION OF ADMIXTURES**

Provision shall be made to stir, agitate, or circulate air-entraining admixtures prior to use so as to ensure a uniform and homogeneous mixture of solids and solution. It is the admixture supplier's responsibility to the contractor to provide a quality product. Therefore the admixture suppliers shall be responsible for the system used to maintain the quality product described above.

Retarding, water-reducing, and high range water-reducing admixtures shall be stirred, circulated, or agitated thoroughly once a day prior to operation of the proportioning plant to maintain the solids in suspension. The agitating shall be done in such a way that the solution in the holding or storage tank is circulated for a minimum of five minutes each day per 100 gallons (380 liters) of solution or any fraction thereof. A circulating pump with a 250-watt (1/3 hp) pump motor and a 5/8-inch (16 mm) inside diameter hose will be considered as a minimum requirement. The engineer shall approve the method of agitation. **NOTE:** Introducing air into a tank will not be acceptable.

### **CERTIFICATION**

#### A. FOR MANUFACTURER

At the beginning of each calendar year, a certification form will be sent to each manufacturer. If the admixture to be supplied during that year is identical with the formulation previously tested and approved, then the manufacturer shall complete the quality control limits to be followed and return it to the Office of Materials in Ames, Iowa.

#### B. FOR DISTRIBUTOR

At the beginning of each calendar year, a certification form will be sent to each distributor. The distributor shall certify that admixtures to be supplied are not altered and will be distributed as received from the manufacturer.

### **MONITOR SAMPLING & TESTING**

Monitor samples will be obtained and sent to Central Materials for testing. Sampling frequency shall be according to IM 204. The sample size shall be one 1 pint (0.5 liter).

For all admixtures, only one acceptance sample per lot/batch is necessary. No project assurance samples are needed.

Samples will be tested for variation from the manufacturer target for solids, specific gravity and chloride content.