CHEMICAL ADMIXTURES FOR CONCRETE

GENERAL

Air entraining, water reducing and retarding, and water-reducing admixtures for Portland Cement Concrete shall meet the requirements of applicable Iowa Department of Transportation Specifications.

ACCEPTANCE

Acceptance of air entraining, water reducing and retarding, and water-reducing admixtures for use on Iowa Department of Transportation projects will be on the basis of manufacturer and brand name approval.

Approved manufacturers and brand names for the four different types of admixtures are listed in Appendixes A, B, C, D, E and F.

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 ASTM specification
4. A current Materials Safety Data Sheet (MSDS)
5. A one-quart (one-liter) representative sample

Specific requirements and testing procedures 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 ASTM C260.

When an air-entraining admixture is produced by neutralizing vinsol resin with sodium hydroxide, the manufacturer shall submit to the Central Office a certification concerning the admixture in the following form:

> "This is to certify that the product ___(trade name),___ as manufactured and sold by the (company), is an aqueous solution of vinsol resin that has been neutralized with sodium hydroxide. The ratio of sodium hydroxide to vinsol resin is one part of sodium hydroxide to (number) parts of vinsol resin. The normal percentage of solids based on the residue dried at 105EC for 3 hours is (number). This percentage will be controlled within minus 1.0 and plus 3.0 of this figure. No other additive or chemical agent is present in this solution."

Brand name approval of air entraining admixtures does not preclude material rejection if satisfactory entrainment air content results in the plastic concrete are not readily and consistently achieved.

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

B. Water-Reducing & Retarding Admixtures

These admixtures can be used to retard structural concrete in bridge floors and for water reduction, retardation, or water reduction and retardation in concrete pavement.

When they are used in bridge floors, use the dosage rates shown in Appendix B, for retarding structural concrete. Use the dosage rate shown for the respective concrete temperature.

When they are used in concrete pavement, use the dosage in Appendix B, for use in concrete pavement. Use the single dosage rate shown for water reduction, retardation, or water reduction and retardation. Dosage rates may be adjusted in accordance with the manufacturer's recommendation during cooler conditions to prevent overextending setting times.

Water-reducing and retarding admixtures shall meet the requirements of ASTM C494; Type D and those outlined herein.

In addition to meeting requirements of ASTM C494, Type D, tests may also be required to show strength and retardation performance as described in this Section B and strength and water reduction performance as described in Section C of this IM.

The analysis as a retarder utilizes concrete specimens from two D-57 mixtures. One mix shall contain the retarding admixture, and the other shall be a control without the retarder. The results of the concrete with retarder as compared to the control shall show:

A minimum increase of 10% in the 7-day compressive strength; a minimum increase of 33% in setting time; reduction in water requirements.

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. When using retarding admixtures, it may 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 B of this IM. Recommended dosage is given for use in concrete pavement. Appendix B also contains a guideline for dosage rates and working time limits for use in structural concrete based on an estimated maximum temperature of the concrete during placement at the point of discharge. Working time limits have been determined by AASHTO T197 using 200 psi (1.38 MPa) penetration resistance.

C. Water-Reducing Admixtures (WR)

Water-reducing admixtures shall meet the requirements of ASTM C494, Type A, and those outlined herein.

Concrete specimens shall be made from two C-3 mixtures. One mix shall contain the WR admixture with an 8% reduction in cement mass and the other shall be a control with no cement reduction or WR admixture. Compressive strengths of WR mix must equal or exceed that of the control at 28 days. Water-reducing admixtures shall also be tested with a deck mix as per ASTM C494. When fly ash is used in the concrete, the dosage rate shall be applied to both the cement and fly ash weight combined.

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

D. High Range Water-Reducing Admixtures (HRWR, sometimes called super water-reducer)

High Range water-reducing admixtures shall meet the requirements of ASTM C494; Type F and those outlined herein. Concrete specimens shall be made from two basic prestressed mixtures 705 lb. cement/yd^3 (419 kg cement/m^3). One mix shall contain the super water-reducing admixture and the other shall be a control mix with no HRWR admixture. There shall be no cement reduction in either mix. Compressive strengths of the HRWR mix must exceed that of the control at 1, 3, and 28 days. 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 high range water-reducing admixtures with their recommended dosage rates are listed in Appendix D of this IM.

E. Non-Chloride Accelerating (NCA) Admixtures

Non-Chloride Accelerating Admixtures shall meet the requirements of ASTM C494, Type C or E, and those outlined herein. Total chloride content, which may come from some indirect sources, shall not exceed 0.1% in the admixtures.

Concrete specimens shall be made from two C-3 mixtures. One mix shall contain the NCA admixture and the other shall be a control with no NCA admixture. Compared to the control mix the NCA mix must achieve a minimum decrease of 33% in initial setting time, a minimum increase of 25% in 3-day compressive strength, and equal or greater in 28-day compressive strength.

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

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.

If alternative requirements specified in ASTM C 494 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) will 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 super 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.