

**New Jersey Department of Transportation**

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**Baseline Document Change Announcement**

**Calcium Nitrite Corrosion Inhibitor**

**BDC99S-021**

**January 19, 2000**

**Subject: Revision to the 1996 Standard Specifications as amended by 1998 Supplemental Specifications, Sections 501, 901, 905, 914 and 990.**

Sections 501 – Concrete Structures, 901 – Aggregates, 905 – Concrete Admixtures and Curing Materials, 914 – Portland Cement Concrete, Mortar and Cement and 990 – Methods of Tests are revised to facilitate the fabrication of Portland cement concrete with respect to the permitted use of chemical admixtures, water/cement ratios, aggregate testing, and testing for calcium nitrite as a corrosion inhibitor are better clarified.

The revision to subsection 914.05 corrects a conflict in the existing concrete fabrication tables that address the required water/cement ratio when chemical admixtures are used in portland cement concrete fabrication. The AASHTO designation for the testing of aggregates for alkali silica reactions has been revised to an AASHTO test method. Additionally, new suppliers for calcium nitrite based corrosion inhibitor admixture have been added.

A summary of all revisions are as follows:

**Subsection 501.12 Placing Concrete.** Subpart 19 is changed to provide a generic specification for the use of corrosion inhibitor admixtures.

**Subsection 901.13 Aggregates for Portland Cement Concrete, Mortar and Grout.** This subsection is revised in order to better control the types of aggregates permitted in concrete fabrication. The test for qualifying aggregates is changed to an AASHTO standard test method.

**Subsection 905.02 Chemical Admixtures.**

1. In the use of chemical admixtures, a change is made to the third paragraph to establish control of the amount of chlorides that may be included in their composition.
2. The seventh paragraph is changed to establish a list of various types of corrosion inhibitor admixtures, which may be introduced in the future. Initially, Item 1 recognizes the use of the calcium nitrite based product.

**Subsection 914.02 Portland Cement Concrete Design, Control and Acceptance Testing Requirements.**

Subpart B, an AASHTO standard test method is identified as the proper test method.

**Subsection 914.05 Tables.**

1. Tables 914-1 and 914-2, Note 1 is changed to establish the provisions by which the Type F water reducing, high range admixture may be used.
2. Table 914-3, the Maximum Water/Cement Ratio is changed to refer to Note 2 of the Table.

### **Section 990, Test M-4 Calcium Nitrite Presence in Plastic Concrete.**

1. A new test method is established. The current test method produced unreliable results.
2. Also, it is established herein that the test is to be performed for each day's operation.

### **Section 990, Test M-5 Calcium Nitrite Presence in Hardened Concrete.**

It is established that the test is only to be performed, if directed, as a retest provision.

To incorporate these revisions into the 1996 Standard Specifications as amended by 1998 Supplemental Specifications, the Standard Input (SI98 DOT1) is revised as follows:

## **SECTION 501 – CONCRETE STRUCTURES**

### **501.12. Placing Concrete.**

SUBPART 19. IS CHANGED TO:

- 19. Corrosion Inhibitor Admixtures.** Corrosion inhibitor admixtures, as specified in Subsection 905.02, may be used in fabricating structural concrete members. Such fabrication shall be in accordance with applicable provisions of Section 501 or Section 502. The use of chemical admixtures, in conjunction with the corrosion inhibitor admixture, subject to the provisions of Subsection 501.03, is permitted. Deck slab construction, unless otherwise stated herein, shall conform to the requirements of Subpart 5 of the above. The following criteria shall be followed in the use of a corrosion inhibitor admixture:
- a. At least 45 calendar days prior to the start of the concrete placement, a mix design, containing the corrosion inhibitor admixture, shall be submitted for approval and verification. Approval of the design mix shall be based on the criteria stated below:
    - (1). The concrete, containing the corrosion inhibitor admixture, shall have a water to cement ratio of 0.40 maximum.
    - (2). Design, control and acceptance testing shall conform to the requirements of Subsection 914.02. The Class of concrete, the concrete slump and the concrete percent air entrainment shall conform to Subsection 914.05 Table 914-2.
    - (3). Mix design requirements shall conform to Table 914.03. In accordance with Subsection 905.02 and the manufacturer's product specifications, chemical admixtures may be added to the concrete mix. The corrosion inhibitor admixture shall be thoroughly mixed before chemical admixtures are added.
    - (4). The provisions of Section 501 or Section 502 concerning placement, curing and finishing of the concrete shall be followed.
    - (5). The corrosion inhibitor admixture shall be added to the concrete at the concrete plant.
  - b. Actual production of the corrosion inhibitor concrete mix that is to be used in the Project shall not begin until the Engineer accepts the mix design. A representative from the corrosion inhibitor admixture supplier shall be present during the initial placement of the concrete. The use of the corrosion inhibitor admixture shall conform to the quality control conditions that are stated in Subsection 905.02.
  - c. A three cubic meter sample of the concrete that contains the corrosion inhibitor admixture shall be placed at the job site at a location that is acceptable to the Engineer. The location shall be a non-structural element. If the Engineer believes that there is sufficient knowledge that the concrete, that contains the corrosion inhibitor admixture, will be able to be placed and cured properly, this requirement may then be waived.

## **SECTION 901 – AGGREGATES**

### **901.13 Aggregates for Portland Cement Concrete, Mortar, and Grout.**

THIS SUBSECTION IS CHANGED TO:

- A. Coarse Aggregate.** Coarse aggregate shall be broken stone or washed gravel conforming to Subsection 901.04 or 901.05 respectively except that carbonate rock shall not be used for concrete surface courses or bridge decks.

Coarse aggregate shall be the size or sizes shown in Subsection 914.05, Tables 914-1 and 914-2. The coarse aggregate shall be washed at least 24 hours before use.

Broken stone and washed gravel for use in white concrete shall be free from dirt and discoloring matter and shall conform to Subsections 901.04 and 901.05 respectively. Broken stone shall be washed, and the gravel rewashed when so directed.

Aggregates used in portland cement concrete shall be tested in accordance with AASHTO T303 Standard Test Method by a laboratory acceptable to the Engineer. Those aggregates which produce expansion of 0.1 percent or more in 14 days in solution shall be considered potentially reactive. The use of potentially reactive aggregate in portland cement concrete will be permitted only in conjunction with remedial agents, including fly ash; ground granulated blast furnace slag and low alkali cement.

- B. Fine Aggregate.** Fine aggregate for any type or class of concrete and for mortar shall be a fine aggregate washed and processed material composed of quartz or other hard durable particles. Sand manufactured from carbonate rock, as defined in Subsection 901.04, will not be permitted in concrete surface courses and bridge deck-wearing surfaces. The fine aggregate shall be predominantly angular in shape.

## SECTION 905 – CONCRETE ADMIXTURES AND CURING MATERIALS

### 905.02 Chemical Admixtures.

THE THIRD PARAGRAPH IS CHANGED TO:

If chemical admixtures are used, they shall contain no calcium chlorides or any other intentionally added chlorides that may initiate or promote corrosion of the reinforcement steel.

THE SEVENTH PARAGRAPH IS CHANGED TO:

Corrosion inhibitor admixtures shall be defined as materials that when added to concrete have the ability to reduce the potential of corrosion of embedded steel. Corrosion inhibitor admixtures shall be the following:

- 1. Calcium Nitrite Based.** Calcium nitrite when mixed into the concrete will become an integral part of the concrete matrix and promote a corrosion barrier around the embedded steel. The following guidelines shall be followed in the use of calcium nitrite:
  - a. Precautions shall be taken to ensure that the calcium nitrite does not come in contact with other admixtures before entering the concrete mix. Air entraining, water reducing and/or retarding admixtures, as per the manufacturers' recommendations, shall be compatible with the calcium nitrite solution. The calcium nitrite solution shall be thoroughly mixed into the concrete before other admixtures have been incorporated into the concrete mix.
  - b. The Contractor shall strictly adhere to the manufacturer's written recommendations regarding the use of the calcium nitrite admixture. This shall include storage, transportation and method of mixing. The manufacturer of the calcium nitrite admixture shall provide a representative to assist the Contractor and the Engineer on the first full day of production of members that contain the calcium nitrite admixture, and to be available on request during subsequent construction.
  - c. Testing for the presence of the calcium nitrite admixture in the concrete shall conform to Section 990 - Method of Tests, M-4 for plastic concrete testing, and M-5 for hardened concrete testing. The test kit that is required to perform the plastic test shall be provided to the Department Laboratory by the Contractor.
  - d. 30 +/- 2 percent by weight of solution of calcium nitrite shall be contained in the admixture. A high range water reducing chemical admixture shall be included in the design mix.
  - e. As per the manufacturer's recommendations, the calcium nitrite shall be added at a rate of 14.83 liters per cubic meter of concrete.

THE FOLLOWING IS ADDED TO THE LIST OF CORROSION INHIBITOR PRODUCT SUPPLIERS:

Calcium Nitrite Based as produced by  
SIKA Corporation  
201 Polito Avenue  
Lyndhurst, NJ 07071  
Telephone: 800 - 933 - SIKA (7452)

Calcium Nitrite Based as produced by  
Great Eastern Technologies, LLC  
"Chem Strong CI"  
515 Route 528  
P. O. Box 3015

## SECTION 914 – PORTLAND CEMENT CONCRETE, MORTAR AND CEMENT

### 914.02 Portland Cement Concrete Design, Control and Acceptance Testing Requirements.

#### B. Proportioning and Verification.

THE SECOND SENTENCE OF THE TWELTH PARAGRAPH IS CHANGED TO:

If AASHTO T303 Standard Test Method results in an expansion greater than 0.40 percent, the minimum addition of fly ash shall be 20 percent.

#### 914.05 Tables.

##### Table 914-1 Requirements for Roadway Concrete Items

NOTE 1 IS CHANGED TO:

Note 1 In accordance with the provisions of Subsection 501.03, a Type F water reducing, high range admixture will be permitted in accordance with Subsection 905.02 and Subsection 914.02, Subparts B and C. When a Type F admixture is used, the table Slump and Air Content values for the given concrete item shall be changed as follows:

##### Table 914-2 Requirements for structural concrete Items

NOTE 1 IS CHANGED TO:

Note 1 In accordance with the provisions of Subsection 501.03, a Type F water reducing, high range admixture will be permitted in accordance with Subsection 905.02 and Subsection 914.02, Subparts B and C. When a Type F admixture is used, the table Slump and Air Content values for the given concrete item shall be changed as follows:

##### Table 914-3 Mix Design Requirements

THE MAXIMUM WATER/CEMENT RATIO PORTION OF THE TABLE IS CHANGED TO:

|  | CLASS OF CONCRETE |       |       |       |        |        |        |
|--|-------------------|-------|-------|-------|--------|--------|--------|
|  | A                 | B     | C     | S     | P      | P-1    | P-2    |
| Max. Water/Cement Ratio Or<br>See Note 2 |                   |       |       |       |        |        |        |
| Kg/Kg                                    | 0.443             | 0.488 | 0.532 | 0.577 | Note 1 | Note 1 | Note 1 |
| L/bag                                    | 19                | 21    | 23    | 25    | Note 1 | Note 1 | Note 1 |

## SECTION 990 – METHODS OF TESTS

### M-4 CALCIUM NITRITE PRESENCE IN PLASTIC CONCRETE

THE TEST METHOD IS CHANGED TO:

#### A. Scope.

This Method of Test is used to determine the presence of calcium nitrite in the plastic concrete state. A freshly mixed concrete sample shall be tested. Quantofix test strips, for high range nitrite, manufactured by Gallard-Schlesinger Industries, Inc. of Carle Place, New York or equivalent, shall be utilized. The equipment to perform this test shall be provided to the State by the Contractor. This will include provision of such equipment for the field laboratory testing operation.

For each day's production, a minimum of one test shall be performed unless directed otherwise.

**B. Apparatus.**

THE FOLLOWING EQUIPMENT SHALL BE PROVIDED:

1. Quantofix Test Strips for high range nitrite #91322, Gallard-Schlesinger Industries, Inc., (516) 333-5600.
2. 10cc disposable syringes with Leur-Lok tip #309604, Becton-Dickinson & Co., (210) 847-6800.
3. Disposable filters 25mm/0.45 micron #SLHA02510, Millipore, (800) 645-5476.
4. Wide-mouth Container.
5. Clean Measuring Cup.

**Procedure.**

1. Using the apparatus list above, add field concrete to pre-measured 2 liters of water in a wide mouth container. Use the water in the container to rinse out the measuring cup.
2. Shake the container 2-5 minutes until contents are well mixed. As indicated in Column 2 of the following Table, the stated quantity of concrete, in millimeters, should be obtained in the container.
3. Using the syringe, uptake approximately 10 ml of extraction water from the container. Attach a disposable filter to the end of the syringe.
4. Filter the extraction water into a clean cup.
5. Dip the test strip into the clear, filtered extraction water and compare the color to the chart on the side of the test strip container.

Use the following chart to determine amount of concrete to be extracted, and expected readings on test strips:

| <b>Amount of Calcium Nitrite Added,<br/>liters/cu. Meters</b> | <b>Volume of Concrete to be<br/>Extracted, milliliters</b> | <b>Expected Reading on Test Strip</b> |
|---|--|---------------------------------------|
| 9.9   | 225  | 0.3                                   |
| 12.4  | 180  | 0.3                                   |
| 14.8  | 150  | 0.3                                   |
| 17.3  | 130  | 0.3                                   |
| 19.8  | 225  | 0.6                                   |
| 22.3  | 200  | 0.6                                   |
| 24.8  | 180  | 0.6                                   |

**M-5 CALCIUM NITRITE PRESENCE IN HARDENED CONCRETE**

**A. Scope.**

THE FOLLOWING IS ADDED TO THE FIRST PARAGRAPH:

The test shall be used, at the direction of the Department, only as a retest provision.

**Instruction to Designers**

These revisions shall be included in all Department projects, with construction of portland cement concrete, which are scheduled for final design submission after February 14, 2000. Department Specification Engineers will incorporate these revisions in the Special Provisions; therefore, designers need not insert these changes.

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