**ITEM 01557.70 M - CONCRETE WITH NON-CHLORIDE ACCELERATOR FOR STRUCTURES**

**DESCRIPTION.** Place and finish Portland cement concrete with non-chloride accelerator. The maximum repair area is 45 square meters.

## MATERIALS.

***A. General.*** All requirements of §557-2 apply, with the following modifications:

| | |
|---|---|
| Recording Thermometer | §584-2.05G |
| Portland Cement | §701-01, Type III only |
| Mortar Bonding Grout | §705-22 |
| Insulating Boards | §711-07, R-value ≥ 10 |
| Air Entraining Admixture | §711-08; vinsol resin based material only |
| Non-Chloride Accelerator Admixture | Use a product from the Approved List |
| Polyethylene Film | ASTM C171, ≥ 0.1 mm thick |

***B. Concrete.*** All requirements of §501 apply, with the following modifications:

1. Mix Proportions. A concrete mix will be furnished to the Contractor. The mix will use the parameters given in Table 1.

**TABLE 1**
**MIX CRITERIA**

| | |
|---|---|
| Cement content ($kg/m^3$) | 490 |
| Maximum water/cement ratio, by mass | Truck mixers - 0.41<br>Mobile mixers - 0.39 |
| Desired air content (%)<br>Allowable air content (%) | 6.5<br>5.0 - 8.0 |
| Desired slump (mm)<br>Allowable slump (mm) | 50<br>40 - 100 |
| Coarse aggregate gradation | CA 2 |
| Minimum 24 hour compressive strength | 21 MPa |

2. Mix Design. At least 20 working days prior to calibration tests for the mixers, provide the Materials Bureau with three bags of cement, 225 kg each of fine and coarse aggregate, one liter of AEA admixture, and four liters of accelerator. Provide material of the same type and size and from the same sources as proposed to produce the concrete. The Director of Materials Bureau will furnish the mix design within 20 working days of receipt of the material.

3. Batching and Mixing. Use only truck or mobile mixers. Heat the mix water as needed to achieve a concrete discharge temperature between 29 - 35 ºC.

a. Truck Mixers. All requirements of §501-3.04E apply, with the following modifications:

The maximum batch size is 5 cubic meters.

Equip all truck mixers with in-line water flow meters capable of being easily reset to zero and withstanding water temperatures of up to 95 ºC. Provide certification from the manufacturer that the meter's flow rate is at least 265 liters per minute. Mount the flow meters to allow easy access for reading.

Equip all truck mixers with air pressurized tanks capable of storing the design quantity of accelerator admixture and discharging that quantity into the mixing drum in less than one minute. Equip each air pressurized tank with a pressure relief valve and clear plastic output hose.

Immediately prior to batching the truck, determine the total moisture content of the aggregates, and compute the quantity of water contained by both aggregates in liters per cubic meter. Subtract that quantity and the quantity of water in the accelerator admixture from the design water, and submit these calculations to the Department representative for approval. Upon approval, write on the batch ticket the exact amount of water to be added to the mix.

Perform all mixing at the point of deposition. Before adding the water into the mixer, provide 20 dry mixing revolutions and reset the flow meter to zero. Add all water in one uninterrupted operation. After the water quantity designated on the delivery ticket has been added to the concrete, add the accelerator admixture. Mix the concrete at 12 - 18 rpm for a minimum of 100 revolutions or until uniform concrete of the required consistency is produced, which ever is longer. The maximum mixing period is 15 minutes.

If the initial slump is less than 50 mm and, in the Engineer's opinion, the material can not be satisfactorily placed and finished, water may be added once with a maximum addition of 8 liters of water per cubic meter of concrete. After this addition, provide at least 30 mixing revolutions before discharging the concrete.

b. Mobile Mixers. All requirements of 501-3.04G apply, with the following modifications:

Use a mobile mixer with positive control of the flow accelerator solution into the mixing chamber. Discharge the accelerator solution from the same point as the mixing water, at least 300 mm away from point of discharge for AEA. Use flow meters to control the quantity of admixture added to the mix. Provide a bypass valve for obtaining a calibrated sample of admixture to determine batching accuracy.

4. Cylinder Testing. During the first day of production the Engineer will take six 150 mm x 300 mm cylinders and place them in autogenous (insulated) curing boxes furnished by the Engineer. The Engineer will test the cylinders for compressive strength, while simultaneously recording the temperature of the repair. From this data the Engineer will determine at what temperature the repair achieves a cylinder compressive strength of 21 MPa. Determine the approximate strength for all subsequent placements by this temperature. The Engineer reserves the right to take additional cylinders for testing at any time.

**CONSTRUCTION DETAILS.** All requirements of §557-3 apply, with the following modifications:

***A. Blastcleaning.*** All requirements of §584-3.04 and §584-3.05 apply.

***B. Structural Slab Wetting.*** Continually wet all surfaces to be in contact with the non-chloride accelerated concrete for at least 1 hour prior to applying bonding grout. Remove all standing water before placing grout.

***C. Bonding Grout Application.*** All requirements of §584-3.07A, B, and C apply.

***D. Weather Limitations.*** Place concrete when the ambient temperature is between 10 and 35 ºC, and the abient temperature for the following 48 hours, based on national weather service reports

obtained on a daily basis, is expected to be between 5 and 35 ºC. During placement operations, record the minimum and maximum temperatures and general weather conditions for each 24 hour period.

***E. Handling and Placing.*** When using truck mixers, begin placing only if a sufficient number loaded trucks are present to place the entire repair area. Discharge the concrete using steel lined shoots, within 20 minutes of the completion of mixing. All concrete in the mixer at the end of the 20 minute period will be rejected.

***F. Curing.*** Apply the polyethylene sheets and insulating boards immediately after initial set (as soon as no cement paste is lifted from the repair when it is lightly rubbed with a finger). Extend the curing materials 300 mm beyond the repair's edge, and secure the materials so that wind can not expose the repair. Place the recording thermometer under the insulation boards at least 300 mm inward from the repaired edge. Construct an enclosure, for the thermometer, using the insulation boards to prevent the hydration heat from escaping.

If at any time during the curing period the ambient temperature drops below the acceptable range, the Engineer will inspect the concrete for damage. Repair any concrete, at no expense to the State, that, in the Engineer's opinion, has been damaged by low temperatures.

***G. Opening to Traffic.*** When the repair area has reached the required temperature established by the cylinder testing, remove the insulating boards and polyethylene sheet, and open the repair to traffic.

**METHOD OF MEASUREMENT.** All requirements of §557-4 apply.

**BASIS OF PAYMENT.** All requirements of §557-5 apply.