ITEM 11502.6099 M - HIGH EARLY STRENGTH PCC PAVEMENT

DESCRIPTION: Construct a high early strength portland cement concrete (PCC) pavement using a Modified Class F concrete. Apply the requirements of §501, Portland Cement Concrete - General, and §502, Portland Cement Concrete Pavement, except as modified in this specification.

MATERIALS AND EQUIPMENT

Portland Cement Concrete 501
Admixtures 711-08
Non-Chloride Accelerator . . . . . Approved List
Membrane Curing Compound (white pigmented) . . . . . .
. 711-05
Transverse Joint Supports 705-15
Longitudinal Joint Supports 705-14

Use Type I/II or Type III portland cement. Type III cement, if used, shall have 10% minimum C_3A content, a Blaine fineness greater than 500 m^2/kg, and water soluble alkalies less than 0.4%.

Use only neutralized vinsol resin based air entraining agents. Water reducers, if used, must be Type A (Normal).

Proportioning Concrete. Proportion Class F concrete in accordance with §501-3.01, Proportioning. At the contractor's option, use any combination of the above materials to achieve the specified strength, air content, and slump. Use only one type of accelerator at any one time. Hot water may be used to raise the concrete drop temperature to 35°C, maximum

Mix Design and Trial Batch. Develop a mix design and prepare a trial batch using those materials to be used on the project. Demonstrate the mix's ability to achieve the specified properties to the Regional Materials Engineer's satisfaction. Changes other than minor fluctuations in admixture dosage rates will require a new mix design. The Engineer may halt paving and order additional trial batches whenever the specified properties are not achieved.

The mix must meet the following requirements:

Property	Minimum	Desired	Maximum
12 Hour Compressive Strength (Trial Batch)	15 MPa	-	-
12 Hour Compressive Strength (Project)	14 MPa	-	-
28 Day Compressive Strength (Trial Batch)	30 MPa	-	-

Air Content	5.0%	6.5%	8.0%
Slump	40 mm	-	100 mm

Alternate mix designs will be considered provided the contractor demonstrates the ability to meet the requirements of this specification to the Regional Materials Engineer's satisfaction.

Concrete Mixing, Transporting, and Discharge. Apply the requirements of §501-3.04A, General, §501-3.04B, Concrete Uniformity, and §501-3.04E, Truck Mixed Concrete. Apply the following additions to §501-3.04E, Truck Mixed Concrete:

Flow Meters. The Regional Materials Engineer will measure the actual flow rate, inspect, and approve flow meters prior to use. Equip trucks mixers with in line water flow meters meeting the following requirements:

- Resets easily to "0",
- Mounted to allow easy reading,
- Withstands water temperatures up to 90°C,
- Equipped with air strainers capable of removing entrapped air within the system,
- A batching delivery tolerance of 1% by weight or volume,
- A manufacturers certified flow rate capacity of 265 liters per minute (lpm), and
- A minimum actual flow rate of 190 lpm.

Air Pressurized Tanks For Accelerator Solution. Equip truck mixers with air pressurized tanks meeting the following requirements:

- Sufficient capacity to supply the required solution quantity,
- Discharges the required solution quantity into the truck mixer drum in less than one minute,
- A tank output hose, made of clear plastic, leading into the truck mixer drum, and
- A properly working relief valve.

Batching and Mixing. Produce maximum concrete batches of 5 m^3 per truck. Incremental batch size increases of 0.5 m^3 are allowable provided the contractor demonstrates the ability to place larger batches in a trial as detailed in "Trial Placement" below. Larger batches must also meet all time requirements of the specification as determined by the Engineer.

Introduce the required amount of non-chloride accelerator solution into the air pressurized tank at the batch plant. Drain wash water from the truck mixer drum before charging.

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Twice daily, or more frequently as ordered by the Engineer, determine the fine and coarse aggregate moisture content. Compute the corresponding water added to the concrete mix from the aggregate moisture in liters per cubic meter (l/m^3). Subtract that quantity, as well as the water portion of the calcium chloride solution (l/m^3), from the design water. Submit these calculations to the NYSDOT plant inspector for approval. Upon approval, write on the delivery ticket, the exact volume of water to be added to the mix at the job site. Upon arrival at the job site, submit the delivery ticket to the Engineer.

Before adding water into the truck mixer, execute twenty dry revolutions at 12 to 18 revolutions per minute (rpm) and reset the flow meter to zero. Add water in one complete uninterrupted operation. No water is to be removed from the truck mixer for any purpose while water is being added to the drum. Discharge the non-chloride accelerator solution into the truck mixer drum after the required water designated on the delivery ticket has been added. Add the entire non-chloride accelerator solution in one complete, uninterrupted operation in one minute or less. Apply a minimum of 100 revolutions at 12 to 18 rpm before discharging. The maximum mixing period is 10 minutes.

Paving Equipment. Use paving equipment meeting the requirements of §502-3.02, Equipment, and §502-3.09A, Mechanical Finishing, or an air screed approved by the Regional Materials Engineer. Use a mechanical placer/spreader approved by the Regional Materials Engineer. Use one hand operated vibrator (and operator) per meter of placement width if the finishing equipment is not equipped with mounted immersion vibrators.

Saw Cutting Equipment. Use an early entry or green cut saw approved by the Director, Materials Bureau. Use diamond blade saws with guides that are capable of making straight cuts to the dimensions depicted in the contract documents. Saws must be equipped with blade guards and cut depth controls. Maintain an adequate supply of saws, new blades, and other parts at the site prior to placing concrete and during saw cutting to ensure uninterrupted operation.

Curing Compound Applicators. Use atomizing mechanical sprayers capable of exerting consistent pressure without hand pumping. The applicators must be equipped with tank agitators to continuously mix the curing compound. Use nozzles with spray shields to prevent drift. Flush nozzles daily before use. Keep an adequate supply of spare nozzles on hand. In a slip form paving operation, use self-propelled applicators guided by the same reference system as the slip form paver. In a fixed form operation, applicators need not be self-propelled.

CONSTRUCTION REQUIREMENTS

General. The Engineer will convene a pre-paving meeting seven to fourteen days before the planned start of concrete or permeable base paving. Inspection personnel,

the Contractor, and PCC paving and saw cutting subcontractors, if applicable, shall attend to coordinate all aspects of paving and inspection.

Construct a smooth, well consolidated pavement to the geometric requirements in the contract documents. Initial concrete set will occur much more quickly with an accelerated mix than a standard mix. Provide a labor force and delivery vehicles sufficient to place and finish the concrete as quickly as possible and without cold joints. Replace or repair cold joints as determined by the Engineer.

Process Control Plan. Submit a process control plan, subject to the Engineer's approval, at least thirty days before any non-chloride accelerated concrete is placed. Identify equipment and manpower needs for completing the work as well as backup contingencies for material supply interruptions or equipment breakdown.

Trial Placement. At the plant, or other off project site approved by the Engineer, construct a 5 m^3 trial placement to the pavement dimensions while employing material, equipment, and processes identical to those to be used on the project. Mix, discharge, place, finish, texture, cure, and saw cut the concrete in accordance with this specification. The Engineer will cast twelve 150 x 300 mm cylinders and cure them in a like manner to the curing method proposed for the actual placement. The Regional Materials Engineer will perform compressive strength tests on the cylinders to verify strength gain. Along with the Engineer, evaluate all operations such that unforseen construction issues are minimized. Construct the trial placement at least one week before paving.

Weather Limitations. Begin concrete placement only when the air temperature is between 10°C and 35°C as measured in the shade, and the air temperature is not expected to fall below 7°C within 48 hours after concrete placement. Do not place concrete when it is raining, if it has rained within two hours, or when rain is expected within two hours after placement. Obtain daily reports from the national weather service to determine weather conditions.

Concrete Discharge. Discharge concrete at a maximum temperature of 35°C. Heat the mixing water as necessary to achieve the discharge temperature. The following also apply:

- Completely discharge the concrete within twenty minutes after the entire non-chloride accelerator solution has been added. After that time, remove any undischarged concrete from the job site.

- The Engineer will determine the slump, air, and discharge temperature for each load of concrete.

- If the initial slump is less than 50 mm and, if in the opinion of the Engineer, the concrete cannot be placed and finished in an acceptable manner, the Engineer may allow the addition of water to the drum. Add between 4.0 and 6.0 liters of water per cubic meter of concrete remaining in the drum. Only one addition of water is permitted. After this addition, apply thirty revolutions at 12 - 18 rpm. No additional discharge time will be given to accommodate water addition and extra revolutions.

Surface Preparation. Apply the provisions of §502-3.03, Preparation of the Subbase Course, §502-3.04, Setting Forms, and §502-3.05, Conditions of the Subbase Course. Also, apply the requirements for any permeable base specifications included in the contract documents.

Concrete Placement. Place and spread concrete in accordance with §502-3.06, Placing and Spreading Concrete. Use immersion vibrators to thoroughly consolidate the full placement width and depth. If the finishing machine is not equipped with immersion vibrators capable of thoroughly consolidating the concrete, use one hand operated immersion vibrator per meter of placement width. Assign sufficient laborers to operate each hand operated vibrator. Do not walk through vibrated concrete. Shut off mounted vibrators if the forward movement of the finishing machine stops.

Transverse Joints. Construct transverse joints in accordance with §502-3.08, Joints, and as modified by this specification.

Locate joints near utilities, drainage structures, intersections, tapers, and other irregular areas in accordance with the contract documents or as directed by the Engineer. If necessary, adjust joint locations from those depicted in the contract documents based on the as-built locations of utilities and drainage structures within the pavement and construction staging. Final joint layout is the Contractor's responsibility. Submit an adjusted final joint layout, if necessary, at least 10 days prior to paving. Revise location plans until approved by the Engineer.

Space transverse joints at 3.5 - 5.5 m intervals. Maintain 5.5 m spacings where there are no utilities, drainage structures, intersections, tapers, or other irregularities unless otherwise specified in the contract documents. Secure joint assemblies to the subbase as depicted in the Materials Detail. Maintain joint assembles in their proper position and alignment during paving. Do not walk or step on joint assemblies. Immediately before concrete placement, cut the tie wires (parallel to the dowels) that hold the two upper transverse assembly members in position. Cut each tie wire twice, once near each weld. Submit alternate methods to place and secure transverse joint assemblies to the Director, Materials Bureau, for approval.

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Accurately mark the location of each transverse contraction joint midpoint with a shim placed into the plastic concrete immediately adjacent to each form. Set the shims perpendicular to the forms and the pavement surface. Use shims 3 mm wide and equal in depth to the contraction joint saw cuts depicted in the contract documents. Make first saw cuts from shim to shim as discussed below. The shim lengths must be sufficient to allow complete saw cutting to each shim without striking the form.

Make 3 mm wide saw cuts as soon as the concrete has hardened sufficiently to permit sawing without raveling and the curing compound has cured sufficiently to allow saw cutting without tracking. Use new saw blades if raveling persists after the concrete has gained sufficient strength in the Engineer's opinion. Complete saw cuts before any uncontrolled cracking occurs. Be prepared to make saw cuts around the clock to prevent uncontrolled cracking. Make saw cuts in succession down the pavement. Performing saw cuts on every other joint and returning later to saw omitted joints is not allowed. Immediately after performing the saw cut, wash the resulting debris from the joint and off the pavement. Reapply curing compound to any areas of curing compound damaged by washing or saw cutting.

Longitudinal Joints. Locate longitudinal joints in accordance with the contract documents or as directed by the Engineer. Use two-piece tie bars. Select joint type (butt or keyed) and tie bar size, spacing, and positioning as depicted in the contract documents. Bolt the female portion of the tie bar to the form prior to paving as depicted in the Standard Sheets. Connect the male end after form removal and before paving the adjacent lane. Do not place tie bars within 375 mm of a transverse joints. Keep tie bars free of materials deleterious to bond. Construct longitudinal joints using the one stage sawing operation depicted in the contract documents. Saw cut joints parallel to the pavement centerline and perpendicular to the pavement surface.

Finishing and Texturing. Finish the pavement in accordance with §502-3.09, Finishing and Texturing. Keep hand finishing to a minimum. Immediately after finishing and prior to applying the curing compound, texture the concrete surface with a set of irregularly spaced spring steel tines perpendicular to the pavement center line. Use rectangular tines 3 mm wide, 0.7 mm thick, and approximately 125 mm long. Use tines with the following center-to-center spacing in millimeters:

16/25/22/16/32/19/25/25/25/25/19/22/25/22/10/25/25/25/32/38/22/25/22/25.

Produce tine texture 3 mm deep with minimal dislodging of aggregate as determined by the Engineer.

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Operate the tine head manually or mechanically. In either case, hold the tines as near an angle of 45° with the concrete surface as possible to minimize mortar dragging. Keep the tines free of hardened concrete. If the tine texture is manually placed, or if the mechanical equipment does not operate off the same referencing system as the paver, provide a 75 - 100 mm finishing blank at each transverse joint saw cut location.

Curing. Immediately after texturing, cure the pavement in accordance with §502-3.10A, Impervious Membrane Method, using white pigmented curing compound.

Sealing. Do not construct a sealant reservoir. Leave all joints unsealed.

Project Strength Determination. The Engineer will cast four pairs (eight total) of cylinders (in accordance with Materials Method 9.2, Field Inspection of Portland Cement Concrete) from each days placement. The Engineer will mark the cylinders and leave them adjacent to the pavement under similar curing conditions.

The Regional Materials Engineer will determine the concrete compressive strength at the desired time. Test two pairs from each of the four pairs cast. Open the placement to traffic if:

- the average compressive strength of each cylinder pair exceeds 14 MPa,
- the compressive strength of each cylinder is above 10.5 MPa, and
- the corresponding time frame has elapsed for the entire area to be opened.

If these conditions are not met, the Regional Materials Engineer will re-test the remaining two cylinder pairs a minimum of six hours later. If these conditions are again not met, open the placement after 72 hours.

Project testing of 28 day compressive strength is not required.

METHOD OF MEASUREMENT

The Engineer will compute the quantity in cubic meters from payment lines shown on the plans and a longitudinal measurement of the finished work, except where revised payment lines were established by the Engineer prior to performing the work. No deductions will be made for catch basins, manholes, or other similar obstructions in the pavement.

BASIS OF PAYMENT

Include the cost of furnishing all labor, materials, and equipment necessary to complete the work in the unit bid price. Include the cost of constructing the trial

placement in the bid price. Transverse joint supports and longitudinal joint ties will be paid separately under their respective items.