RMCAO The Power of Concrete

Technical Bulletin

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Standard Test Method for Determining Plastic Density

Since pervious concrete is a relatively new concrete product that is used for stormwater management, there are currently a large number of potential test methods that can be used to evaluate this product. One of the key material evaluation methods is to determine the plastic density of the product during the pervious concrete trial placement, and to then compare that result to the actual product density during the final project placement. A plastic density acceptability criterion of ± 80 kg/m^3 is then used as the primary quality control acceptance and rejection tool on the jobsite during the pervious concrete placement.

Since multiple density test methods exist, it is important that a standardized test method be selected prior to the start of the project. ASTM is currently in the process of finalizing a new test method for determining the density of plastic pervious concrete. The test method that they have selected was based upon conducting a round robin testing program and comparing the results of 6 different consolidation methods performed by 6 different concrete testing laboratories. The resulting draft test method was then selected based upon the high level of repeatability between testing laboratories and the ease of implementation of this test method on construction projects.

RMCAO therefore recommends that all pervious concrete density testing be conducted following this draft ASTM test method. Unfortunately, this test method has not yet been formally introduced; therefore we are unable to directly reference it for use on Ontario projects at this time. In the meantime, RMCAO has developed this basic pervious concrete testing protocol based directly upon the draft ASTM test method. Once the ASTM testing protocol has been finalized and published, this Technical Bulletin should be discarded and the appropriate ASTM testing protocol followed.

Standard Pervious Concrete Density Test Method

Definition

Pervious concrete is rigid concrete pavement with large interconnected voids that allow rapid water flow through the pavement.

Testing Equipment

- Cylindrical container made from metal conforming to the requirements of CSA A23.2-6C with a capacity of 7.0 ± 0.6 L
- Balance or scale conforming to the requirements of CSA A23.2-6C
- Standard proctor hammer
- Strike off bar
- Small tools: scoops, rubber gloves, sponge, etc.

Testing Procedure

- Obtain a representative concrete sample in conformance with CSA A23.2 – 1C. The minimum sample size shall be 30 litres.
- Using the balance or scale, determine the mass of the empty cylindrical container and record the value to the nearest 0.05 kg.
- Place the measure on a flat and level surface free from vibration and slightly moisten the measure prior to placing concrete. Place the concrete in the measure in two approximately equal lifts using a large scoop. Drop the proctor hammer 20 blows/lift at the full 300 mm drop. For each lift, distribute the position of the tamper in such a way that the whole surface area of the measure is consolidated. Before consolidating the second and final layer, fill the measure to overflowing.
- On completion of consolidation the measure must not contain a substantial excess or deficiency of concrete. An excess of concrete protruding approximately 3 mm above the top of the measure is optimum. If after 10 hammer drops to the final layer it appears that there will be insufficient concrete, add a small quantity of concrete to correct the deficiency. If the measure contains a great excess of concrete at completion of consolidation, remove a representative portion of excess concrete with a trowel or scoop immediately following consolidation and before strike-off.
- After consolidation, strike off the top surface of the concrete and finish it smoothly with the flat strike-off bar using great care to leave the measure just level full.
- After strike-off, clean all excess concrete from the exterior of the measure and determine the mass of the concrete and measure and record to the nearest 0.05 kg.

Density Calculations

- The density (unit weight) of the pervious concrete sample is determined by calculating the net mass of the concrete (in kilograms) by subtracting the mass of the measure, M_m, from the mass of the measure filled with concrete, M_c. The density of the pervious concrete, D, is found by dividing the net mass of concrete by the volume of the measure, V_m as follows:

$$D = (M_c - M_m)/V_m$$

Where:

D	=	Density (unit weight) of concrete in kg/m^3
M_c	=	Mass of the measure filled with concrete in kg
M_m	=	Mass of the measure in kg
V_m	=	Volume of the measure in m^3

Test Result Reporting

Reporting shall include the following information:

- Identification of laboratory performing the test (name & address)
- Name of technician who performed the testing & CSA or ACI Certification Number
- Identification of the sample (location, truck #, and time at which sample was taken)
- Density of the concrete to the nearest 1 kg/m^3
- Name and signature of the person responsible for the review and approval of the test report.