

ALBERTA TRANSPORTATION
TECHNICAL STANDARDS BRANCH

BT010 - JULY 2000

**TEST PROCEDURE FOR CASTING AND STORING ONCRETE TEST SPECIMENS
FOR USE IN APPROVAL TESTING OF SEALERS**

SCOPE - This test procedure outlines the methods and requirements used for the batching, casting, and storing concrete test cubes for use in the testing of penetrating and film-forming sealers for use on concrete bridge surfaces.

1.0 GENERAL

1.1 INTRODUCTION

This test procedure outlines the details for manufacture of test cubes used in the approval of concrete sealer products. For the purpose of evaluating sealers, it is important that the test specimens be uniform with respect to permeability and dryness. The compressive strength of the test specimens is of secondary importance.

1.2 EQUIPMENT

Concrete mix equipment, smooth surfaced moulds, vibrators, trowels and moist curing room.

2.0 TEST SPECIMENS

2.1 CONCRETE MIX DESIGNS

The mixes for the test specimens shall contain well-graded, normal density, non-absorptive aggregates meeting the requirements of CSA Standards 23.1 regarding concrete materials and methods of concrete construction.

There are two types of test cubes, 0.5 water cement (w/c) ratio cubes used for testing sealer types 1a, 1b, 2a, 2b and 3. A 0.35 w/c ratio cube is used for evaluating Type 1c sealers. Use a compatible superplasticizer if needed to achieve a workable consistency in the 0.35 w/c cubes only.

No fly ash allowed.

Constituents/Properties	0.5 W/C Ratio	0.35 W/C Ratio
Cement Content/m ³	300 kg	425 kg
Maximum Aggregate Size	14 mm	14 mm
Sand Content, % Total Aggregate	40.5 to 41.5	40.5 to 41.5
Fineness Modulus of Sand	2.4 to 2.9	2.4 to 2.9
Air Entraining Agent	Neutralized Vinsol Resin or Equivalent	Neutralized Vinsol Resin or Equivalent
Water Reducing Agent	Lignosulfonates	Lignosulfonates
Superplasticizer	Nil	Poly-Naphthalene Sulfonates. Optional
Flyash	Nil	Nil
Age of Mix at Discharge	30 to 60 minutes	30 to 60 minutes
Maximum temperature	18°C	18°C
Slump	75 - 125 mm	75 - 125 mm
Entrained Air Content	5.0 to 7.0%	5.5 to 6.5%
Minimum Slump Retention	-	50% of Slump at Start of Discharge

Slump Retention - minimum 50% of initial slump at time of discharge.

The 0.50 water cement ratio mix is designed to create a relatively permeable concrete that is representative of typical infrastructure of the 1960's and 1970's. The 0.35 water cement ratio mix is designed to represent newer bridge concrete used in precast girders, concrete overlays, and salt exposed elements. The testing laboratory shall report the mix design, 28 day compressive strength, slump and entrained air content.

2.2 CASTING

The concrete mix shall be accurately proportioned and batched in a minimum quantity of two cubic metres. Extreme care shall be taken to ensure the exact water cement ratio in the mixes. This will require the inside surfaces on the mixer to be clean and free of crust. The mix shall be properly vibrated and consolidated to reduce the amount of surface voids in the cubes.

The test cubes shall be formed in smooth surfaced moulds, and no form oil or other contaminants shall come in contact with the test cube surfaces that will later be sealed. The concrete in the cubes shall be vibrated using an electric vibrator with a maximum head size of 22 mm diameter.

2.3 FINISHING

After casting, the mix shall be screeded and then hand trowelled using proper concrete practice.

2.4 IDENTIFICATION OF CUBE TYPES AND MINIMUM CURING TIMES

For ease of identification, the two types of cubes shall meet the following size requirement ± 2 mm.

<u>W/C Ratio</u>	<u>Cube Size (mm)</u>	<u>Minimum Curing Time (days)</u>
0.50	100 x 100 x 100 mm	42
0.35	95 x 100 x 100 mm	5

2.5 IDENTIFICATION OF SCREEDED FACE

Due to the difference in permeability between the screeded surface and the formed surfaces the screeded surface shall be identified with a felt-pen mark located in the centre of the screeded face of the cube. This identification is made so that the screeded surface can be maintained in an upward facing orientation throughout the course of the procedures of subsequent sealer tests. This orientation is required to more closely simulate the conditions in the real world. The felt-pen mark shall be re-established whenever it is removed by sandblasting or other procedures.

2.6 CURING

The test cubes shall be cured as shown in Section 2.4 above at $23^{\circ}\text{C} \pm 2$ and 100% relative humidity. Prior to use, each cube shall be weighed, numbered, and labeled for future identification. Labeling shall be done in a manner that does not affect the water absorption or the accuracy of weighing.

2.7 SURFACE PREPARATION

Cubes shall be dried in laboratory air for 24 hours and then sand blasted on all surfaces to uniformly remove a total of 24.0 ± 2 grams, which will expose the pores in the concrete. The cubes shall be blasted on one face at a time to remove 4.0 grams per face. The resulting surface should be free of laitance. The cube surfaces shall be substantially free of voids from entrapped air pockets, as these would affect the coverage rates of the sealers. This requires special care in consolidating the concrete mix during casting. Cubes with more than 3% voids on the surface or 18 square centimetres, shall not be used for evaluating sealers with this test method, however they may be used as non-sealed control samples.

Surface voids smaller than 10 mm diameter need not be included in this measurement. A quick estimate of the area of surface voids can be done by measuring the diameter of all voids to the nearest millimetre, counting the number of voids of each even numbered size and calculating the total area assuming each size is a perfect circle. A planimeter is needed for a more accurate measurement.

The sandblasting shall produce surfaces that are uniform in condition. A typical sandblasting sand, such as Sil 7, with a gradation similar to that shown shall be used. The cubes shall be air blown to remove sand or dust prior to weighing. No method of surface preparation other than sandblasting will be allowed.

Nominal Opening (microns)	Gradation of Sandblast Sand % Retained
1180	4-12
850	8-15
600	15-25
425	35-45
300	15-25
Pan	0-3

2.8 STORAGE

Bulk test specimens with the 0.35 w/c ratio may be kept in storage for a maximum period of 182 days from the time of casting. Bulk specimens with the 0.5 w/c ratio may be kept in storage indefinitely. However, the drying requirements of Table I of Bridge Test [BT001](#) must be met for all cubes. Storage shall be done in a moist curing room with 100% relative humidity.