



**Minnesota Department of Transportation  
Shotcrete - Concrete Surface Repair  
February 6, 2020**

The Minnesota Department of Transportation (MnDOT) will only accept pre-packaged dry mix from the MnDOT Approved/Qualified Products List. The dry mix consists of a Portland cement, silica fume, air-entraining admixture, synthetic fibers and blended aggregates.

For Dry Mix to be pre-approved by MnDOT, a Manufacturer must demonstrate an ability to manufacture pre-packaged material meeting the requirements of the information stated below.

The Dry Mix manufacturer must comply with the following:

**A. Portland Cement**

Portland cement conforming to 3101, "Portland Cement" and *ASTM C150, Standard Specification for Portland Cement, Type I*.

**B. Silica Fume**

Provide Silica Fume conforming to *ASTM C1240, Standard Specification for Silica Fume Used in Cementitious Mixtures*.

**C. Blended Aggregates (Grades No. 1 or No. 2)**

Provide blended aggregates of natural siliceous and consisting of hard, clean, strong, durable uncoated particles, conforming to the requirements of *ASTM C33, Standard Specification for Concrete Aggregates*. Provide all aggregates dried to a moisture content of less than 0.1% by mass, based on oven drying at 220°F to 230°F. Gradation shall comply with Grading No. 1 or Grading No. 2 of the Table A below or Table 1.1.1 of ACI 506R-16, Guide to Shotcrete.

Table A: Testing requirements for dry mix designs

Sieve Size	Percent Passing	
	Grading No. 1	Grading No. 2
1/2-inch	-	100
3/8-inch	100	90-100
#4	95-100	70-85
#8	80-98	50-70
#16	50-85	35-55
#30	25-60	20-35

#50	10-30	8-20
#100	2-10	2-10

Clearly indicate in the product name or data sheet the gradation being supplied.

#### D. Synthetic Fiber Reinforcement

Use Type III Collated fibrillated-polypropylene (CFP) synthetic fibers that conform to *ASTM C1116, Standard Specification for Fiber-Reinforced Concrete*. The fibers will need to control, plastic, thermal and drying shrinkage cracking at a dosage designed by the manufacturer, but at a minimum dosage rate of 1.5 pounds per cubic yard of shotcrete. Recommend a fiber length modification if necessary to achieve both shotcrete consolidation and mitigation of cracking due to shrinkage and thermal related effects.

#### E. Mix Design and Testing

Produce dry-bagged premixed shotcrete materials in conformance with the pertinent requirements of *ASTM C1480, Standard Specification for Packaged, Pre-Blended, Dry, Combined Materials for Use in Wet or Dry Shotcrete Application*.

In situ shotcrete mix properties must meet or exceed the performance requirements outlined in the following Table B:

Table B: Testing requirements for dry mix designs

TEST DESCRIPTION	TEST METHOD	AGE (Days)	SPECIFIED REQUIREMENT
Min. Compressive Strength (psi)	ASTM C1604	7 28	4000 5000
Min. Flexural Strength (psi)	ASTM C78	28	900
Max. Boiled Absorption, %	ASTM C642	7	8
Max Volume of Permeable Voids, %	ASTM C642	7	17
Max. Air Void Spacing Factor ( $\mu\text{m}$ )	ASTM C457		300
Min. Freeze-Thaw Resistance (%)	ASTM C666		100
Max. Salt Scaling (lb/ft <sup>2</sup> )	ASTM C672		0.04

Max. Rapid Chloride Penetrability	ASTM C1202	28	700
Max. Uniaxial Drying Shrinkage ( $\mu\text{m/m}$ )	ASTM C157	28	650

Make allowances for the shooting orientation and rebound in shotcrete mixture proportioning. Perform tests at curing temperatures expected to be encountered in the field.

### **F. Laboratory Acceptance**

Submit a Certified Test Report from a Qualified Laboratory (as defined in 1103, "Definitions") accredited through the AASHTO Accreditation Program (AAP), and/or an AASHTO accredited laboratory to the Department that indicates actual results of tests, the manufacturer name, the mix name, and the name of the plant which produced the mix used for testing.

Annual recertification will not be required.

### **G. Non-Compliance**

Please also note that it is the manufacturer's responsibility to immediately notify MnDOT of any product change or modification including mix design and sources of aggregate, silica fume or Portland cement, or if the product is no longer being produced. If our testing determines that there has been a change, without prior notification from the manufacturer, the product may be removed from the approved product list.

The list of approved products may be found on the MnDOT Bridge A/QPL website at <http://www.dot.state.mn.us/products/bridge/index.html>

Reference Materials and Certification shall be sent to:

MnDOT Bridge Office  
Attn. Mark Spafford  
3485 Hadley Avenue North  
Oakdale, MN 55128