



## Section 03 37 13 Shotcrete

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**SIKA SPECIFICATION NOTE:** *This guide specification includes test methods, materials and installation procedures for SikaCem®-103, a one component, high performance repair mortar for dry/wet spray application. This guide specification should be adapted to suit the needs and conditions of individual projects. It is prepared in CSI Master Format and should be included as a separate section under Division 3 - Concrete.*

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### Part 1 - General

#### 1.01 Summary

This Specification shall be read as a whole by all parties concerned. Each Section may contain more or less the complete Work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their Work and coordinate overlapping Work.

#### 1.02 System description

This specification describes the patching or overlay of interior and/or exterior horizontal, vertical, or overhead surfaces with a pneumatically placed cementitious, silica fume portland cement mortar/concrete.

#### 1.03 Related sections

- A. Maintenance of Cast-in-Place Concrete: Section 03 01 30
- B. Maintenance of Precast Concrete: Section 03 01 40
- C. Maintenance of Cast Decks and Underlayment: Section 03 01 50
- D. Maintenance of Mass Concrete: Section 03 01 70
- E. Structural Concrete: Section 03 33 00

#### 1.04 Quality Assurance

- A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
- B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.
- C. Store and apply materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Safety Data Sheets (SDS) for complete handling recommendations.

### **1.05 Delivery, Storage, and Handling**

- A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
- B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.
- C. Condition the specified product as recommended by the manufacturer.

### **1.06 Job Conditions**

- A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 40°F (4°C) and rising.
- B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.

### **1.07 Submittals**

- A. Submit two copies of manufacturer's literature, to include: Product Data Sheets (PDS), and appropriate Safety Data Sheets (SDS).
- B. Submit copy of Certificate of Approved Contractor status by manufacturer.

### **1.08 Warranty**

Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

## **Part 2 - Products**

### **2.01 Manufacturer**

SikaCem®-103, as manufactured by Sika® Corporation, is considered to conform to the requirements of this specification.

### **2.02 Materials**

- A. The mortar shall be a blend of selected portland cements, microsilica, fibers, and specially graded aggregates. It shall be applicable for horizontal, vertical, and overhead surfaces.
- B. The materials shall be non-combustible, both before and after cure.
- C. The materials shall be supplied in a factory-proportioned unit.
- D. The cementitious, microsilica mortar must be placeable from 1/3" (8.1 mm) in depth and greater.



### 2.03 Performance Criteria

Typical Properties of the mixed polymer-modified, portland cement mortar:

1. Yield	0.48 ft <sup>3</sup> (0.01 m <sup>3</sup> ) per bag
2. Color	Concrete gray
3. Mixing Ratio	5-6 pts (2.4-2.8 L) per 55 lb bag
4. Application Thickness	Min 1/4" (6 mm) Max 6-10" (150-250 mm)
5. Application Temp	> 40 °F (4 °C)
6. Setting time (ASTM C-266)	Initial: 2-3 hrs Final: 5-6.5 hrs
7. Working time	5-10 min
8. Finishing time	10-20 min
9. Density (ASTM C-138)	137 lb/ft <sup>3</sup> (2.2 kg/l)
10. Compressive Strength (ASTM C-109)	2 days - 6,000 psi (41.4 MPa) 7 days - 7,000 psi (48.3 MPa) 28 days - 8,000 psi (55.2 MPa)
11. Flexural strength (ASTM C-298)	7 days - 1,000 psi (6.9 MPa) 28 days - 1,400 psi (9.7 MPa)
12. Splitting tensile strength (ASTM C-496)	7 days - 600 psi (4.1 MPa) 28 days 750 psi (5.2 MPa)
13. Bond strength (ASTM C-469)	28 days - 2,000 psi (13.8 MPa)
14. Pull off strength (ASTM C-1583)	28 days - 290-580 psi (2.0-4.0 MPa)
15. Modulus of Elasticity in Compression	28 days - 5.8x10 <sup>6</sup> psi (40 GPa)
16. (ASTM C-496)	

**Note: Tests above were performed with the material and curing conditions @ 71°F – 75°F and 45 - 55% relative humidity.**

## Part 3 – Execution

### 3.01 Surface Preparation

- A. Areas to be repaired must be clean, sound, and free of contaminants. All loose and deteriorated concrete shall be removed by mechanical means. Mechanically prepare concrete substrate to obtain a surface profile of  $\pm 1/3$ " (CSP 5 or greater as per ICRI Guidelines) with a new exposed aggregate surface. Area to be patched shall not be less than  $1/3$ " in depth.
- B. Where reinforcing steel with active corrosion is encountered, sandblast the steel to a white metal finish to remove all contaminants and rust. Where corrosion has occurred due to the presence of chlorides, the steel shall be high pressure washed after mechanical cleaning. Prime steel with 2 coats of Sika® Armatec® 110 EpoCem as per the Product Data Sheet (PDS).

### 3.02 Mixing and Application

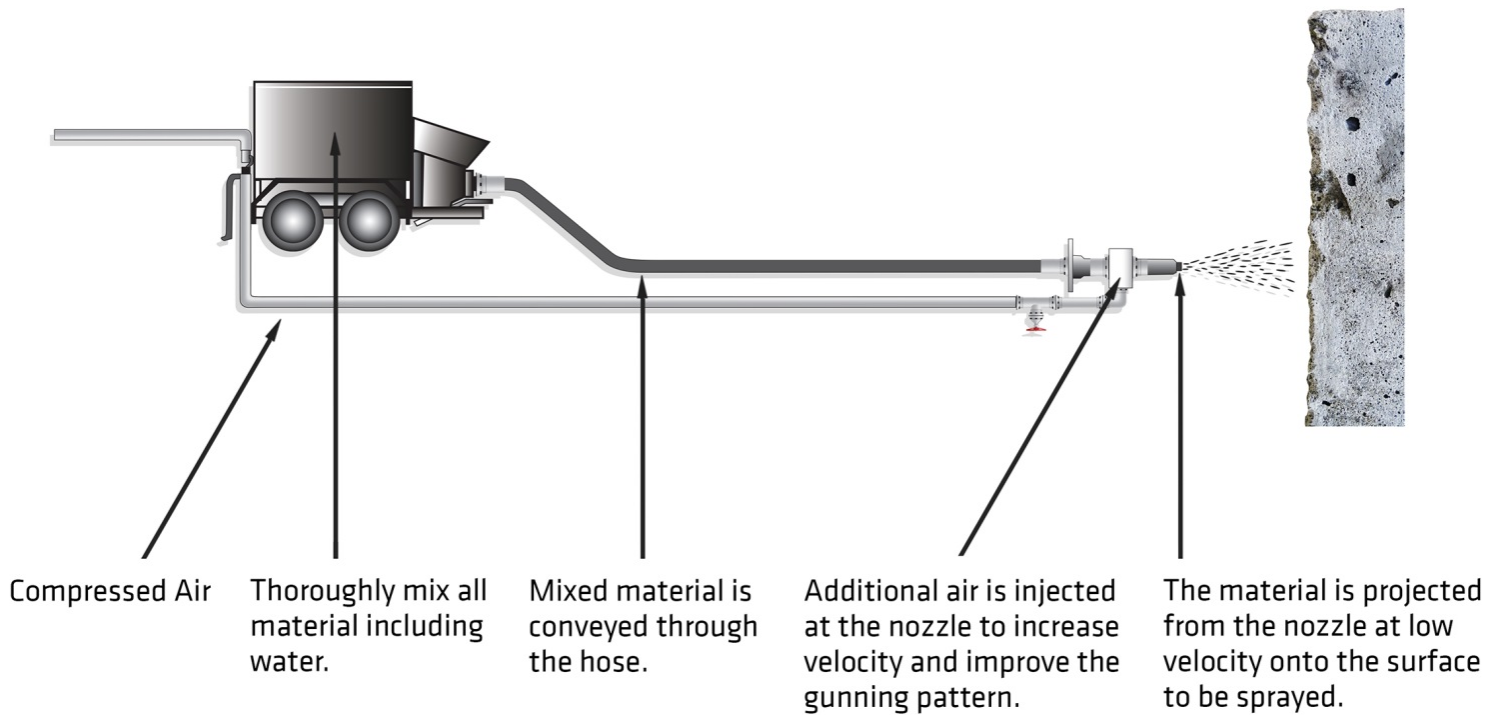
- A. Material is to be applied by conventional dry spray shotcrete or wet spray equipment. Consult Product Data Sheet (PDS).
- B. Placement Procedure Dry Process: At the time of application, the substrate shall be saturated surface dry with no standing water. Apply the material in accordance with ACI 506R-90 "Guide to Shotcrete". Important factors during shotcreting are: the nozzle distance (2-6ft), angle to substrate (90o) and consistency of mortar. Mortar consistency should be plastic (like firm jelly), immediately after application and before set. A natural gun finish may be used. If gun finish is too rough, you may apply special finishes. Slice off excess material with a sharp-edged cutting screed 5 to 10 minutes after initial set. The surface may then be finished to your requirements: 1. Broomed for rough textured, 2. Wood-floated for a granular texture, 3. Steel-troweled for smooth surface finish.
- C. Placement Procedure Wet Process: At time of application, surface should be Saturated Surface Dry (SSD) but hold no standing water. Apply material by spraying or troweling for repairing vertical or overhead surfaces. Shoot the material perpendicular to the surface. This minimizes rebound, creates the smoothest pattern (reduces bumps) and properly encases the rebars. The velocity of the shotcrete is sufficient if, at a distance of 18 to 24", the shotcrete pattern flattens out on contact with the surface and the rebars are encased. After applying the material, allow to stiffen for approx. 10 minutes before removing bumpy areas with a trowel. If a another layer is desired, allow the material to reach initial set. This will take anywhere from 2-4 hours depending on mix consistency, mix and ambient temperature, wind conditions and humidity. Begin and finish a given patch on the same day.
- D. As per ACI recommendations for portland cement concrete, curing is required. Moist cure with wet burlap and polyethylene, a fine mist of water or a water-based\* compatible curing compound. Moist curing should commence immediately after finishing and continue for 48 hours. Protect newly applied material from rain, sun, and wind until compressive strength is 70% of the 28 days compressive strength. To prevent from freezing cover with insulating material. Setting time is dependent on temperature and humidity.
  - \*Pretesting of curing compound is recommended.
- E. Adhere to all procedures, limitations and cautions for the polymer-modified portland cement mortar in the manufacturers current printed Product Data Sheet (PDS) and literature.

### 3.02 Cleaning

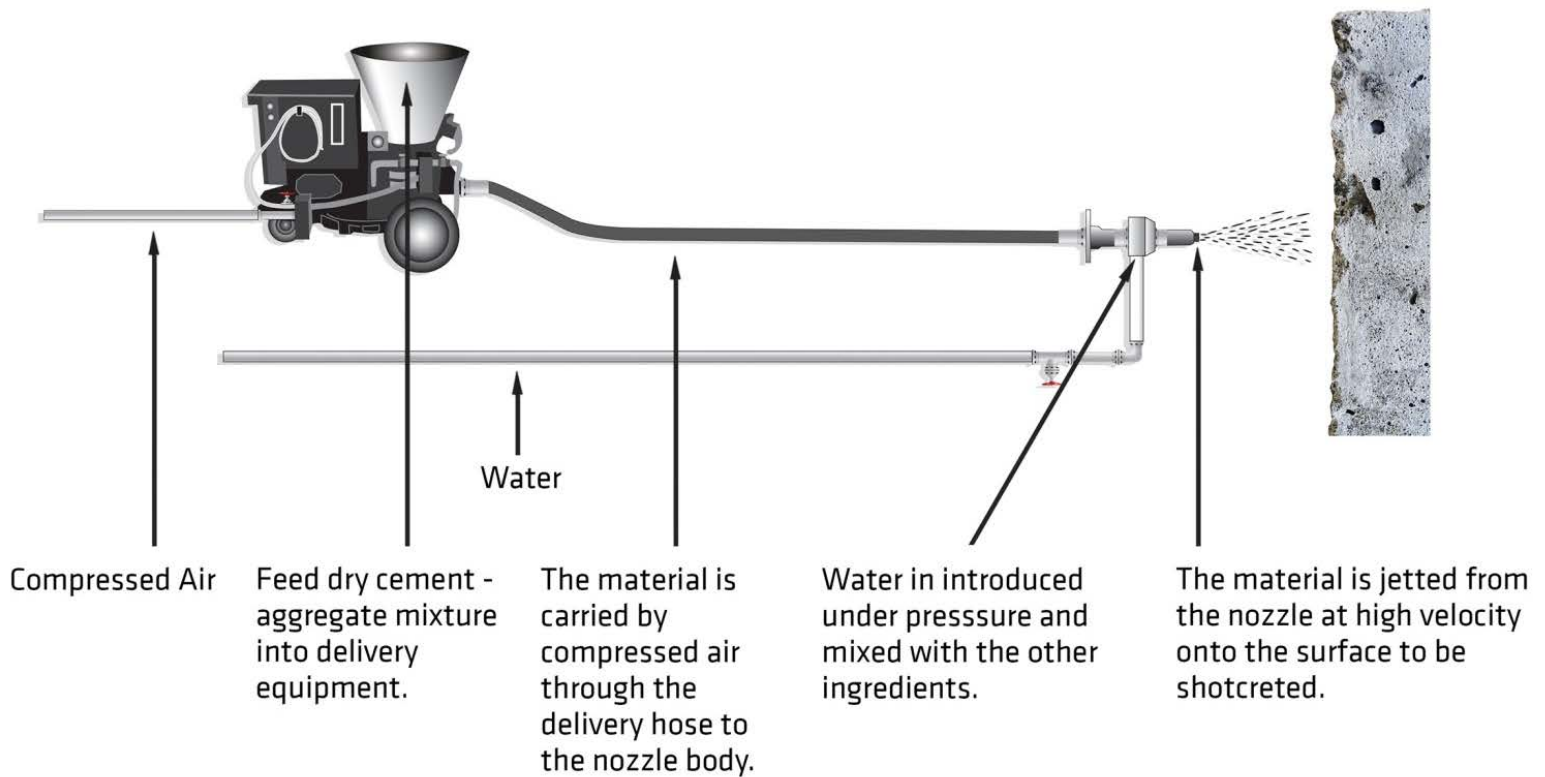
- A. The uncured silica fume portland cement mortar can be cleaned from tools with water. The cured polymer modified portland cement mortar can only be removed mechanically.
- B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

# Machine-applied

## 1- Wet Spray



## 2- Dry Spray



**Concrete Restoration Systems by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071**

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