BUILDING TRUST

PRODUCT DATA SHEET

# King® RS-D1

RAPID STRENGTH SHOTCRETE MATERIAL FOR DRY-MIX PROCESS APPLICATIONS

## PRODUCT DESCRIPTION

King® RS-D1 is a rapid hardening, pre-blended, and pre-packaged shotcrete material formulated for dry-mix applications, powered by Rapid Set® technology. It contains controlled blended aggregates along with other carefully selected components. It offers enhanced shooting characteristics and physical properties, greatly reduced setting times, along with very rapid strength development.

## USES

**Overall:**

- Rehabilitation of concrete bridges, dams, reservoirs, tunnels, marine structures, and parking ramps
- Lining and rehabilitation of sewers, and water pipes
- New construction including slope stabilization, soil-nailing, shaft, and tunnel lining

**Included Steel fiber reinforcement (ST):**

- Ground support applications for mining, tunneling, and other underground openings
- Rehabilitation of marine structures
- Lining and rehabilitation of sewers, and other tunnels
- Slope stabilization, soil-nailing, shaft and tunnel linings

## CHARACTERISTICS / ADVANTAGES

- Very high early strength for a reduced construction schedule
- Improved performance in presence of running water
- Air-entrainment provides superior resistance to freeze-thaw cycling, and salt-scaling resistance
- Allows earlier re-opening of traffic lanes on bridges, and earlier reentry times in tunnels and parking garages
- Low modulus of elasticity and low drying shrinkage, reducing cracking potential
- Simplified curing method to accelerate construction schedule
- Significantly reduced rebound, resulting in lower material usage
- Superior ability to build greater thicknesses in a single pass, in both vertical, and overhead orientations
- Improved resistance to water washout
- Improved resistance to sulfate attack
- Very low permeability and low shrinkage
- Compatible with integral, pre-applied, and/or post-applied corrosion inhibitors
- Designed with natural normal-density non-reactive aggregates to eliminate potential alkali-aggregate reactivity (AAR)

**OPTIONAL FEATURES AND BENEFITS**

**Micro-Synthetic Fiber (SY)**

- Micro-Synthetic fibers reduce cracking caused by intrinsic stresses
- Type III synthetic fiber in accordance with ASTM C1116
- Grade FR Class I shotcrete in accordance with ASTM C1480

**Corrosion Inhibitor (CI)**

- Corrosion inhibitor protects steel reinforcing and other metals embedded in concrete from corrosion induced by carbonation or chlorides
- Pre-blended corrosion inhibitor provides the correct dosage to enhance corrosion protection

**Steel Fiber (ST)**
Different grades of RS-D1 ST with higher and lower dosages of steel fiber are available upon request.
- Significantly increased load carrying capacity
- Significantly increased energy absorbing capacity (toughness)
- Significantly increased impact resistance

**EXAMPLES:**
- For King® RS-D1 with micro-synthetic fibers and gradation No. 2, the name of the product would be: **King® RS-D1 SY G2**.

**Gradation (G2)**
- By default King® RS-D1 & King® RS-D1 ST are blended to meet *ACI 506 "Guide to Shotcrete", Table 1.1, Gradation No. 1* (No Added Abbreviation)
- King® RS-D1 G2 & King® RS-D1 ST G2 are blended to meet *ACI 506 "Guide to Shotcrete", Table 1.1, Gradation No. 2* (G2)

## PRODUCT INFORMATION

| | |
|---|---|
| **Packaging** | 66 lb (30 kg) bag<br>2205 lb (1000 kg) FIBC*<br>Products with Macro-Synthetic fibers (MF) or Steel fibers (ST) can only be packaged in FIBC*<br>Custom packaging is available to suit specific project requirements<br>*Flexible Intermediate Bulk Container |
| **Shelf Life** | 12 months in original, unopened packaging |
| **Storage Conditions** | Stored in a dry, covered area, protected from the elements between 40°F - 95°F (5°C - 35°C)<br>**Underground Environments**<br>Stored in a dry, covered area, protected from the elements between 40°F - 95°F (5°C - 35°C)<br>Physical properties may be adversely affected if material is stored in temperatures below 40°F (5°C) and should be allowed to warm to ambient underground temperatures before application |

## TECHNICAL INFORMATION

**Compressive Strength**

**ASTM C116**

| | 50 % HUMIDITY CURE |
|---|---|
| 1 hour | 1500 psi (10 MPa) |
| 2 hours | 2175 psi (15 MPa) |
| 3 hours | 3000 psi (21 MPa) |
| 1 day | 3625 psi (25 MPa) |

**ASTM C1604**

| | 50 % HUMIDITY CURE |
|---|---|
| 7 days | 4640 psi (32 MPa) |
| 28 days | 5500 psi (38 MPa) |

**Modulus of Elasticity in Compression**

| MODULUS OF ELASTICITY | ASTM C469 |
|---|---|
| 28 days | 3.7 x $10^6$ psi (25.3 GPa) |

**Flexural Strength**

| | ASTM C78 |
|---|---|
| 28 days | 785 psi (5.4 MPa) |

**Flexural toughness**

**STEEL FIBER** — **ASTM C1550**

| 1 day | Toughness as a function of flexure | | | | |
|---|---|---|---|---|---|
| **Peak applied load** | **5 mm** | **10 mm** | **20 mm** | **30 mm** | **40 mm** |
| 3821 lbf (17 kN) | > 75 J | > 140 J | > 230 J | > 250 J | > 300 J |

| 28 days | Toughness as a function of flexure | | | | |
|---|---|---|---|---|---|
| **Peak applied load** | **5 mm** | **10 mm** | **20 mm** | **30 mm** | **40 mm** |
| 6070 lbf (27 kN) | > 100 J | > 200 J | > 300 J | > 350 J | > 400 J |

**Shrinkage**

| **UNIAXIAL DRYING SHRINKAGE** | **ASTM C157** |
|---|---|
| 28 days | 0.04 % |

**Rapid Chloride Permeability**

| **CHLORIDE ION PENETRABILITY** | **ASTM C1202** |
|---|---|
| 28 days | 1200 Coulombs (Low permeability) |

**Porosity**

**AIR CONTENT** — **ASTM C457**

6 % ± 2 %

**MAXIMUM AIR VOID SPACING FACTOR** — **ASTM C457**

0.0118 in (300 µm)

| **BOILED ABSORPTION** | **ASTM C642** |
|---|---|
| 28 days | 6.0 % |

| **MAXIMUM VOLUME OF PERMEABLE VOIDS** | **ASTM C642** |
|---|---|
| 28 days | 15.0 % |

**Freeze-Thaw Stability**

| | **ASTM C666** |
|---|---|
| 28 days | 100 % (Excellent durability factor) |

**Salt resistance**

**SALT SCALING RESISTANCE** — **ASTM C672**

0.12 lb/ft² (0.6 kg/m²)

## APPLICATION INFORMATION

**Coverage**

Approx. 0.5 ft³ per 66 lb bag (0.014 m³ per 30 kg bag)
Approx. 16.5 ft³ per 2205 lb FIBC (0.45 m³ per 1000 kg FIBC)

**Set Time**

| | **ASTM C1117** |
|---|---|
| Initial | 5-10 minutes |
| Final | 10-20 minutes |

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

The following data was obtained under controlled conditions with material and ambient temperatures of 70 °F (21 °C). Higher or lower temperatures can respectively accelerate or delay setting time and early-age compressive strength gain.

## AVAILABILITY/WARRANTY

Each of the following descriptors / features have the possibility of being included in a specific mix design; Either on their own, or combined with any other descriptors / features.

| Descriptors / Features of fiber dosages: | |
|---|---|
| Steel Fibers | ST |
| Micro-Synthetic Fibers | SY |

| Descriptors / Features of other technologies: | |
|---|---|
| Corrosion Inhibitor | CI |
| Retarded/Delayed Set-Time | RT |
| Gradation 2 | G2 |

## ENVIRONMENTAL, HEALTH AND SAFETY

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

### EQUIPMENT

Special precautions needed when using predampeners with dry blended powdered accelerated shotcrete.

Contact your Sika STM Technical Representative for more information.

### SURFACE PREPARATION

**Temperatures above 40 °F (5 °C):**

- **Repair or Rehibilitation:** All surfaces to be in contact with product must be free from dust, oil, grease or any other foreign substances that may interfere with the bond of the material. Remove all loose or delaminated concrete providing a roughened surface and a minimum of ¾ inch (20 mm) clearance behind any corroded reinforcing steel. The perimeter of the repair area should be saw-cut a minimum of ¾ inch (20 mm). Clean the area to be repaired with potable water, leaving the concrete saturated but free of standing water (SSD).
- **Rock surfaces:** All surfaces to be in contact with product must be free from dust, oil, grease or any other foreign substances that may interfere with the bond of the material. Remove all loose or delaminated rock. Clean the area with potable water, leaving the substrate saturated but free of standing water (SSD).

**Temperatures below 40 °F (5 °C):**

- **Repair or Rehibilitation:** All surfaces to be in contact with product must be free from oil, grease or any other foreign substances that may interfere with the bond of the material. Remove all loose or delaminated concrete providing a roughened surface and a minimum of 1 inch (25 mm) clearance behind the reinforcing steel. The perimeter of the repair area should be sawcut a minimum of ¾ inch (20 mm). To avoid freezing of the interface between the shotcrete and the parent concrete, do not pre-wet the receiving surface. Pneumatically remove any free standing or other fine particles that may interfere with the bond between the product and the substrate. Do not apply when ambient temperature is below or is expected to fall below 20 °F (-5 °C) within six (6) hours following the application of shotcrete. Do not apply when temperature of receiving surface is below 20 °F (-5 °C). Material and mixing water temperature must be maintained between 70 °F and 86 °F (20 °C and 30 °C).
- **Rock surfaces:** All surfaces to be in contact with the product must be free from dust, oil, grease or any other foreign substances that may interfere with the bond of the material. Remove all loose or delaminated rock. To avoid freezing of the interface between the shotcrete and the parent concrete, do not pre-wet the receiving surface. Pneumatically remove any free standing or other fine particles that may interfere with the bond between the product and the substrate.

### APPLICATION

Apply product in accordance with the *ACI 506 "Guide to Shotcrete"* publication.

Performance of in-place shotcrete relies heavily upon application techniques. The shotcrete material, equipment and key personnel should be pre-qualified prior to project start-up to ensure optimum quality of in-place shotcrete.

### OPTIMUM PERFORMANCE

- King® RS-D1 & King® RS-D1 ST should not be applied when ambient, substrate, and material temperatures are below 20 °F (-5 °C) or above 95 °F (35 °C).
- Material should be allowed to warm to at least 60 °F (15 °C) prior to shooting in order to optimize early age compressive strength results.
- For adverse temperatures, follow ACI recommendations for Cold / Hot Weather Concreting.
- King® RS-D1 ST recommended minimum inside diameter of shotcrete hoses should be 2 in (50 mm).

Contact your Sika STM Technical Representative for more information.

### CURING TREATMENT

Curing is essential to optimize physical properties of the shotcrete and minimize plastic shrinkage. In order to reduce the construction schedule, this product was developed and tested using a simplified curing method consisting of applying two (2) coats of a water-based curing compound in compliance with ASTM C309. Curing is particularly critical in rapid moisture loss conditions such as high temperatures, high winds and low humidity.

**Temperatures below 40 °F (5 °C):**
Good curing conditions are beneficial to optimizing physical properties. Immediately after shotcrete reaches final set, apply two (2) coats of a resin-based liquid membrane curing compound approved for use in cold weather conditions.

### CLEANING OF TOOLS

Clean all tools and equipment immediately after use with water. Once hardened, material can only be removed mechanically.

## OTHER RESTRICTIONS

See Legal Disclaimer.

## LEGAL DISCLAIMER

- **KEEP CONTAINER TIGHTLY CLOSED**
- **KEEP OUT OF REACH OF CHILDREN**
- **NOT FOR INTERNAL CONSUMPTION**
- **FOR INDUSTRIAL USE ONLY**
- **FOR PROFESSIONAL USE ONLY**

Prior to each use of any product of Sika Corporation, its subsidiaries or affiliates ("SIKA"), the user must always read and follow the warnings and instructions on the product's most current product label, Product Data Sheet and Safety Data Sheet which are available at usa.sika.com or by calling SIKA's Technical Service Department at 1-800-933-7452. Nothing contained in any SIKA literature or materials relieves the user of the obligation to read and follow the warnings and instructions for each SIKA product as set forth in the current product label, Product Data Sheet and Safety Data Sheet prior to use of the SIKA product.

SIKA warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Product Data Sheet if used as directed within the product's shelf life. User determines suitability of product for intended use and assumes all risks. User's and/or buyer's sole remedy shall be limited to the purchase price or replacement of this product exclusive of any labor costs. **NO OTHER WARRANTIES EXPRESS OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SIKA SHALL NOT BE LIABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. SIKA SHALL NOT BE RESPONSIBLE FOR THE USE OF THIS PRODUCT IN A MANNER TO INFRINGE ON ANY PATENT OR ANY OTHER INTELLECTUAL PROPERTY RIGHTS HELD BY OTHERS.**

Sale of SIKA products are subject to the Terms and Conditions of Sale which are available at https://usa.sika.com/en/group/SikaCorp/termsandconditions.html or by calling 1-800-933-7452.

**Sika Corporation**
201 Polito Avenue
Lyndhurst, NJ 07071
Phone: +1-800-933-7452
Fax: +1-201-933-6225
usa.sika.com