

# PRODUCT DATA SHEET

## King® HC-D1

ENHANCED SHRINKAGE AND CRACKING RESISTANT SHOTCRETE MATERIAL FOR DRY-MIX PROCESS APPLICATIONS

### PRODUCT DESCRIPTION

King® HC-D1 is a pre-packaged, pre-blended shotcrete mix, specially designed for dry-process applications, formulated with Portland cement and other carefully selected components. King® HC-D1 is a highly crack-resistant repair material, compatible with existing concrete substrates that allows for durable repairs.

### WHERE TO USE

Rehabilitation of concrete bridges, dams, reservoirs, subway, tunnels, marine structures, parking ramps and other concrete structures.

### CHARACTERISTICS / ADVANTAGES

- Low cracking potential (according to AASHTO T334)
- Very low shrinkage
- Physical properties similar to conventional concrete, thus offering excellent compatibility with existing concrete
- Air-entrainment providing superior resistance to freeze-thaw cycling and salt-scaling resistance
- Improved adhesive and cohesive plastic properties
- Significantly reduced rebound, resulting in lower material usage
- Very low permeability
- Designed with natural, normal-density, non-reactive, fine and coarse aggregates to eliminate potential alkali-aggregate reactivity (AAR)

### PRODUCT INFORMATION

<b>Packaging</b>	<ul style="list-style-type: none"> <li>▪ 30 kg (66 lb) bag</li> <li>▪ 1000 kg (2205 lb) bag</li> </ul> <small>*Custom packaging is available to suit specific project requirements</small>
<b>Shelf Life</b>	12 months in original, unopened packaging
<b>Storage Conditions</b>	Material should be stored above ground, in a dry, covered area, protected from the elements.

### TECHNICAL INFORMATION

<b>Compressive Strength</b>	1 day	15 MPa (2175 psi)	<b>ASTM C1604</b>
	3 days	21 MPa (3000 psi)	
	7 days	25 MPa (3625 psi)	
	28 days	35 MPa (5075 psi)	
<b>Modulus of Elasticity in Compression</b>	<b>MODULUS OF ELASTICITY</b>		<b>ASTM C469</b>
	7 days	25.9 GPa (3.8 x 10 <sup>6</sup> psi)	
	28 days	30.8 GPa (4.5 x 10 <sup>6</sup> psi)	
<b>Tensile Strength in Flexure</b>	<b>FLEXURAL STRENGTH</b>		<b>ASTM C78</b>

	7 days	5.0 MPa (725 psi)	
	28 days	7.0 MPa (1015 psi)	
<b>Splitting Tensile Strength</b>	7 days	3.2 MPa (465 psi)	<b>ASTM C496</b>
	28 days	3.8 MPa (550 psi)	
<b>Pull-Off Strength</b>	<b>TENSILE BOND STRENGTH</b>		<b>ASTM C1583</b>
	28 days	2.0 MPa (290 psi)	
<b>Shear Adhesion Strength</b>	<b>BOND STRENGTH BY SLANT SHEAR(MODIFIED)</b>		<b>ASTM C882</b>
	7 days	14.8 MPa (2145 psi)	
	28 days	19.2 MPa (2785 psi)	
<b>Shrinkage</b>	<b>UNIAXIAL DRYING SHRINKAGE*</b>		<b>ASTM C157</b>
	28 days	220 µm/m	
	56 days	290 µm/m	
	180 days	360 µm/m	
<b>Restrained Shrinkage / Expansion</b>	<b>ESTIMATION OF CRACKING POTENTIAL *,**</b>		<b>AASHTO T 334</b>
	Age at cracking	No cracks after 100 days	
	Maximum strain	-98.8 µm/m	
	Stress rate	0.026 MPa (3.77 psi)/day (low cracking potential)	
<b>Coefficient of Thermal Expansion</b>	28 days	11.0 x 10 <sup>-6</sup> /°C (6.1 x 10 <sup>-6</sup> /°F)	<b>CRD-C39</b>
<b>Chloride Ion Diffusion Resistance</b>	<b>CHLORIDE ION PENETRABILITY</b>		<b>ASTM C1202</b>
	28 days	500 Coulombs	
<b>Porosity</b>	<b>AIR CONTENT</b>		<b>ASTM C457</b>
	6 % ± 2 %		
	<b>MAXIMUM AIR VOID SPACING FACTOR</b>		<b>ASTM C457</b>
	300 µm		
	<b>BOILED ABSORPTION</b>		<b>ASTM C642</b>
	28 days	6.0 %	
	<b>VOLUME OF PERMEABLE VOIDS</b>		<b>ASTM C642</b>
	28 days	15.0 %	
<b>Freeze thaw resistance</b>	28 days	99 %	<b>ASTM C666</b>
<b>Salt Resistance</b>	<b>SALT-SCALING RESISTANCE</b>		<b>ASTM C672</b>
	0.46 kg/m <sup>2</sup> (0.09 lb/ft <sup>2</sup> )		

## APPLICATION INFORMATION

### Yield

- Approx. 0.014 m<sup>3</sup> (0.5 ft<sup>3</sup>) / 30 kg (66 lb) bag
- Approx. 0.45 m<sup>3</sup> (16.5 ft<sup>3</sup>) / 1000 kg (2205 lb) bag

### Curing Time

Curing is essential to optimize physical properties of the shotcrete and minimize shrinkage. King® HC-D1 should be cured immediately after material has reached initial set in accordance with ACI 308 "Guide to Curing Concrete". For optimum results, begin by continuously moist curing for a minimum period of three (3) days. Following the 3 day moist curing period, apply two (2) coats of a curing compound (ASTM C309 compliant). When the area of the repair area does not exceed 1 m<sup>2</sup> (9 ft<sup>2</sup>), it is possible to directly apply two (2) coats of curing compound (ASTM C309 compliant). Curing is particularly critical in rapid moisture loss conditions such as

## BASIS OF PRODUCT DATA

All technical data stated in this Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.

\*The following data was obtained using a 100 % RH curing period of 3 days followed by 50 % RH curing with material and ambient temperatures of +21 °C (70 °F).

\*\*Tested in accordance with the modified test methods indicated in the following article: Girard, S.; Jolin, M.; Bissonnette, B.; and Lemay, J-D. (2017) "Measuring the Cracking Potential of Shotcrete." Concrete International, V. 39, No. 8, 44-48.

## LIMITATIONS

- King® HC-D1 should not be applied when ambient substrate and material temperatures are below +5 °C (40 °F) or above +35 °C (95 °F).
- For adverse temperatures, follow ACI recommendations for Cold/Hot Weather Concreting.
- Performance of in-place shotcrete relies heavily upon application techniques. To ensure optimum quality of in-place shotcrete, the material, equipment and key personnel should be pre-qualified prior to project start-up.

## ENVIRONMENT, HEALTH & SAFETY

User must read the most recent corresponding Safety Data Sheets (SDS) before using any products. The SDS provides information and advice on the safe handling, storage and disposal of chemical products and contains physical, ecological, toxicological and other safety-related data.

## SURFACE PREPARATION

### REPAIR OR REHABILITATION

All surfaces to be in contact with King® HC-D1 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 25 mm (1 in) clearance behind any corroded reinforcing steel. The perimeter of the repair area should be saw-cut a minimum of 20 mm (¾ in). Clean the area to be repaired with potable water, leaving the concrete saturated but free of standing water (SSD).

## APPLICATION

Apply King® HC-D1 in accordance with the ACI 506 "Guide to Shotcrete" publication.

## CLEAN UP

Remove King® HC-D1 from tools and equipment with water. Cured product can only be removed mechanically.

## LOCAL RESTRICTIONS

Note that as a result of specific local regulations the declared data and recommended uses for this product may vary from country to country. Consult the local Product Data Sheet for exact product data and uses.

## LEGAL NOTES

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.