CONSTRUCTION & REPAIR OF
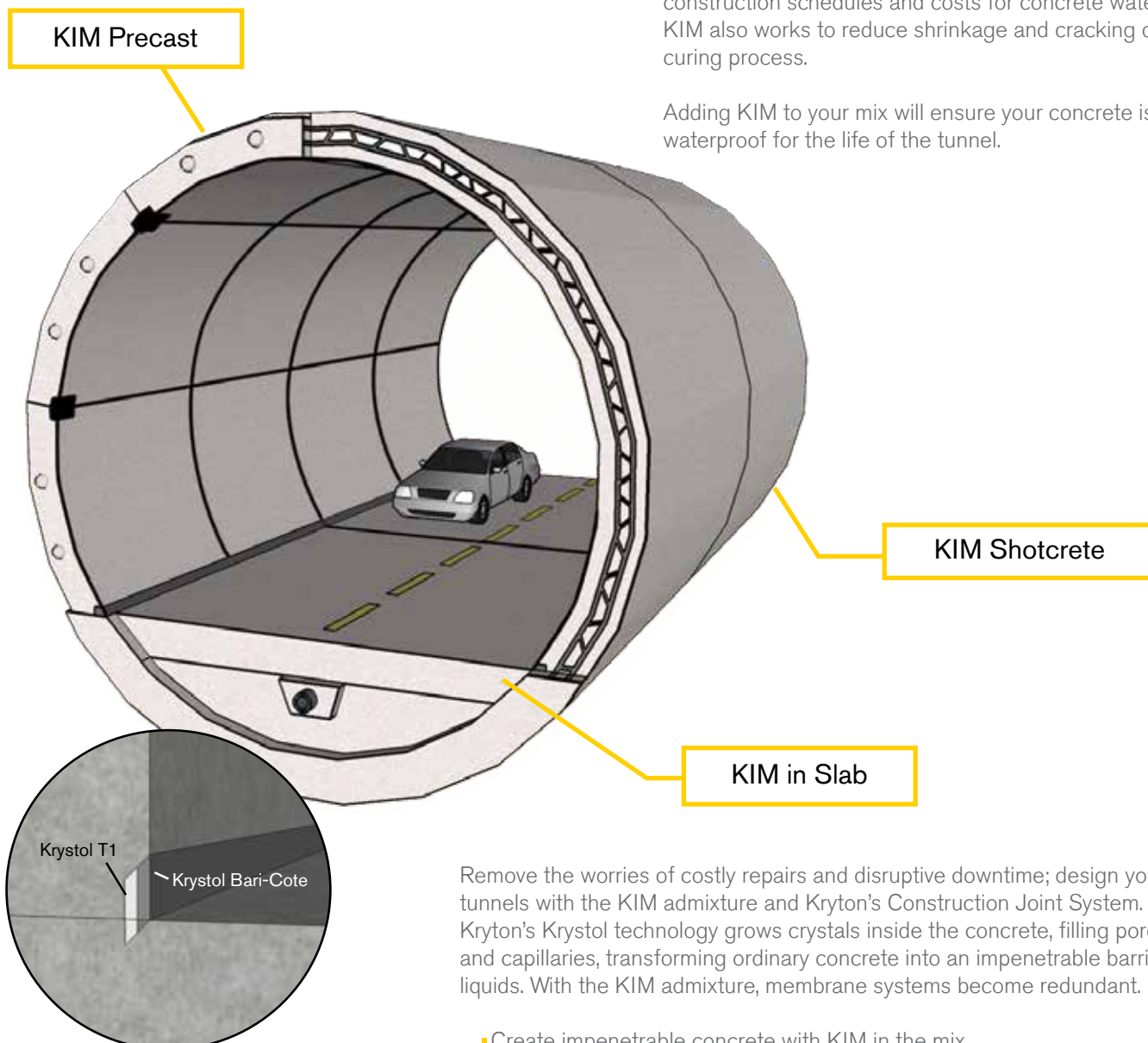# CONCRETE TUNNELS

KRYTON

BE SURE. BE KRYTON.

CONSTRUCT WATERTIGHT
TUNNELS THAT LAST

Tunnels can be subjected to heavy traffic and vibration, temperature changes, corrosion damage and freeze thaw cycles which affect the tunnel's durability.

Proper waterproofing prevents the penetration of moisture and chemicals into the concrete and steel components of the tunnel. Ultimately protecting the durability and structural integrity of the concrete; overall, prolonging the life of the tunnel. Kryton's Krystol® concrete waterproofing system protects the structural rebar from corrosion and provides a durable, leak-free solution that will last for the life of the tunnel.

Whether using cast-in-place, shotcrete and/or precast to construct your tunnel, Krystol Internal Membrane™ or KIM® can be added to the concrete at the plant, or on-site to the mixer truck to make your concrete watertight. KIM turns the concrete itself into the waterproofing membrane – eliminating the need for any surface-applied membrane to be applied. KIM and Kryton's Construction Joint System reduce labor, construction schedules and costs for concrete waterproofing. KIM also works to reduce shrinkage and cracking during the curing process.

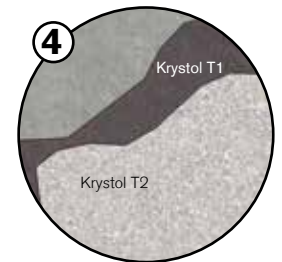Adding KIM to your mix will ensure your concrete is waterproof for the life of the tunnel.

KIM Precast

KIM Shotcrete

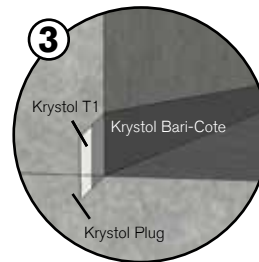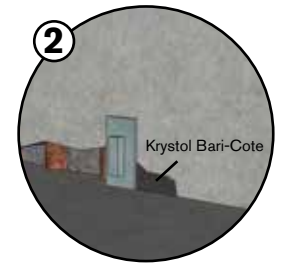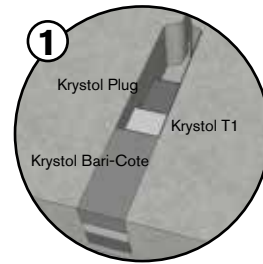KIM in Slab

Krystol T1

Krystol Bari-Cote

Remove the worries of costly repairs and disruptive downtime; design your tunnels with the KIM admixture and Kryton's Construction Joint System. Kryton's Krystol technology grows crystals inside the concrete, filling pores and capillaries, transforming ordinary concrete into an impenetrable barrier to liquids. With the KIM admixture, membrane systems become redundant.

- Create impenetrable concrete with KIM in the mix
- Ensure non-moving construction joints are sealed with Kryton's Construction Joint System

REPAIR AND WATERPROOF
EXISTING TUNNELS

Wherever previous waterproofing systems have failed, Kryton has a solution; the only solution that is as strong as concrete and works 100% of the time.

- Seal cracks and stop leaks with the Krystol Crack Repair System
- Resurface honeycombing and spalling, and waterproof with Krystol Bari-Cote™
- Repair leaking cold joints using the Krystol Crack Repair System
- Prevent water ingress by applying Krystol T1® and Krystol T2® to the concrete on the inside of the tunnel

① Krystol Plug / Krystol T1 / Krystol Bari-Cote

② Krystol Bari-Cote

③ Krystol T1 / Krystol Bari-Cote / Krystol Plug

④ Krystol T1 / Krystol T2

REPAIRING THE **YUNNAN SHUIMA TUNNELS**

Repair work on the Yunnan Shuima Tunnels

BACKGROUND

In 2007, construction was completed on a 180 km (112 mi.) superhighway that included five pairs of tunnels through the mountains of the Sichuan Province of China.

Shortly after completion the tunnels needed to be repaired; the soil and rock conditions paired with heavy seasonal rainfall quickly contributed to cracking and water leakage within the newly completed tunnels. With approximately 125,000 sq m (150,000 sq. y.) of surface area throughout the tunnels, the waterproofing repair work was a significant undertaking.

SOLUTION

Because the leaking tunnels had already been built using cast-in-place concrete, Kryton's team recommended using Krystol T1 & T2 surface-applied crystalline slurry coat system. Krystol T1 & T2 is a two-step, brush-applied system that prevents water intrusion, repairs cracking and maintains existing concrete structures. T1 seals the concrete against permeating water and T2 protects the surface of the structure from moisture. Once applied, the chemicals are absorbed into the concrete creating a strong barrier to water.

25,000 kg (550,000 lb.) of T1 & T2 were used to waterproof the 125,000 sq m (150,000 sq. y.) of tunnel walls and about 2,000 kg (4,400 lb.) of Kryton's Krystol Crack Repair System material were also used to mend the 1,200 m (3,937 ft.) of cracked and leaking concrete.

Less than a year later, a massive earthquake struck Sichuan killing more than 68,000 people. It destroyed communities and cost the government 1 trillion Yuan ($146.5 billion USD) to rebuild. Despite the quake's wholesale destruction the waterproofed tunnels of the Sichuan Mountains remained unaffected.

Shotcrete Construction

Several waterproofing systems were considered for the new pedestrian tunnel, including HDPE membrane, PVC membrane, double-bonded spray-applied cementitious membrane and cementitious concrete admixtures. After evaluating the cost and constructability issues of these methods, a combination of two systems were selected to achieve the specified and desired results. It was decided to use Kryton's Krystol Internal Membrane (KIM) in the structural shotcrete walls and invert concrete slab of the tunnels and then apply a double-bonded spray-applied membrane to the walls.

Knight Theater Pedestrian Tunnel, Charlotte, North Carolina, USA

Cast-in-Place Construction

A below grade concrete tunnel to house a belt transportation system and grain silo were constructed using Kryton's Krystol Internal Membrane (KIM) admixture, Kryton's Construction Joint System, and Krystol Crack Repair System. The port location meant that the tunnel would be in constant contact with sea water and it was essential the tunnel remained water free. Water in the transport tunnel could ruin entire containers worth of valuable grain. Further, salt water and its ability to corrode the steel and structure was also a key factor in the waterproofing design.

Ensenada International Terminal Grain Tunnel, Ensenada, Baja California, Mexico

Precast Construction

The new Manukau Police Hub built an underground tunnel between the police hub and the adjacent courthouse. The tunnel was constructed out of fifty precast box culverts with the most sound structural integrity in mind. The contractor selected Kryton's Krystol Internal Membrane (KIM) as the waterproofing choice based on performance and pricing. All fifty of the precast box culvert segments contained KIM, ensuring that they would be permanently protected from water ingress from the inside out.

Manukau Police Hub Tunnel, Manukau City, New Zealand

Applicators in Ahmedabad, Bangalore, Chandigarh, Chennai, Hyderabad, Kolkata, Mumbai and Pune.

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