CASE STUDY
Yunnan Shuima Tunnels
Sichuan, China (2006)

BACKGROUND
In 2006, a superhighway project in Sichuan province, China, became a major focus for the government. Spanning more than 180 kilometers, the new expressway was developed to run along the Yangtze River from Sichuan’s capital city Chengdu to Leshan.

Construction of the superhighway involved building five pairs of tunnels in a mountainous region of the province. While the tunnels were completed in early 2007, the soil and rock conditions paired with heavy seasonal rainfall quickly contributed to cracking and water leakage within the structures. Only a few months after completion, the tunnels needed to be repaired. With approximately 125,000 square meters of surface area throughout the tunnels, the repair work was a significant undertaking.

Kryton International Inc. was selected by the China Highway Authority to perform this task. The company supplied its Krystol concrete waterproofing system, which can transform concrete into a permanent, water-resistant barrier. In mid 2007, approximately 250 tons of Kryton’s products were delivered to the jobsite in the Sichuan mountains. The remote work location not only called for extensive planning, but also required contractors who could live on-site for a long period of time.

Kryton’s local distributor in Chengdu, Chengdu Kaidan Underground Works Ltd, put together a team of workers that would live in the area for at least 12 weeks. Due to the scope of the project, all workers had to complete a preliminary training in Chengdu as well as a comprehensive on-site, hands-on training with Kryton staff to ensure that they would be prepared to handle any challenges that could arise.

OWNER:
China Highway Authority

DISTRIBUTOR:
Chengdu Kaidan Underground Works Ltd.

PRODUCTS & TECHNICAL SPECIFICATIONS:
Learn more at kryton.com
Krystol Internal Membrane (KIM)®
Kryton’s Crack Repair System
Krystol T1®/T2®
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SOLUTION

Because the leaking tunnels had already been built out of cast-in-place concrete, Kryton’s team recommended using its Krystol T1 and T2 surface applied crystalline slurry coat system. Krystol T1 and T2 is a two-step, brush-applied system that prevents water intrusion, repairs cracking and maintains existing concrete structures. Once applied, the chemicals are absorbed into the concrete creating a water barrier. Kryton’s crack repair system was also used to mend static structural cracks.

Due to the size of the project, 6 meter high scaffolding was assembled to assist in the product application. All 250 tons of T1 and T2 were used to waterproof the 125,000 square meters of tunnel walls. About 2 tons of Kryton’s crack repair system material were also used to mend the 1,200 lineal meters of cracked and leaking concrete.

The entire waterproofing project took about 18 weeks to complete. Keeping the application process and workers on-site for the duration of the project helped to meet the tight deadline. The China Highway Authority signed off on the completion of the tunnels in late 2007 and the tunnel remains to be dry to present day.
In 2006, a superhighway project in Sichuan province, China, became a major focus for the government of the People’s Republic of China. The goal of the project was to build a highway along the Yangtze River, connecting two major cities: Chengdu, Sichuan’s capital city, and Leshan. Part of an extensive upgrade to the country’s vast transportation network, the new expressway ran more than 180 km through some of the most rugged terrain in the whole of China.

It wasn’t an easy construction project for Chinese engineers. Road builders needed to blast through mountains to create five pairs of tunnels. By early 2007, crews had completed the tunnels and had moved onto other sections of the project. However, after several months of particularly wet winter weather, the soil and rock lining the tunnels eroded. The freshly laid concrete, only a few months old, began to crack and water was seeping through.

In the spring of 2007, Kryton International Inc., a Canadian concrete waterproofing company, heard about the repair challenges the road builders were facing. Kryton was selected by the China Highway Authority to provide the solution – Kryton’s Krystol® Concrete Waterproofing System.

Due to the remote location, work crews were required to live on site for at least 12 weeks.
The Krystol concrete waterproofing system can transform concrete — even concrete that has set for months or years — into a permanent, water-resistant barrier. Using integral crystalline waterproofing technology, Krystol’s system keeps concrete structures dry by becoming a part of the concrete matrix. When combined with water and cement, proprietary chemicals react with unhydrated cement particles to form millions of needle-like crystals. Over time the crystals grow, filling naturally occurring pores and voids in concrete and providing permanent waterproof protection.

Waterproofing 125,000 sq m of concrete tunnels deep in the mountains was a challenge. Over the next few months, Krystol worked closely with the Chinese Highway Authority to plan how they would complete the project. In the summer of 2007, approximately 250 tons of Krystol’s products were manufactured in Canada and shipped to China. Once the products arrived in port, local workers loaded them onto large trucks, then once inland, transferred again onto smaller flatbed trucks to be delivered to the jobsite in the Sichuan Mountains.

The Chinese workers faced yet another challenge. Due to the remote location, work crews were required to live onsite for at least 12 weeks. Krystol’s distributor in Chengdu, Chengdu Kaidan Underground Works Ltd., comprised a crew of workers that would complete preliminary training in Chengdu while receiving hands-on training at the job site by Krystol staff.

It was essential that the workers be prepared to handle any challenges thrown at them by the cracking tunnel concrete and that they also be familiar with how to utilise the Krystol system to effectively mend the moisture damage. The contractors were shown how to store and mix the material for the best performance and were taught application techniques, curing methods and best practices. Then it was off to the tunnels to start waterproofing.

The first step of the process was to ensure all surfaces in the tunnels were cleared of dust and loose particles by using a high-pressure washer. Additional water was applied to thoroughly saturate the surface. Once the concrete surfaces were cleared of debris, crews erected

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The contractors were taught application techniques, curing methods and best practices.

6-m-high scaffolding to allow them to reach the massive tunnel walls.

Because the leaking tunnels had already been built out of cast-in-place concrete, Kryton’s team recommended using its Krystol T1 and 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 contains a high concentration of crystalline chemicals and seals the concrete against permeating water. T2 provides a second dose of crystalline chemicals and serves to protect the surface of the structure from moisture and fortify the initial application of T1 as the treatments penetrate the concrete.

Once applied, the chemicals are absorbed into the concrete, creating a water barrier. It takes 28 days for most of the active crystalline chemicals to migrate into the concrete. Any further damage or deterioration to the structure will not change the concrete’s waterproofing properties.

Kryton’s crack repair system was also used to fix large static structural cracks. About two tons of Kryton’s crack repair system material were also used to mend the 1200 lineal m of cracked and leaking concrete.
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Only 18 weeks after the products had been shipped to China, the repair project was finished. It was an ambitious and aggressive timeline for an undertaking of this scope and size. In late 2007, the China Highway Authority gave its stamp of approval.

Less than a year later, a massive earthquake struck Sichuan killing more than 68,000 people. It destroyed communities and cost the government a trillion Yuan to rebuild. Despite the quake’s wholesale destruction, one structure remained unaffected: the waterproofed tunnels of the Sichuan Mountains.

Today they continue to provide dry and safe passage for everyone who travels on China’s southwest superhighway. As the years pass, and the rains continue to pour, the tunnels’ concrete waterproofing system only grows stronger.

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Construction of the superhighway involved building five pairs of tunnels in a mountainous region of the province. While the tunnels were completed in early 2007, the soil and rock conditions paired with heavy seasonal rainfall quickly contributed to cracking and water leakage within the structures. Only a few months after completion, the tunnels needed to be repaired. With approximately 125,000 sq m of surface area throughout the tunnels, the waterproofing repair work was a significant undertaking.

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proprietary chemicals react with unhydrated cement particles to form millions of needle-like crystals. Over time the crystals grow, filling naturally occurring pores and voids in concrete and providing permanent waterproof protection.

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Before using the product, the tunnels' surfaces needed to be carefully prepared to ensure that the waterproofing system would be effective. A high-pressure washer was used to remove dust and other loose particles from the wall surface, and additional water was applied to make sure the surface was adequately saturated. Kryton's crack repair system was also used to mend static structural cracks.

Due to the size of the project, 6 m high scaffolding was assembled to assist in the product application. When all preparations had been completed, the project team began applying Krystol's T1/T2 slurry coating. All 250 t of T1/T2 were used to waterproof the 125,000 sq m of tunnel walls. About 2 t of Kryton's crack repair system material were also used to mend the 1,200 lineal metres of cracked and leaking concrete.

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The China Highway Authority signed off on the completion of the tunnels in late 2007.