



SIKA AT WORK

HONG KONG-ZHUHAI-MACAO BRIDGE

SIKA FULL RANGE SOLUTIONS FOR BRIDGES

BUILDING TRUST



THE LONGEST BRIDGE-AND-TUNNEL SEA CROSSING IN THE WORLD

PROJECT DESCRIPTION

What can be said about the Mount Everest of the bridge industry? It's the longest bridge-and-tunnel sea crossing, the longest and deepest undersea tunnel and it took over 400,000 tons of steel to build – just to name a few world records which the Hong Kong-Zhuhai-Macao bridge set in October 2018 when it was officially open. It came as no surprise that after nine years of construction, one of the most complex projects in China's history was lauded as an engineering marvel.

A 55 km-long bridge-island-tunnel system crosses the waters of the Lingdingyang channel in the Pearl River Estuary linking Hong Kong in the east with Zhuhai and Macao in the west. The main bridge section is 29.6 km and consists of a 22.9 km viaduct, an island and a 6.7 km offshore immersed tunnel. As the interconnecting backbone of the Guangdong-Hong Kong-Macao Greater Bay Area, the bridge has greatly cut journey

times between the cities from over three hours to 45 minutes. It's a true game changer when it comes to improving connectivity in this dynamically developing region, opening it up for greater interaction and opportunity.

PROJECT REQUIREMENTS

The Hong Kong-Zhuhai-Macao bridge is a milestone and breakthrough in Chinese engineering and as such posed a number of challenges. The complicated geological conditions, multifarious processes and rigorous standards meant that engineers involved in that project had no precedent to follow. The bridge had to be designed to last 120 years and to withstand a magnitude-8 earthquake, level-16 typhoon, and 300,000-ton impact. Sika China engineers helped supply top professional, highest quality solutions for numerous applications and provided comprehensive technical support for this world-class project.

SIKA SOLUTIONS

CONCRETE

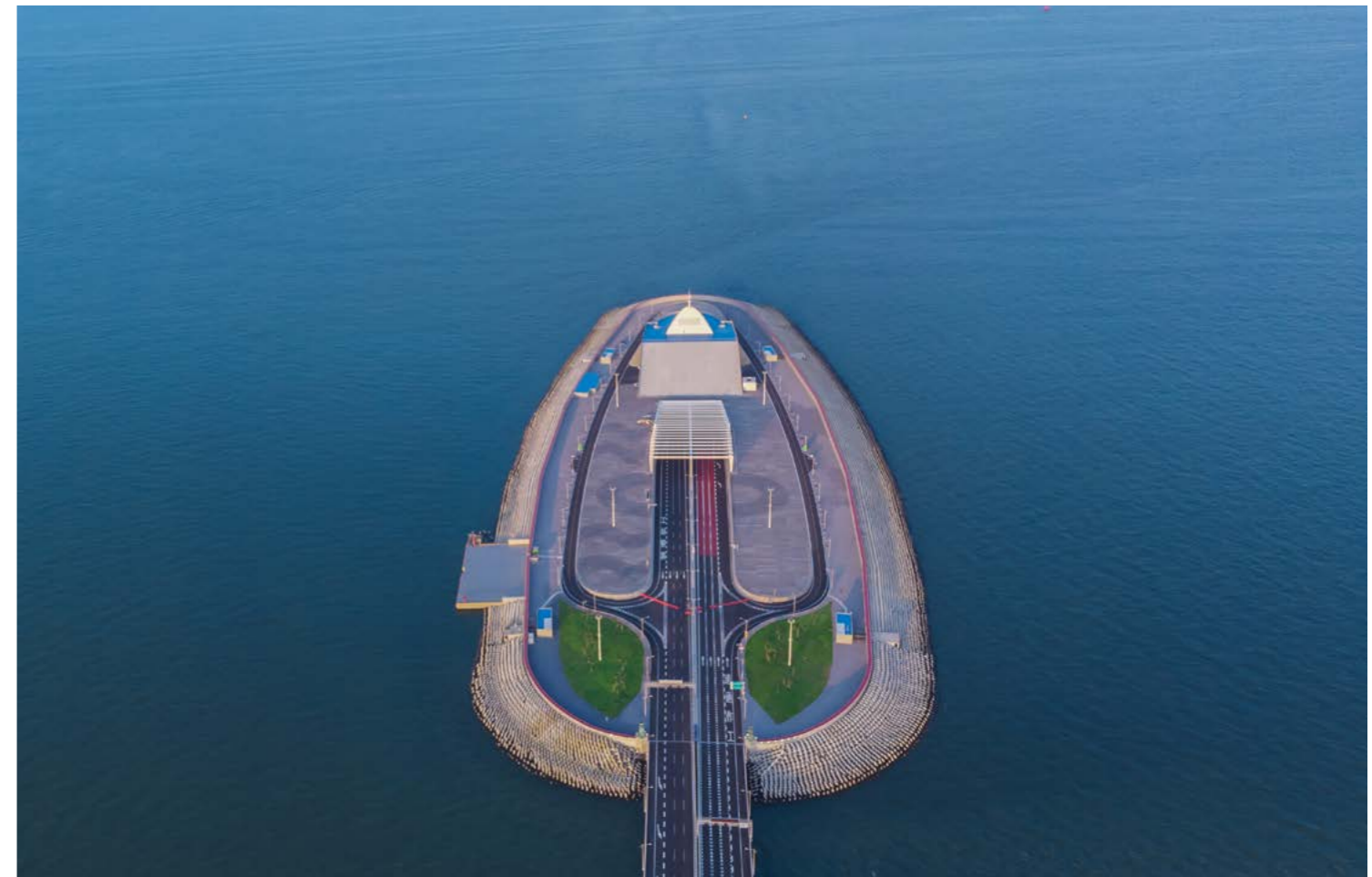
Sika admixtures were used to produce several types of concrete for the Hong Kong-Zhuhai-Macao bridge project.

- Architectural concrete design, referred to as Brutalist architecture or Brutalism, was specified for the construction of the wave wall of the artificial island. It is concrete that is left unfinished after being cast, which enables the pattern left by the formwork to be expressed. To achieve the remarkable quality of C30 concrete with a highly aesthetic white look, Sika China and CCCC Shanghai Harbour Engineering Design & Research Institute conducted a 6-month full-scale concrete model test. They chose Sika® ViscoCrete®-3310C high range water reducing and superplasticizing admixture to produce 20,000 m³ of concrete. Thanks to Sika technology, it was

possible to avoid such problems as laitance, blackening and bleeding of concrete.

- Sika® ViscoCrete®-3310C was also used to produce 75,000 m³ of marine C45 concrete. It was applied in the hidden section of the artificial island. Through mix design optimization, Sika superplasticizer ensured concrete cooling and prevented cracking. The same admixture was used to produce 20,000 m³ of C55 site cast (in-situ) concrete on the artificial island. It prevented cold joints occurring during a pour.
- To produce C30 concrete for the retaining wall project of the artificial island, Sika® ViscoCrete®-1220 high-performance water reducer was used.
- Sika admixtures were also used to produce about 500,000 m³ of concrete for bridge construction.

Thanks to concrete admixtures from Sika, the concrete produced met the high requirements for durability and fit the trends of modern concrete placing and architectural aspects.



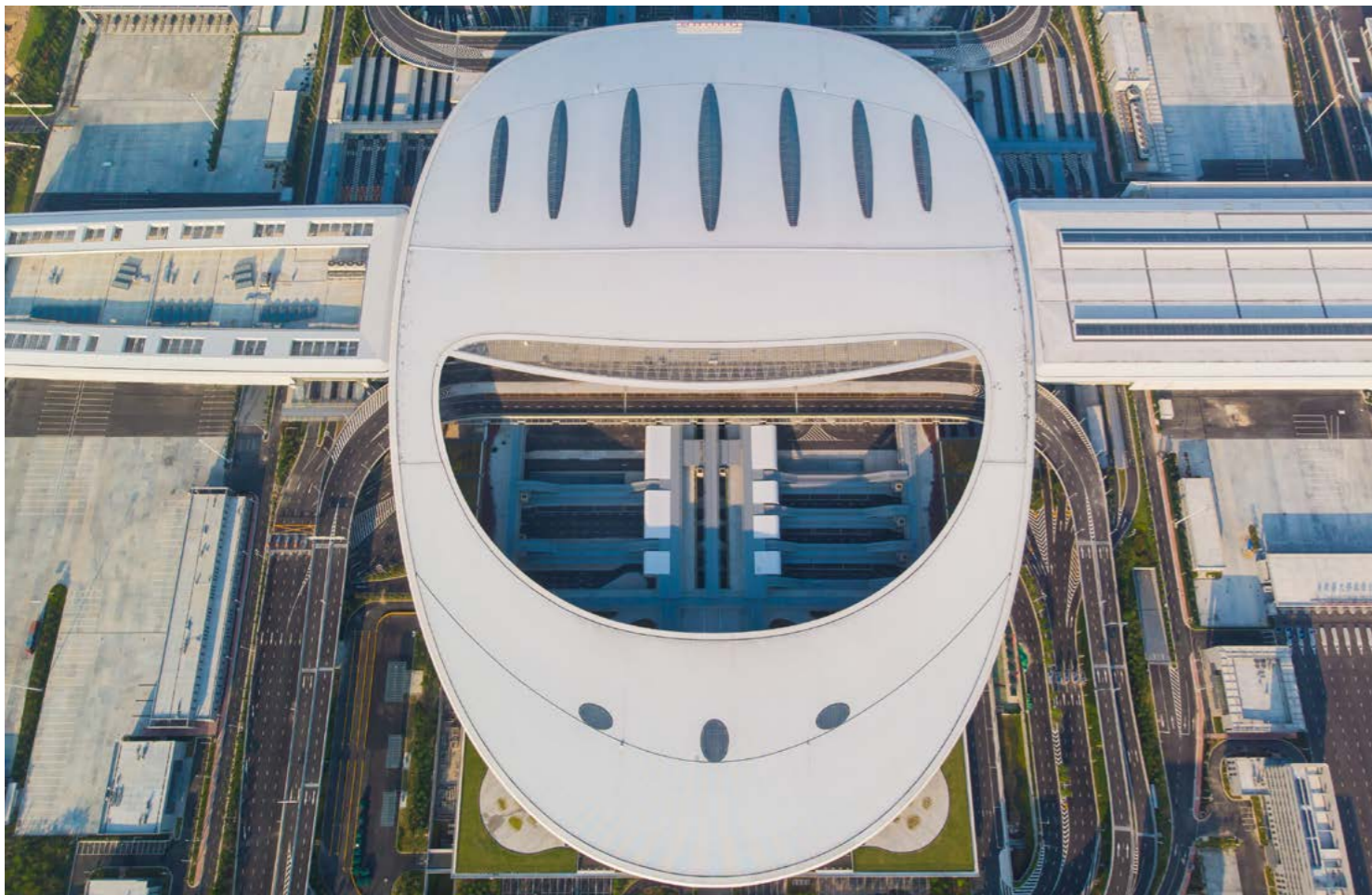
REPAIR, PROTECTION AND REINFORCEMENT

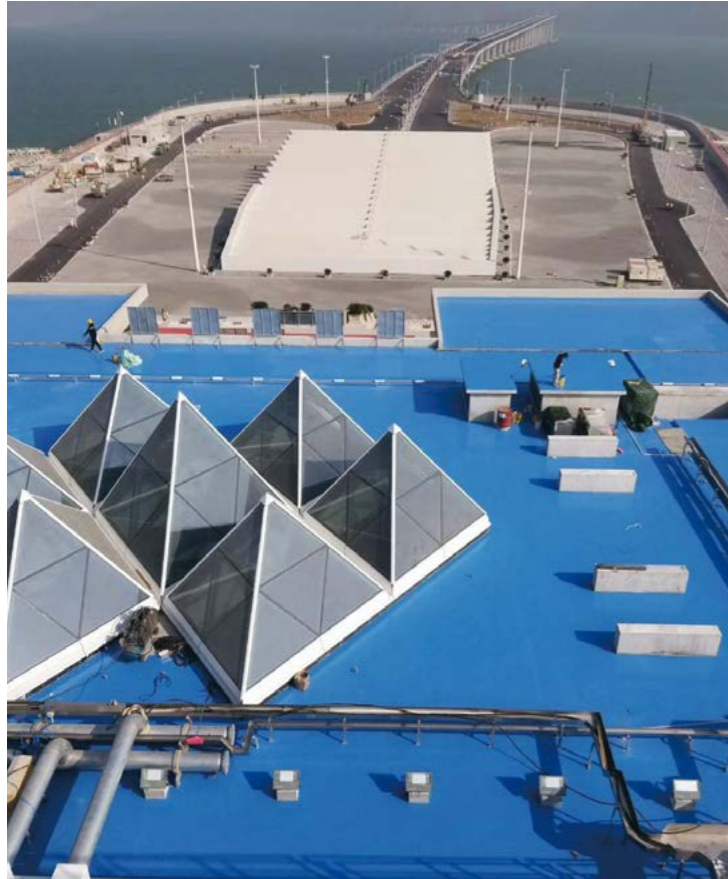
Such a complex project required only high-quality structural repair and reinforcement solutions. Sika has a long and successful track record of bridge construction projects worldwide, therefore it's not surprising that a wide range of our refurbishment products was chosen to meet the requirements of specific construction problems.

The prefabricated elements of concrete piers were structurally bonded with Sikadur®-31 SBA epoxy paste adhesive with a 10-year service life, which proves the extremely stable quality of the product. Other applied Sika solutions include Sika® MonoTop®-412 NFG structural repair mortar, Sikagard®-720 EpoCem surface sealing mortar, Sika® MonoTop®-910 N corrosion protection coating material, SikaGrout®-214 cementitious grout, Sikadur®-42 MP Normal epoxy grouting system, Sikadur®-52 STP crack sealing grout and Sikadur®-31 CF Normal structural adhesive and mortar. With Sika top level technology, the structure of the bridge is reinforced and well protected for many years to come.

ROOFING

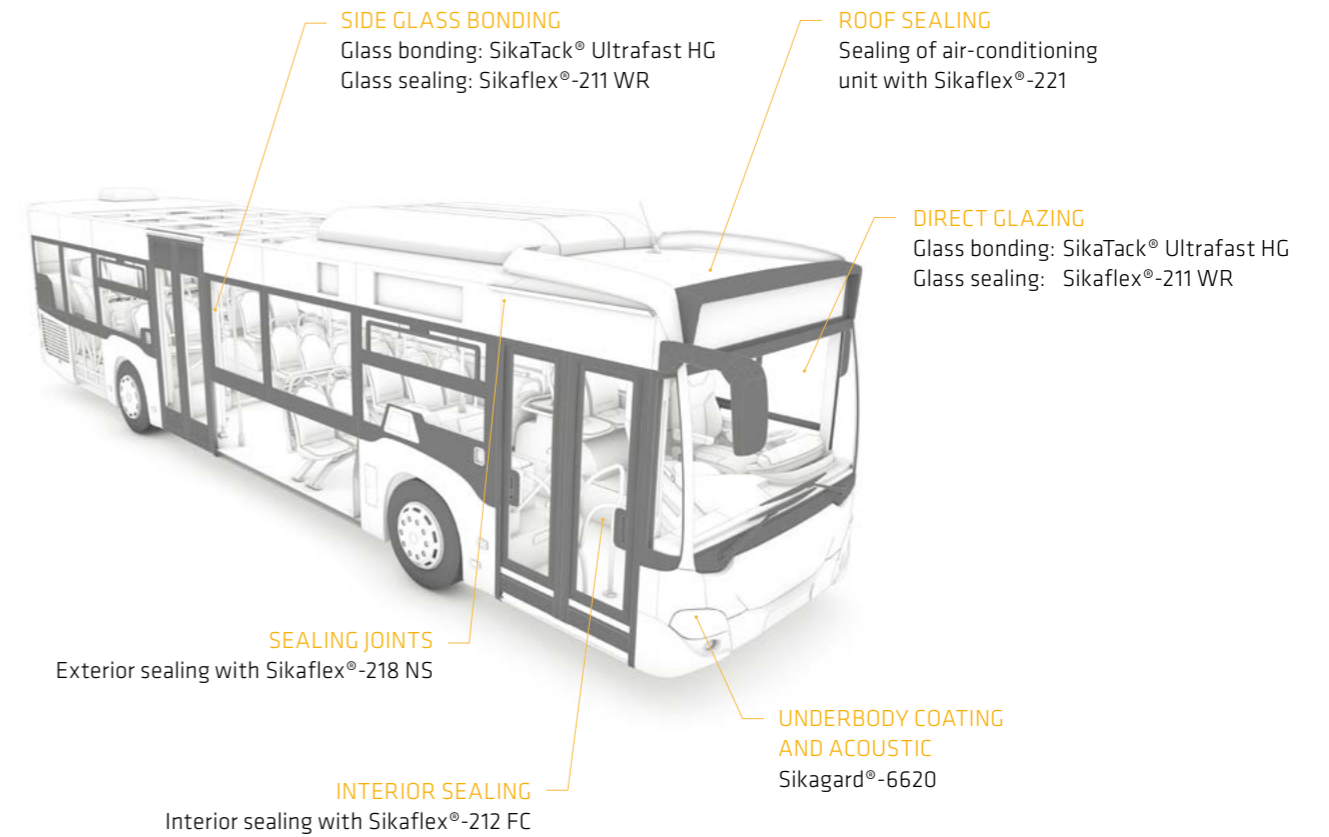
HKZMB Zhuhai Port is an important part of the Hong Kong-Zhuhai-Macao bridge project with a total area of 325,000 m². To cover 141,000 m² of roof area over the passenger inspection areas A and B, Sarnafil PVC single-ply roofing membrane was applied. It not only provided safe and reliable waterproofing protection but also contributed to the architectural design of the building matching with the aluminum standing seam system above it. To achieve this effect, the Sarnafil® S327-15L PVC roof waterproofing membrane was customized to pearl white color for the project.





FLOORING

For the construction of the bridge, Sika provided a wide range of outdoor and indoor flooring solutions, such as epoxy terrazzo flooring, highly wear-resistant polyurethane and dry shake floor hardeners for concrete floors. Sika floor systems were used on a total area of over 140,000 m² in passenger control halls, parking garages, equipment rooms, office areas and pedestrian walkways on breakwaters. Sika's high-performing flooring solutions were a perfect fit for this project, as they are designed for the latest trends and requirements and comply with all regulations and standards. Applied systems ensured durability, safety, sustainability as well as an appealing look.



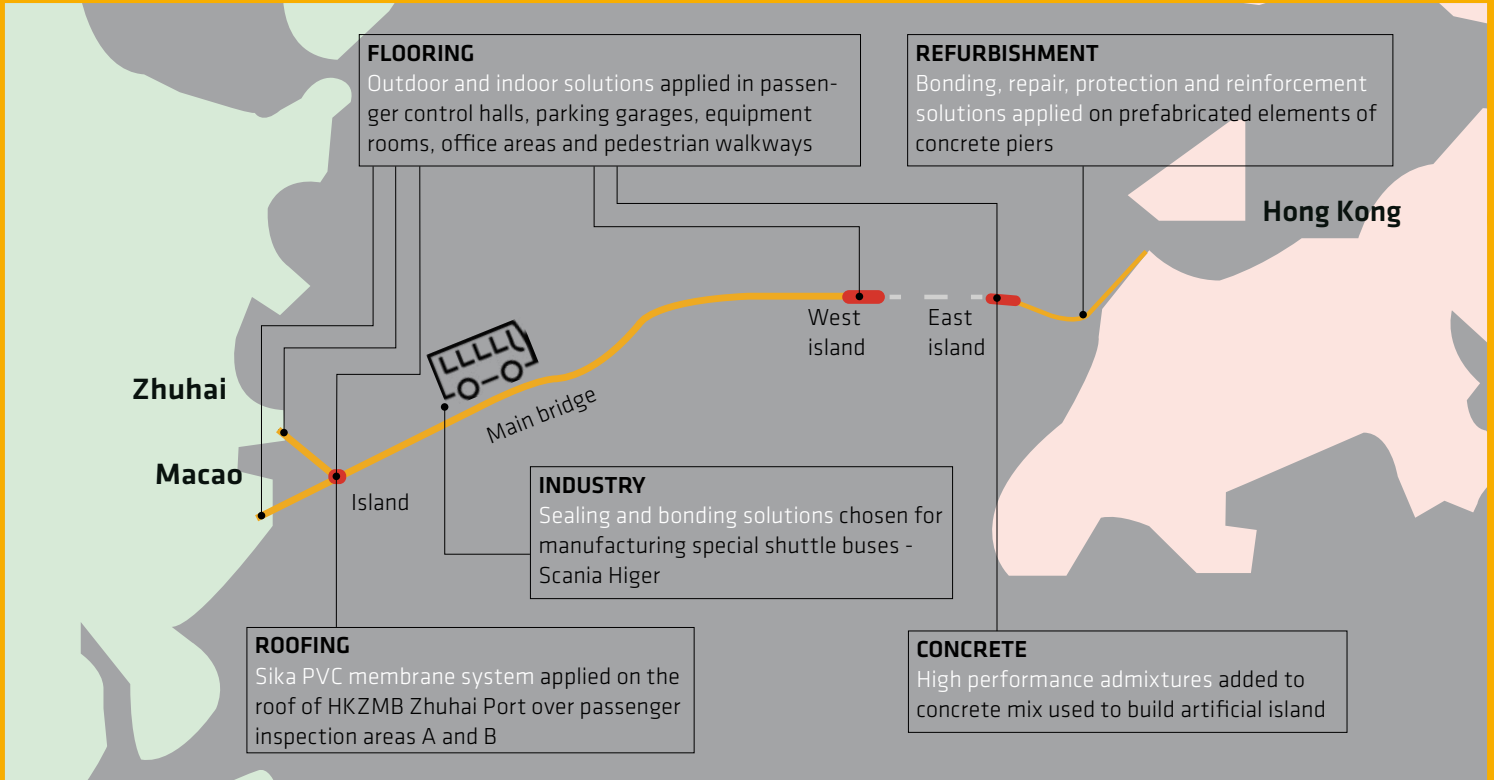
INDUSTRY

Once the bridge was open for traffic, a special shuttle bus drew national attention. The deluxe bus Scania Higer produced by Higer Bus Company Limited is made of state-of-the-art bus manufacturing products that ensure high quality and aesthetic design.

Prior to and during production, the Sika Industry department offered Higer professional system engineering and product selection support. As a result, a wide range of Sika technologies were specified. All of the glass on the bus is bonded with

SikaTack® Ultrafast HG and the exterior glass joint sealing is completed with Sikaflex®-211 WR. Other external joints around the bus are sealed with Sikaflex®-218 NS Special gray to achieve a smooth and good-looking appearance. Sika also provided Sikaflex®-212 FC for internal sealing application and bus skylights as well as the air conditioning unit being sealed with Sikaflex®-221. Last but not least, SikaGard®-6620 is used for chassis protection on the underbody of the bus to ensure longevity and durability of the vehicle. Sika China is a leader of the Chinese bus market and is proud to have contributed to the project.

HONG KONG-ZHUHAI-MACAO BRIDGE



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