

Metal polymer ensures form- and force locking gap compensation

One of the biggest subway stations will soon be in Hong Kong

Hong Kong: A cosmopolitan city on the move. This is especially true for the traffic, which pulsates here 24/7. One of the main modes of transport is the Mass Transit Railway (MTR), which will soon be one of the world's largest subway stations: the Kowloon station under construction. Its dynamic, arch-shaped design stands self-confidently in front of Hong Kong's tallest building - the ICC - and the famed Elements shopping center. Central components of the bridge-like construction are the built-in bridge bearings. They ensure the connection between the steel components and trusses. The 100% form- and force locking gap compensation in the pressure-loaded area between the bearing plate and the crosshead is handled by a special metal polymer.

The Mass Transit Railway (MTR), the Hong Kong SAR subway system, carries nearly five million passengers a day. To work, home, to play sports, to shop, just from A to B. That's more than half of Hong Kong's population.

With around two million people, the Kowloon Peninsula is one of the most populated parts of the metropolis. It is only logical that this is where one of the world's largest subway stations is built: The West Kowloon Terminus Station - a modern architectural masterpiece that is also Hong Kong's international gateway to China.

9,000 tons of installed steel, 600,000 cubic meters of molded concrete and large-area glazing testify to 380,000 square meters of the highest and most powerful architectural masterpieces. A key element of the project is the impressive roof construction above the station entrance, with a total of 7,000 tonnes of traverses.

The structure consists of three geometrically complex lattice girders, which are

supported in only nine places by 30-meter-high, curved steel columns. The secure connection of the steel and concrete parts throughout the structure is ensured by special (earthquake-proof) bridge bearings, which are installed both horizontally and vertically.

These high performance bearings were selected to ensure controlled load transfer between the complicated structure of the roof and its substructure. They allow movements in all directions and can withstand fluctuations in the superstructure even with high loads.

Naturally, however, material-related unevenness and building-side gaps and clutches always occur at this point. Nevertheless, the optimal absorption of the occurring lateral forces on the bearings between seating and carrier plate must be ensured. This in turn only works with a 100% positive and form- and force locking connection between the components.

Gap compensation between bearing plates and trusses safe and one hundred percent frictional

Common methods for gap compensation work with wedge plates or shim plates. However, you struggle with numerous disadvantages. In spite of the high expenditure of time and machinery as well as costly adaptation, it is virtually never possible to achieve a completely form-fitting support. And therefore not a hundred percent traction.

The bridge bearing supplier, bridge manufacturer mageba, knew how to achieve 100% traction between the components. The globally active specialist and manufacturer of bridge bearings, roadway crossings and earthquake protection and construction monitoring systems had extensive project experience.

Mageba regularly assures the expertise of the German Diamant Metallplastic GmbH for such challenging structures and the 100% form- and force locking gap compensation required. The metal polymer manufacturer based in Mönchengladbach in the Rhineland has specialized precisely in these challenges and has developed a special two-component reaction resin system: the metal

polymer MM1018. So far, it has become the only material of its kind with general building approval for the steel to steel sector and more than 1,000 applications worldwide in the metal industry - especially steel and bridge construction.

The polymer for the one hundred percent form- and force locking gap compensation can be pasty smoothed and liquid injected. Both versions offer the complete gap compensation without any mechanical pre-work on the components, but are fundamentally different in application. This opens up the possibility of flexibly responding to on-site conditions.

One construction site, two work locations, three different applications

"We used MM1018 in two places of application: Firstly, at the construction site on the already placed warehouses. And second, in the port of Kowloon, where we have connected the bearings with the respective components, so to speak, to prefabricated components. These then had to be used just like Lego bricks on the construction site", recalls Luigi Di Gregorio. The sales and product engineer at Diamant Metallplastic is project manager for the MM1018 application at the West Kowloon Terminus Station construction site.

In total, the German polymer and coating specialist processed 20 bearings over 13 days in three stages. In the first and third construction phases, the liquid variant of MM1018 was used. Due to the honey-like consistency, the material could be easily pressed into the interstices via injection orifices and closed them completely and 100% form- and force locking. The thereby displaced air from the gap could escape via vents.

In the second construction phase, the paste-like variant of MM1018 was used in conjunction with shim plates, as the space available and the accessibility to four bearings were extremely limited: "We coated narrow sheets with the suitable MM1018, then raised the bridge by two centimeters, pushed the sheets underneath and then put down the bridge. All without any major disassembly or sealing work," explains Di Gregorio.

In addition, Diamant Metallplastic pre-installed screw protection and the company-made polymer-specific release agent during bearing installation in order to be able to carry out a possible later bearing replacement problem-free, safely and quickly.

MM1018: One metal polymer, many applications

Speaking of the port of Kowloon: In steel and bridge construction, the metal polymer MM1018 is also used in the maritime sector. Here it scores with its seawater resistance, especially in the offshore industry and in hydraulic engineering.

In power plant construction, the metal polymer convinces with its high resistance under extreme conditions, such as vibrations or temperature fluctuations from -40° to +90°C. Here, too, MM1018 maintains its high compressive strength.

Added to this are the weathering and corrosion resistance and a low creep coefficient of the resistant material.

Crawling is not an option

The creep, so to speak the increasing compression or "migration" under constant load is a critical factor especially for prestressed connections - as with the mageba high-performance bearings installed in the metro station.

Diamant Metallplastic's two-component reactive resin system has a low creep coefficient (1.1 after 182 days).

One thing is for sure: When installing the bearings of the West Kowloon Terminus Station, both variants proved their reliability. For Diamant Metallplastic, the work on the construction site is complete. In 2018, the construction of the West Kowloon Terminus Station should be completed. Then it can finally join the list of the world's largest subway stations and call itself Hong Kong's public transport hub and international gateway to China.

