

Spherical bearings from Munich for the 5 km long Bogibeel Bridge in India

Brahmaputra bridge: bearings transmit a load of 2,800 t in the smallest of spaces.

Munich, Bogibeel. In 2002, construction work for the largest combined rail-road/road bridge in India started. The Bogibeel Bridge owes its name to a secluded village in the tri-border region of India, Myanmar, and China, where the Brahmaputra leaves the Himalaya. MAURER supplied 164 spherical bearings to be placed between the bridge deck and the piers. The bearing specialists from Munich were awarded the contract because they succeeded in designing bearings capable of transmitting the extreme structural loads of 2,800 t, yet fitting into the confined space on the piers.

The Bogibeel order is the largest contract awarded so far for bearings to be installed in an Indian railroad bridge which is considered to be the second longest of its kind in Asia. The Brahmaputra is infamous for its mass of water and floods a five km wide region near Bogibeel in the monsoon season. The annual severe monsoon flooding also accounted for the long construction period. The bridge featuring a length of 4.94 km consists of 41 single-span beams, 39 of which with a length of approx. 125 m each. The railroad tracks are located at the bottom of the bridge, the two-lane road at the top.

Confined space

Below the bridge deck, four MSM® bearings rest on each of the 41 pier caps. The bearings per area are arranged in a "classic" way: one fixed bearing, one guided-sliding bearing in longitudinal direction, one guided-sliding bearing in transversal direction, and the fourth one free-sliding. Thus the spherical bearings transmit vertical loads and allow for rotations and movement while keeping the bridge deck in position.

"The particular challenge was to dimension the bearings in such a manner that they fit onto the small pier caps," explains Dipl.-Ing. Peter Günther, project manager at MAURER. "Space was limited both in terms of height and surface area, since the construction of the piers and the steel support structure was already too far advanced to create additional space when we received the order." This is why there were controversial debates about the maximum permissible dimensions in the run-up of order placement. "The advantages we offered were the use of the MSM® sliding material and our know-how in the dimensioning of bearings", reports Günther.



The Bogibeel Bridge across the Brahmaputra, at the bottom of the Himalaya. The picture was taken during construction in 2017.

Photo: MAURER



The bearings underneath the Bogibeel Bridge transmit a load of 2,800 t in the smallest of spaces.

Photo: MAURER

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Among other things, MSM® distinguishes by being capable of accommodating pressures of 180 MPa which exceeds the pressure allowed for customary sliding materials by 100%. This enables designing the bearings approx. 30% smaller, and, in this case, more lightweight with approx. 2 t. The 164 MSM® spherical bearings feature an outline of just about 1,200x1,200 mm and a height of 200 mm. They are designed for a structural load of 28 MN and a horizontal force of 8 MN. The high horizontal force results from an earthquake with a magnitude of 7 on the Richter scale. A spherical joint accommodates occurring rotations of 0.02 rad around all horizontal axes without significant resistance in the bearings, which means the bearings smoothly and optimally adjust to all load and structural conditions. Thanks to the durability of the selected material that has been tested without wear for an accumulated sliding path of 50,000 m, a service life of at least 50 years can be expected. In addition, the minor sliding friction of the bearings of max. 1.5% at bearing movements of up to 150 mm gives higher safety for the design of the bridge piers and the pier foundation in the water.

Load tests in Shanghai

The bearings were produced in Munich early in 2016, the anchor plates at the factory of MAURER India in Bhopal. In early summer 2016, 12 bearings were tested in Shanghai. The installation of the bearings started mid-2017. On December 25, 2018, Prime Minister Narendra Modi inaugurated the Bogibeel Bridge. The bridge near the Chinese border is of strategic importance to India and had already been referred to as one of several important infrastructure measures in the Assam Treaty of 1985.

Northeast Frontier Railway acted as building contractor, Hindustan Construction Company (HCC) as construction company, and DSD Brückenbau GmbH as consultant.

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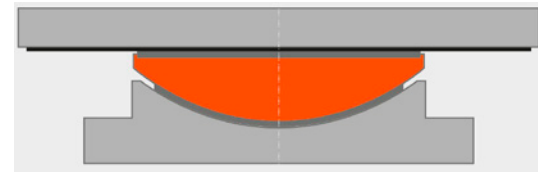
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Cross section of a spherical bearing.

Graphic: MAURER

Quick facts about MAURER SE

MAURER SE is a leading specialist in mechanical engineering and steel construction with over 1,000 employees worldwide. The company is the market leader in the field of structural protection systems (bridge bearings, expansion joints, anti-seismic devices, vibration absorbers and monitoring systems). It also develops and manufactures vibration isolation systems for buildings and machinery, roller coasters, and special steel structures.

MAURER is involved in many spectacular large projects such as the world's largest bridge bearings in Wasirabad, anti-seismic expansion joints on the bridges over the Bosphorus, vibration absorbers in the Donau City Tower or uplift/load bearings for the Zenit Stadium in Saint Petersburg. Showpieces in the field of structural engineering include BMW World and Munich Airport's Terminal 2. Spectacular amusement rides include the world's largest mobile Ferris wheel – hi-Sky in Munich – the Rip Ride Rockit roller coaster at Universal Studios in Orlando and the Fiorano GT Challenge in Abu Dhabi.

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