

New construction of the Schiersteiner Bridge: spherical bearings for 6,000 t of structural load and large rotations

MAURER delivers latest-generation bearings and roadway expansion joints.

Wiesbaden, Mainz. The Schiersteiner Bridge ranks among the most significant new highway bridge constructions in Germany. The challenge is the enormous structural weight causing structural loads of up to 6,000 t and large rotations. As a specialist for structural protection systems, MAURER delivers high-performance spherical bearings and noise-reduced roadway expansion joints.

The previous highway bridge in the course of the A643 was erected in 1962 and connects Wiesbaden-Schierstein and Mainz-Mombach. Due to the considerably increased traffic volume (90,000 vehicles per day) it will now give way to a new construction comprising two parts with a length of 1,280 m and 1,285 m, respectively. The box girder bridge has three traffic lanes, one breakdown lane as well as bike lanes and walkways with a width of 21.72 m.

The first superstructure has been erected downstream since 2013, accommodating traffic in both directions since November 2017. In the meantime, the old bridge was dismantled and the second new construction, partly using the old foundation, is scheduled to be completed in 2021. The ambitious highlight in terms of construction in 2016 was the floating and lifting into position of the 120-metre centerpiece across the River Rhine. As early as in the course of planning it had to be estimated to which movements and forces the bearings would be subjected during this complex installation process.

Spherical bearings for up to 6,000 t and 1.5% of rotation

Large rotations of 1.5% were predicted. At the same time, the bearings have to accommodate high vertical loads of more than 6,000 t. This is why spherical bearings featuring a sliding combination consisting of MSM® (MAURER Sliding Material) and stainless steel sheet were used.

In accordance with the European Technical Approval ETA-06/0131), MSM® has a certified, extremely high specific characteristic pressure of 180 N/mm². Even with a safety factor of 1.4 included in the calculation, extraordinary high pressure of 128 N/mm² is possible on this sliding material. Hence, the dimensions of the spherical bearings could be reduced to a minimum of approx. 1,600 x 1,500 x 380 mm (up to a weight of 4,600 kg per bearing). Compared to customary bearings, this means volume savings of approx. 30%. The friction occurring with this sliding combination is restricted to a very low 2% thanks to MSM®.

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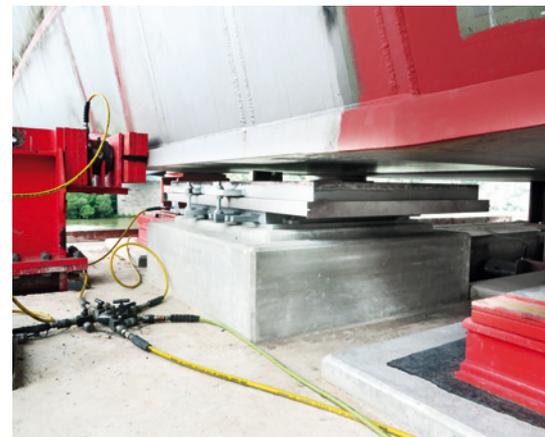
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Box girder bridge under construction, on the right the old Schiersteiner Bridge that has been dismantled by now.

Photo: MAURER



Installed spherical bearing on which the wedge plate is measured.

Photo: MAURER

The large rotations were possible due to a specially adapted inner joint, the calotte, which was manufactured from high-strength MSA® material. MSA® is a special metal alloy preventing any kind of corrosion and featuring a service life of 100 years, even under very harsh environmental conditions.

The 30 spherical bearings have been installed in the first river bridge in fall 2017.

Noise-reducing roadway expansion joints

The structure also counts with MAURER'S swivel joint expansion joints with noise-reduction layer on top. They bridge the structural gaps due to thermal movements at both ends of the bridge deck. At the same time, a safe and durable function must be ensured given a traffic crossing of 90,000 vehicles a day. With this type of expansion joint, the noise level when passing the bridge can be reduced by 40% to 60%. The construction type of swivel joint expansion joints does not include components requiring extensive maintenance. The swivel joint expansion joints enable an elastic positive control creating joint gaps of equal size. Moreover, this principle allows for restraint- and fatigue-proof bridge movements in all directions over a period of 50 years and more.

The design is in accordance with the regulations, and the noise reduction has been confirmed by the Federal Ministry of Transport and Digital Infrastructure (BMVI). All load-bearing components and noise-reducing rhomboid elements at the joint surface are welded; no high-maintenance bolted connections are used.

In total, four roadway expansion joints with a width of 22 m were installed in the first superstructure. The tolerable bridge movements in longitudinal direction range between 700 mm and 1,100 mm, for a single-profile expansion joint they amount to 95 mm.

The second bridge across the river is presently under construction and will be equipped with the same structural protection elements. Building contractor is the ARGE Bögl/Stahlbau Plauen, building owner is Hessen Mobil – Straßen- und Verkehrsmanagement in Wiesbaden. The opening to traffic is scheduled for 2021.

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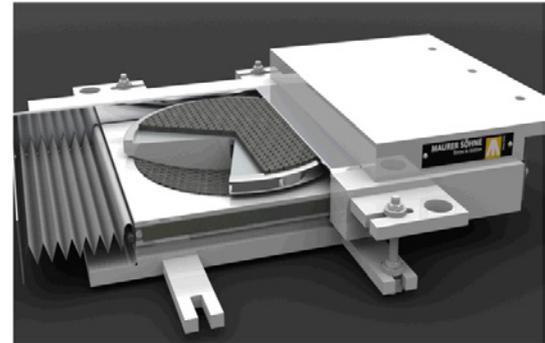
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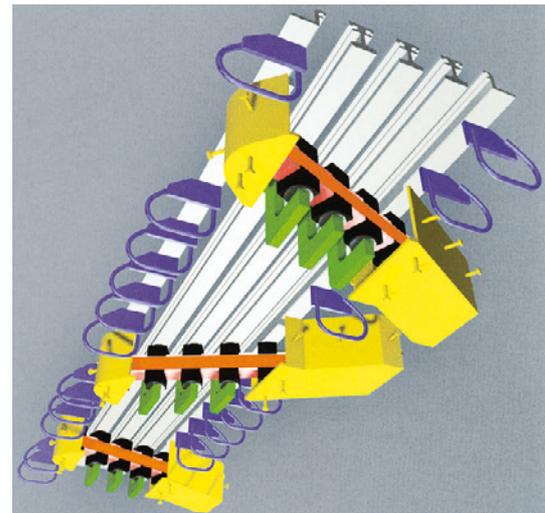
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Sectional view of a spherical bearing in transverse direction.

Graphic: MAURER



3D view of a swivel joint expansion joint from below.

Graphic: MAURER

Quick facts about MAURER SE

The MAURER Group is a leading specialist in mechanical engineering and steel construction with over 1,000 employees worldwide. The company is market leader in the area of structural protection systems (bridge bearings, expansion joints, seismic devices, tuned mass dampers, monitoring systems). It also develops and produces vibration isolation of structures and machines, roller coasters and ferris wheels as well as special structures in steel.

Maurer participates at many spectacular projects world wide, like for example the world's biggest structural bearings for the Signature Bridge in Wazirabad, Delhi, earthquake resistant expansion joints for the Bosphorus bridges in Turkey, semi-active tuned mass dampers for the Danube City tower in Vienna, or uplift bearings for the Zenit-Football-Arena in St. Petersburg. As for steel structures, the BMW World in Munich or the Terminal 2 of Munich Airport count among the reputed projects. In terms of spectacular amusement rides, to be mentioned are the world's biggest transportable Ferris Wheel R80 in Mexico, the Rip Ride Rockit Roller Coaster in the Universal Studios Orlando or the Fiorano GT Challenge in Abu Dhabi.

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