

Press Release – January 2005

Special Spherical Bearings for the Tejo Bridge in Lisbon

MSM is the sliding material of choice in case of high velocities and frequencies

Munich/Lisbon. **Between September and December 2004, Maurer Söhne replaced the old damaged roller bearings of the Tejo Bridge “25 April” with 8 MSM spherical bearings. This conversion to sliding bearings was possible because contrary to the conventional PTFE, MSM – Maurer Sliding Material – is capable to adopt extreme displacements in case of earthquake, as well as adopt high accumulated sliding displacements and sliding velocities that occur at this bridge in service stage. In addition, 4 bridge bearings that cater for uplift forces were replaced. Due to the considerable horizontal movements of the bearings caused by train traffic, the replacement could only be carried out during time windows without train traffic.**

The bridge „Ponte 25 de Abril“ that spans the Tejo River between Lisbon and Almada was constructed in 1966 with the Golden Gate Bridge in San Francisco as a model. The fact that there is a daily road traffic of 160,000 vehicles does not pose any extraordinary challenge to the bridge. Rather, it is the 140 trains that daily use this bridge which pose special strain to the bridge bearings. Due to their weight and their velocity, the trains induce high vertical displacements of the bridge deck, which cause corresponding displacements and rotations at the ends of the bridge. Big accumulated sliding displacements, combined with a high displacement velocity, so far put so much strain onto the existing roller bearings that in the recent years their position had to be reset almost every week, and now have to be replaced. Last autumn, these roller bearings were replaced by MSM spherical bearings, owing to the fact that the sliding material in combination with the spherical bearings could demonstrate a much longer service life, with no continuous maintenance works to be required.

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MSM – Maurer Sliding Material

Since 2003, MSM is on the market and displays major advantages as compared to the conventional PTFE. MSM can accommodate double as much compression stress, can take at least a 5 fold accumulated sliding displacement, and a 7.5 times higher sliding velocity. These performance characteristics were compelling enough for the owner to go for MSM spherical bearings.

The installation could only take place in periods of no rail traffic, because the trains cause high displacements. “What remained was a window of 3.3 hours on Friday night, and 5.50 hours on Saturday night”, Micha Walter reports, who is project manager of Maurer Söhne in Munich. “This posed quite some challenge in terms of planning and coordination”. During the day, the preparatory works were carried out. Three to four hours before installation, the fitters went on site, and as soon as the last train had passed, the works started according to an exactly defined time schedule. Road traffic continued without any interruption.

Two nights for one bearing

For the replacement of each bearing, 2 nights were required. In the first night, the 3 old roller bearings were moved such as to clean those parts in the bridge that remain, and to prepare the following works.

In the second night, the roller bearings were removed. Deformations that the roller bearings had caused were compensated with a fast hardening filler material, and then the MSM spherical bearings were inserted. The complete bearing slides on a steel plate with a stainless steel sheet attached, because contrary to conventional spherical bearings the horizontal movement is not accommodated over the spherical bearing, but under it.

The old multi-roller bearings had a hinge located above the rollers which accommodated the rotations

of the bridge. This joint was neutralised by means of stabilisators between the bridge and the middle shoe. Wedge elements made sure that the middle shoe could be adjusted in an exactly horizontal manner, prior to fixation.

In the days following the installation, the bearing was completed, and among others an electronic monitoring system was installed that continuously records the displacements. The system records the sliding displacements at each bearing by means of cable sensors. The recorded values can be gathered through the Internet and evaluated.

According to project manager Walter, the biggest challenge of the replacement of the roller bearings was “that we had to adapt complete special bearings in enormous dimensions to the given situation on site.” To be replaced were 8 bearings, 4 each at the 2 abutments. The bearings are designed for a load of 7,500 kN and 16,500 kN. Already in ordinary service stage, they have to accommodate sliding displacements of up to ± 140 mm, at a displacement velocity of a maximum of 15 mm/sec. In case of earth quake they have to accommodate as much as ± 800 mm,, because Lisbon is located in a dangerous area. In 1755, two thirds of Lisbon were damaged by an earth quake of magnitude 8.7.

At the piers that carry the cables, in addition 2 special stainless steel uplift devices were installed. In case of earthquake, these uplift devices shall prevent the bridge to lift up, but transfer the uplift forces into the piers. These special bearings are completely made of stainless steel, because they are exposed to considerable pollution and salty sea air.

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The bridge „Ponte 25 de Abril“ links Lisbon with Almada. At the 2 abutments and at the cable bearer piers, roller bearings were replaced by MSM spherical bearings

Photo: REFER, E.P.



One of the new MSM spherical bearings in Lisbon during installation stage. The joint in the upper right section of the photo was replaced by the stabilisator to be seen in the left part of the picture. The new bearing below completely slides on a stainless steel sliding plate.

Photo: Maurer Söhne