

Slender art structures require efficient dampers

MAURER Tuned Mass Dampers for "Red Sticks" in Melbourne.

Melbourne, Australia. The Red Sticks are 25-metre-tall, slender art structures that – after 27 years of exposure to the elements – required structural refurbishment. The challenge of the retrofit was to design efficient TMDs with tuneable natural frequency that also fit into the compact dimensions of the Red Sticks. MAURER solved this demanding task with TMDs with adaptive friction plate damping and springs for the on-site tuning of their natural frequency.

The Red Sticks, together with a yellow beam affectionately known as the Cheese Stick, are an art installation that has been a landmark of Melbourne since 1999. The 39 Red Sticks are 25 m tall and positioned over a length of 420 m close to the motorway that connects Melbourne's city centre to the city's airport. There are 21 Red Sticks to the north of the road, and 18 Red Sticks to the south.

Due to their square cross-section and the harsh weather conditions, the Red Sticks are prone to wind-induced vibrations. After 25 years, issues began to arise at their base. The main problem was that the existing TMDs were primarily activated at greater wind forces, but provided barely any supplemental damping to the Red Sticks at lower but more frequent wind loads.

The retrofit consisted of the following two measures:

- The section between the concrete foundation and the steel structure of each Red Stick was reinforced via concrete confinement to reduce bending stresses.
- New TMDs were installed that generated supplemental damping over a wide range of wind loads.

The specific requirement in this project was the need for the TMDs' natural frequency to be tuneable on site, in order to retune this to the first bending mode eigenfrequency of the Red Sticks following the confinement at their base. MAURER met this requirement using TMDs with a pendulum mass, combined with tuning springs with variable quantity and angle.

Pendulum mass with damping

MAURER friction plate TMDs are robust and provide adaptive friction plate damping. Their natural frequency can be optimised to the structural eigenfrequency via tuning springs. Their pendulum mass is designed to provide the required supplemental damping for the structure, while the computation of the TMDs' natural frequency also takes into consideration the friction plate dynamics.



Red Sticks in Melbourne fitted with MAURER TMDs to minimise wind-induced structural vibrations.

Photo: MAURER



The Tuned Mass Damper (TMD) consists of an octagonal pendulum mass hanging on three rods with Cardan joints, four stacked friction plates below the pendulum mass, and tuning springs installed between the rack and the pendulum mass for natural frequency tuning. The special shape of the TMD rack allows the TMD to be installed horizontally in the Red Stick, which is inclined at an angle of 20 degrees.

Photo: MAURER

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The MAURER TMDs with adaptive friction plate damping and tuning springs mitigate the Red Sticks' vibrations over a wide range of amplitudes. Four friction plates, each with different mass and geometry, are coupled to the pendulum mass in such a way that the supplemental damping provided to the Red Sticks hardly depends on the vibration amplitude. In addition, tuning springs installed between the rack and the pendulum mass allow the TMDs' natural frequency to be retuned to the changed eigenfrequency of the Red Stick. The special shape of the TMD rack was developed to allow the TMDs to be installed horizontally in the Red Sticks, which are inclined by approximately 20 degrees.

Tuning the TMDs' natural frequency was challenging, as the eigenfrequencies of the Red Sticks changed when the old TMDs were replaced by the new MAURER TMDs, as well as when the confinement was made at their base. The confinement also took place at the same time as the TMD installation. The optimum design value of the TMDs' natural frequency was derived via non-linear simulation, taking into consideration all the aforementioned issues. The natural frequencies of the new TMDs were checked by Factory Production Control (FPC) in Munich before they were shipped to Melbourne.

Optimising the natural frequency

After the MAURER TMDs were installed at the top of the Red Sticks, the damping of all 39 Red Sticks with working TMDs was experimentally verified in April 2026. Here, each Red Stick was manually excited by two people up to its maximum vibration amplitude. The total damping (supplemental plus inherent damping) was then derived from the subsequent free vibration response. Where necessary, the natural frequency of the TMD was fine tuned to the actual Red Stick eigenfrequency.

Seven damping tests had to be performed overnight, as seven of the Red Sticks lean over the motorway, requiring a road closure between 10 pm and 5 am. The damping measurements in April 2026 confirmed that the MAURER TMDs led to a total structural damping of 2 % to 3.5 % and that the MAURER TMDs were activated at the Red Sticks' top amplitude of ± 5 mm.



Installation of a new damper.

Photo: MAURER

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Quick facts about MAURER SE

MAURER SE is a leading specialist in mechanical engineering and steel construction, with over 1,500 employees worldwide. The company is the market leader in structural protection systems (bridge bearings, expansion joints, seismic protection devices, tuned mass dampers and monitoring systems). It also develops and produces vibration isolation solutions for structures and machines, roller coasters and Ferris wheels, as well as special structures in steel construction.

MAURER has been characterised by strong values and reliable people since 1876. In 2026, the company celebrates 150 years of teamwork, innovation and engineering prowess.

MAURER has been involved in many spectacular large-scale projects. These include the world's largest bridge bearings in Wazirabad, Pakistan, earthquake-resistant expansion joints for the world's longest suspension bridge, the 1915Çanakkale in Turkey, tuned mass dampers in the Baku and Socar Towers in Azerbaijan, and the unique guided cross-ties with derailing protection on the Champlain railway bridge in Montreal. Complete structural isolation projects range from the Acropolis Museum in Athens to the new airport in Mexico. MAURER has also worked on spectacular amusement rides, such as the Umadum Ferris wheel in Munich, BOLT™ – the first roller coaster on a cruise ship, and the world's first duelling roller coaster at the Mirabilandia Park in Ravenna, Italy.

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