

How SHARKS are helping children enjoy theatre safely

First installation of pioneering MAURER seismic protection devices in a building in Kazakhstan.

Almaty, Kazakhstan. **SHARKS®** are simple, robust and innovative earthquake dampers that reliably absorb seismic energy. They were recently installed to protect the new State Children's Theatre in Almaty.

Almaty is the largest city in Kazakhstan. Lying in the south-east of the country, the former capital is a hub for business and culture. The Natalia Sats State Academical Russian Theatre for Children and Youth was founded in 1944 and is one of the country's most important stages for children's and youth theatre. It is named after the Russian theatre and music teacher Natalia Sats, who was one of the founders of professional children's theatre in the Soviet Union.

The main building, erected in 1981, is currently undergoing a thorough renovation, expansion and technical modernisation. The new extension, with 10,000 m² of floor space, will have a chamber theatre on the ground floor with around 200 seats. The four upper floors will have rehearsal rooms, workshops for stage and costume design, storage areas and functional rooms.

Earthquake zone 9-10

Almaty lies in one of Kazakhstan's most seismically active regions, at the northern edge of the Tian Shan mountain range. It is in earthquake zones 9-10 on the MSK-64 scale (intensities ranging from 1-12). Large parts of the city were destroyed by severe earthquakes in 1887 and 1911.

Modern seismic hazard analysis systems show that a severe seismic event today could generate earth accelerations of over 0.4 g. This level is far above that for which the original theatre building was designed 50 years ago.

Since 2025, all buildings of public importance, such as hospitals, schools and nurseries, in earthquake-prone areas are required to be fitted with seismic protection devices. While the old building is being seismically reinforced in the renovation, the new extension is being fitted with an innovative new seismic protection system: MAURER SHARKS®. In conventional seismic design, the goal is often to make a building as rigid as possible. When subjected to extreme vibrations, however, highly rigid structures often absorb more seismic energy. This can lead to brittle fractures on the structure. For the Natalia Sats Theatre, the team of engineers from MAURER SE, collaborating with international experts, chose a different solution: protection via hysteretic energy dissipation.



The SHARKS® can be seen on the front side of the extension building, shown here during construction. The right-hand facade has already been cladded. The main building, which is being renovated, can be seen on the left.

Photo: MAURER



Four SHARKS® at the corners of the two top floors. On the right are SHARK® 2400 kN and on the left are SHARK® 1400 kN.

Photo: MAURER

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The main aim was to reduce seismic forces acting on the main framework of the building by 60 %. This was achieved by integrating a series of special damping units, known as MAURER SHARKS®, into the diagonals of the framework.

Nothing but steel

SHARKS® are innovative, bilinear steel hysteresis dampers. This means they consist entirely of steel. They prevent earthquake damage to the building by diverting energy, thanks entirely to their innovative and patented shape.

When subjected to wind pressure and temperature movements, the SHARK® dampers operate like conventional elastically operating bilinear dampers, comparable to a rigid spring that provides structural stability. The SHARK® only deforms plastically in the event of an earthquake, so that the energy is diverted. The key detail of the SHARKS® are the specially shaped hysteresis lamellas arranged on the four sides of the dissipative core's hollow profile. Thanks to the shape of the lamellas, the SHARK® reacts stably to seismic events up to 3-4 MCE (Maximum Considered Earthquake) without damage. The parallel redundant arrangement of the lamellas makes the system extremely reliable. If one of the lamellas were to fail, the others would still deliver a proportional level of resistance and damping.

The dampers were designed to be installed in the bracing systems of buildings, which are made from either steel frame or steel-reinforced concrete. They limit the displacement between floors, while also preventing structural damage caused by seismic forces.

In Almaty, a total of 40 SHARKS® were installed across the five floors of the theatre building. Two types were fitted: SHARK® 1400 kN with three lamellas, and SHARK® 2400 kN with five lamellas for the areas with higher calculated loads.

SHARK® dampers offer many important advantages, including:

- High reliability and no need for regular maintenance due to the use of only one material
- Service life of around 100 years and more, similar to building structure systems
- Stable reaction to 3-4 MCE events
- Redundant reliability thanks to parallel arrangement of the hysteretic lamellas
- Simple visual inspection and replacement if required, such as after a fire
- High fatigue strength against wind and other operating loads

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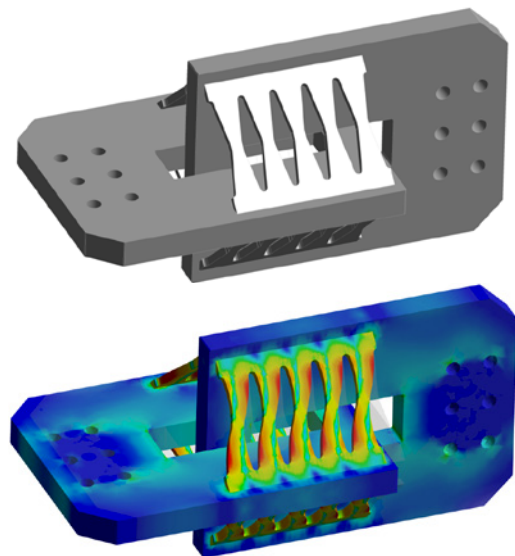
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A SHARK® with 2,400 kN of response force installed in Almaty.

Photo: MAURER



SHARK® with five lamellas.

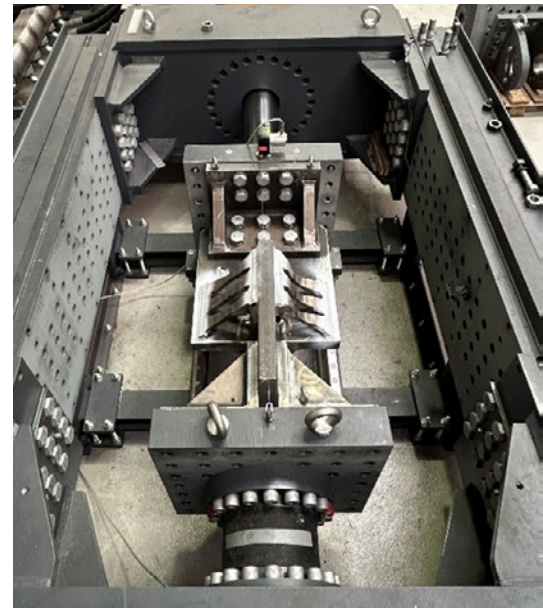
Graphic: MAURER

The SHARKS® were screwed into place in Almaty. They can also be welded or fitted in a different way.

Tests in Munich and Pavia

The SHARK® dampers were successfully tested at the University of the Bundeswehr in Munich and the EUCENTRE laboratory in Pavia (Italy) in line with the European standard EN15129. They also comply with Kazakh earthquake standards.

Construction work is due to be completed in summer 2026. The building is owned by the Almaty municipal administration.



A SHARK® with three lamellas on MAURER's own test stand.

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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