

## A jewel resting on spherical bearings

### 14 support bearings accommodating structural loads of up to 8,000 kN.

Singapore, Munich. Singapore has put a gem into its architectural crown, the "Jewel Changi Airport". The largest single-layer steel-glass construction and the world's largest indoor waterfall – both resting on 14 spherical bearings from MAURER. A new showcase project of the bearing specialists from Munich.

Singapore is a booming metropolis and the number of passengers at Changi Airport is supposed to double by the mid-2020s. As the central element of the airport expansion, the Jewel will be put into operation step by step in 2019. The large steel-glass construction measuring 137,000 square meters is situated like a slightly oval donut between terminals 1, 2 and 3 and connects them. In the center, quasi in the "eye" of the donut, the world's largest indoor waterfall drops 40m – during the monsoon season with a flow rate of about 40,000 liters of rainwater per minute.

As project manager at MAURER, Dipl.-Ing. Peter Günther travels around the globe and has seen many things – however, even he admits: "This is really impressive: the forest, the waterfall, the entire dimension and atmosphere – beyond comparison." On ten stories, the Jewel hosts a 130-room hotel, 280 shops, bars and restaurants, a movie theater, an amusement park, check-in counters, baggage check-ins, and a jungle with over 60,000 trees and bushes.

### Spherical bearings in the green

The structure features superlatives also in terms of technology. The steel-glass shell of the Jewel is the largest single-layer structure in the world. It is supported by pendulum supports that rest on comparably inconspicuous support bearings. These bearings are situated in leisure facilities, restaurants, or in the green. "I think this is the first time I actually see our bearings in a forest," reflects Günther. This results from the fact that the bearings are placed on the concrete of the highest story, the tenth one. Like a giant funnel, the jungle twines up the upper five stories of the building.

### High structural loads of up to 8,000 kN

The bearings are fixed spherical bearings featuring a diameter of approx. 1,000 mm. Thanks to a special polyethylene sliding material inside, the dimensions of the bearings could be reduced by about 30%. This enabled a very slim design of the support base. The bearings accommodate high structural loads from 5,525 to 8,000 kN and allow for rotations of up to 1.5%. The three or four



The world's largest indoor waterfall drops 40 meters in the Jewel at Changi Airport in Singapore. The waterfall and the roof and facade structures are supported by 3- or 4-armed pendulum supports that can be seen at the upper right of the picture. On the left you can see the railroad line of the airport express train.

Photo: MAURER



The support bearings accommodate up to 8,000 kN of structural load and rotations of up to 1.5%. They are situated on the upper level of the building.

Photo: MAURER

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pendulum supports for each bearing feature joints underneath the roof. The horizontal and vertical loads and the rotations of the roof are accommodated by these supports and transferred through the bearings in a controlled manner, thus protecting the structure from damages.

The bearings were manufactured at the MAURER headquarters in Munich in 2016. The installation monitoring on site was conducted by MAURER India in 2017.

The architects of the Jewel are Safdie Architects and RSP Architects, Singapore. Safdie is also responsible for the Marina Bay Sands, the landmark of Singapore with a roof-top garden bridging three skyscrapers. This garden also rests on MAURER bearings.

Building contractors of the Jewel are Captiamalls Asia Limited and Changi Airport Group, Singapore.

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Rare sight: a spherical bearing in the green.

*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 1,000 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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