

KISTLER

measure. analyze. innovate.



**Increased safety
in rail traffic**

World's first crash wall for high-speed trains

Precise measurement and analysis of impact forces

A distance of 1,318 kilometers separates the megacities of Beijing and Shanghai. Since June 2011 passengers have been able to travel between these Chinese cities several times a day, with a journey time of less than five hours, and at speeds of up to 380 kilometers per hour. The third longest high-speed line in the world is one of the most used in the country, with approximately 100 million passengers per annum. To ensure that Chinese rail transport can continue to handle such large passenger numbers and cycle times in the future, the high-speed trains must fulfill strict safety requirements. To that end, the world's largest provider of rail transport technology relies on Kistler's measurement expertise. Thanks to the only crash wall of its kind in the world, the impact forces of the trains and their components can be precisely measured and analyzed.

High-speed trains are a key to the development of the Chinese economy. They are safe, fast and comfortable. It is not without reason that China currently possesses one of the largest high-speed networks in the world, with approximately 20,000 kilometers of track. Since the Chinese railway authority records a year-on-year increase in passengers of almost one third, the rail network for fast trains will be extended 50 per cent by 2020.

However, wherever high speeds are involved there is also an increased safety risk. Therefore, allied to the extension of the high-speed rail network, passenger safety is also a key issue in China, particularly in the wake of the rail accident in Shuangyu (province of Zhejiang) in 2011, which resulted in the deaths of 40 people. Following this incident the speed of travel for the super express trains was initially limited to around 300 kilometers per hour. However since September 2017 the speed limit has been increased and is now 350 kilometers per hour.

Crash tests with high measuring ranges

The world's largest provider of rail transport technology has worked for years on optimizing its railway vehicles. In its own technology and product development center the Chinese corporation regularly carries out extensive crash and component tests on its high-speed trains. The declared objective of this extensive



The world's largest provider of rail transport technology relies on Kistler's measurement expertise

test program is to minimize personal injury and material damage in the event of a crash, and to sustainably develop rail transport. In tests to determine what impact forces operate on the trains and their components, the company relies on measurement technology provided by Kistler. Since the end of 2017 a groundbreaking Kistler application has been in use in the crash hall: the world's first ever crash wall for high-speed trains.

Christof Sonderegger, the Product Manager for Test & Measurement at Kistler, is responsible for this major project. "This is the first time in the entire history of our company that we have had the opportunity to handle an application like this. With the crash wall for high-speed trains we enter a measurement range that is up to twenty times higher than in the typical crash tests performed in the automotive industry. Cars are driven into the wall with up to 64 kilometers per hour, while our Chinese client's trains crash into the walls with up to 72 kilometers, generating a force equivalent to a mass of 10,000 tons."

Modular concept with freely combinable sensors

The challenge for Kistler was to develop a custom-built crash wall, which could not only handle the high impact forces of the high-speed trains, but was also modular and extendable. On top

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Christof Sonderegger, Product Manager for Test & Measurement at Kistler

of that Kistler had to adhere to a very tight delivery schedule and was required to provide a full turnkey solution. "We were only able to handle such a demanding task thanks to outstanding internal cooperation", explains Sonderegger.

After an intensive engineering phase lasting several weeks, the measurement technology experts were able to develop a crash wall with a total of six segment plates, each of which allowed for 36 sensors to be installed on them. A key advantage is that the sensors can be flexibly combined with each other and cover all load requirements. If required, the crash wall can be extended by a further three segment plates, again, each with additional sensors. In the Chinese client's crash wall the Kistler engineers installed 1-component force sensors with measuring ranges of 700 kN, 2.5 MN, 5 MN and 10 MN. The sensors come ready calibrated and guarantee constant measuring precision over a broad force range.

Ground-breaking DTI technology

The digital electronics, the so-called DTI (Digital Transducer Interface) technology, is integrated into Kistler's force sensors. "The DTI technology has already been successfully used for several years in vehicle safety, driving dynamics and operational stability. Our engineers were also able to integrate this unique technology for our client in China", Sonderegger explains. In sensors with DTI technology, the signal is digitalized in the sensor and relayed with a bus. The sensor data flows interference-free into the central Kistler DTI logger and is transferred into the computer and recorded via Ethernet.

Excellent on-site service

The sensors, electronics and testing equipment were produced in Winterthur (Switzerland), where Kistler is based, and the measurement technology experts had the segment plates manufactured by a local supplier. The Kistler Tech Center in Shanghai was responsible for the segment plates system test and installation at the client's facility. Finally, the custom-built crash wall was installed in the Chinese corporation's technology and product development center. Kistler's crash wall has been in operation since the end of 2017. "Our client is very satisfied with the modular concept with freely combinable sensors and the robust interface. For future tests the company plans to order further sensors and segment plates from us", says Sonderegger.



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Installation of the crash wall at the customer's site.



First test with the new crash wall.

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Kistler Group
Eulachstrasse 22
8408 Winterthur
Switzerland
Tel. +41 52 224 11 11

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