Feature section

THK supports society

Protecting lives and property: THK's seismic isolation technology supports society.

The Suruga Bay earthquake underlined the role of seismic isolation devices

At left, five images of Buddha by the sculptor Unkei, on display at Ganjojuin.
At right, the Aichi Prefectural Office Main Building

Creative thinking and original technology enabled THK to put an unparalleled new mechanism on the market—the LM Guide. Its applications range from machine tools and other industrial uses to architectural and construction applications; LM Guides are incorporated into seismic isolation devices that help protect houses and other buildings during earthquakes. THK's seismic isolation systems provide fundamental support for societal infrastructure and daily life. Seismic isolation offers real value—it provides people with a sense of safety and confidence.

August 2009: The Suruga Bay earthquake destroys a section of highway

In the 1990s, motivated by concern over Japan's well-known susceptibility to earthquakes, THK began developing seismic isolation devices incorporating LM Guides. THK now offers a variety of earthquake-protection options, ranging from large seismic isolation systems for entire buildings to small-scale seismic isolation devices designed to protect objects such as cultural treasures and computers.

The effectiveness of THK's seismic isolation systems is demonstrated every time a major earthquake occurs. At 5:07 on the morning of August 11, 2009, a major earthquake struck Shizuoka Prefecture in central Japan. The epicenter of the quake, which had an estimated magnitude of 6.5, was located some 23 kilometers under Suruga Bay, near the city of Omaezaki. In Omaezaki and the cities of Makinohara, Yaizu, and Izu, the earthquake registered a low 6 on the Japanese scale of 7, indicating moderately severe seismic intensity. Casualties occurred across a broad area encompassing four prefectures. A 40-kilometer section of the inbound Tomei Expressway near Makinohara collapsed, obliterating one traffic lane as well as the road shoulder; surface cracks occurred on the inbound passing lane and all over the outbound side of the highway. The collapsed inbound lane remained closed to traffic until midnight on August 15.

The aftermath: Testing the effectiveness of THK's seismic isolation systems

When a major seismic event such as the Suruga Bay earthquake occurs, that's when THK's seismic isolation systems prove their worth. When a house is equipped with a seismic isolation systems, the system prevents vibrations from being transmitted directly to the building's structure. During an earthquake, not only will the structure itself remain undamaged, the furniture inside won't topple or tip over—the house and its furnishings will remain in essentially the same condition.

After the Suruga Bay earthquake, THK representatives visited the homes of customers in Shizuoka Prefecture who had installed seismic isolation system and spoke with them about the earthquake (some of these exchanges have been posted on THK's Seismic Isolation website*). Every customer who had installed a THK seismic isolation system stated that vibrations had been minimized. None of them had incurred any damage; none of the houses collapsed, and no furniture was overturned. THK's seismic isolation devices have been highly praised by customers who rely on them. This fact is included not only for the reader's edification but also because it will provide useful guidance for future product development.

* Seismic Isolation website: http://www.menshin.biz/

Protecting people's lives and property

THK's seismic isolation devices

Toshifumi Daicho

Executive Vice-president
Daicho-tekko. Co., Ltd.
Fujieda, Shizuoka Prefecture

Testimonial Construction incorporating seismic isolation

I had been looking for a sturdily built house. After the Suruga Bay earthquake I realized that seismic isolation is tremendously effective.

The experts say it's highly possible that a major earthquake will occur in the Tokai region in the near future. That's a serious concern for people in Shizuoka Prefecture, and it's why I wanted to build an especially sturdy house. At first I was interested in earthquake-resistant construction, but I went to a home improvement store and opted for a seismic isolation devices that keep the house safe by isolating it from tremors while still providing plenty of freedom in the design of the house. I examined seismic isolation mechanisms offered by various makers and finally decided on a THK product because it provides strong protection against vertical shocks, those up-and-down vibrations, and had the most reassuring product concept. When the Suruga Bay earthquake struck in August 2009 I was in bed. The house was swaying gently, and it seemed like a level-two or level-three earthquake (on the Japanese scale). I turned on the TV and found out it had been a major earthquake registering a low six, and I heard later that people at my parents' house had been knocked off their feet. I realized then that the seismic isolation of our house was extremely effective.

Efforts to equip residential structures with earthquake-resistance and vibration-damping features are proceeding in Shizuoka as a countermeasure against the potential occurrence of a Tokai earthquake. This may well reduce the vibration of the building, but objects inside could still be shaken and fall over. When it comes to protecting your personal safety, I think seismic isolation devices, which absorb vibrations, are the best way to go.

In their own words A local employee

I was glad to hear that the customer's home didn't incur any damage. I sell seismic isolation devices to building contractors and architectural firms in this area, and I've found that THK's seismic isolation devices are known for their high quality and for providing safety. They are prized for their ability to handle vertical shocks, thanks to the fact that the rail and base are both part of a single unit, which keeps the building from moving upward. In our daily sales activities we will continue to emphasize the considerable safety benefits provided by THK's seismic isolation devices, not only to people who are aware of the impending danger but to homeowners in general.

Morihiko Endo, Senior Assistant Supervisor, Sales Section, SHIZUOKA Branch, Sales Department, East Japan Region II

Shuji Nakada

President
Nakada Building Firm Corporation
Fujieda, Shizuoka Prefecture

Testimonial Construction incorporating seismic isolation

I had seismic isolation devices installed to protect the lives of the people in family. Since the Suruga Bay earthquake, these devices have been very popular with my clients too.

My house was rebuilt in 2006 and equipped with seismic isolation devices. I had been building houses equipped with these devices for a long time, so when I rebuilt my own house I wanted to incorporate seismic isolation. At first I was going to use equipment made by a different manufacturer, but when I checked out the seismic isolation devices that the Shizuoka Branch carries and saw how they're structured, I decided to go with THK. The rail and the base form a single unit, so even if a level-six vertical tremor hit, the force would be released sideways. On the morning of August 11, 2009, I was watching the TV coverage of a typhoon that was approaching, when I realized the house had shifted slightly. I figured it was because of the wind. Then I saw an earthquake bulletin being broadcast; it was only then that I found out an earthquake had occurred. Prior to the Suruga Bay earthquake, I had recommended and actually installed seismic isolation devices in seven houses, and none of them incurred any damage from the earthquake. The owners were all very pleased. There was one owner in particular who had had second thoughts about installing seismic isolation devices after seeing the estimate—and then three months after his house was built this earthquake struck, and there was no damage. He was so glad that he had gone ahead and had those devices installed.

Installing seismic isolation devices certainly isn't cheap, but you can't put a price on protecting the lives of your loved ones. There should a subsidy system to cover seismic isolation devices, as there is for other quake-resistant construction mechanisms. The Suruga Bay earthquake has made people in the Fujieda area more aware of the benefits of seismic isolation. THK's seismic isolation simulating vehicle was a very popular attraction at the Shizuoka housing expo in September 2009.

In their own words A local employee

When I meet with a client, I point out that seismic isolation has a value that can't be expressed in monetary terms, because it will keep furniture from toppling over and keep your family safe. Most people don't really understand how seismic isolation works, so I usually give a detailed explanation. Since the Suruga Bay earthquake, though, attitudes have definitely changed. People talk about how frightening it was, and more people are interested in having seismic isolation devices installed. At the same time, a lot of building contractors say they've never installed these devices and are worried that it might be difficult. I do my best to help them understand the effectiveness of seismic isolation.

Akinori Suzuki, Sales Section, SHIZUOKA Branch, Sales Department, East Japan Region II

Protecting important cultural properties

THK's seismic isolation devices

Shoudou Kozaki

Chief Priest
Tenshukunzan Ganjojuin

Testimonial Construction incorporating seismic isolation

Ensuring the safety of important cultural property—Unkei's Buddhist sculptures—even in a major earthquake

At this Buddhist temple, Ganjojuin, located in the city of Izunokuni in Shizuoka Prefecture, we have five images of Buddha that are authentic works of Unkei. Unkei was a master sculptor of Buddhist images in the Kamakura period (1185-1333). These works were created when he was about 35 years old and still in his prime. The statues, which include a seated image of Amida, have all been designated by the government of Japan as important cultural properties, so the question of how to keep them safe in the event of a major earthquake was naturally a matter of great concern. There was already a mechanism to keep them from falling over—the statues have tenons that hold them to their pedestals—but this didn't seem adequate, so we joined forces with our temple patrons to find a more effective way to protect the statues and put our minds at ease. In light of their great value as works of art, we considered the idea of putting the statues in the storehouse for safekeeping, but we can't burn incense or even light a candle in the storehouse. Then, through a design firm, we found out about THK's seismic isolation system. I saw a video explaining how seismic isolation works. Just then a housing expo was being held in Shizuoka, and I had a chance to visit THK's seismic isolation simulating vehicle. I realized that seismic isolation was the best way to protect the statues, so we decided to have the temple hall and the dais reinforced with earthquake-resistant steel bars and plates and then install seismic isolation devices under the statues. The project was still underway when the Suruga Bay earthquake struck, and the seismic isolation devices had not yet been installed, but luckily the tremors were less intense in this area and didn't cause any damage. The seismic isolation devices have now been installed, and I feel relieved.

In their own words A local employee

It was a bit difficult at first, because neither the chief priest, the temple patrons, nor even the design firm knew much about seismic isolation, which THK knows a lot about, of course. To help them understand what seismic isolation devices do, we gave them a ride on THK's seismic isolation simulating vehicle. They experienced a simulation of the 2004 Chuetsu earthquake, and they were all amazed at how strong the tremors were and how tremendously effective seismic isolation is. In this type of seismic isolation project, when it's not just material objects but images of Buddha, a god, that are being protected, it's essential to closely respect the client's wishes. Seismic isolation devices are very good products, and we're undertaking this effort with the understanding that we have a mission to help protect these Buddhist statues as works of art that are important to the whole country.

Makoto Inoue, Manager, Sales Section, NUMAZU Branch, Sales Department, East Japan Region II

Construction incorporating seismic isolation: Example

Protecting the Heijo Palace Imperial Audience Hall in Nara for future generations

Nara Heijokyo became Japan's first large-scale capital city when the capital was relocated there from Fujiwarakyo in the year 710. The Heijo Palace ruins, which include the remains of the Imperial Audience Hall, are now a public park. As part of a project overseen by the national government, restoration of the main gate, the Suzakumon, was completed in 1998. Restoration of the main section of the Imperial Audience Hall was completed in 2010, exactly 1,300 years after the capital was established. An ongoing commemorative event marking the 1,300th anniversary of the founding of Nara Heijokyo is being held at the Heijo Palace ruins and elsewhere, in an effort to enable future generations to appreciate the site as a place where history can be absorbed through firsthand experience. THK's seismic isolation devices are being used in the reconstruction of the Imperial Audience Hall. The provisions called for in the original reconstruction plan would not have satisfied contemporary safety requirements, so it was decided to incorporate seismic isolation devices in the execution of the plan to minimize the effects of earthquake tremors. Seismic isolation devices made up of linear slides, laminated rubber pads, and Viscous Dampers are being inserted into the bed plate that forms the foundation of the structure. With seismic isolation devices interposed between the reconstructed building and the ground, only minimal structural reinforcement of the building itself is needed, allowing engineers to stay close to the original reconstruction plan.

Construction incorporating seismic isolation: Example

Seismic isolation of the Aichi Prefectural Office Main Building, a cultural asset and disaster-control base

The Aichi Prefectural Office Main Building, completed in 1938, is representative of the *teikan* style, having a traditional Japanese tiled roof atop a Western-style structure. In 1998 it was designated a tangible cultural property. The building currently houses government offices and is a designated disaster-control base. It became clear, however, that the building in its former state would not be able to perform the latter function in the event of a Tokai earthquake or Tonankai earthquake, either one of which is expected to occur in the near future, so seismic isolation was carried out. Incorporating quake-resistance technology would have required reinforcing the structure with quake-resistant walls or braces, which would have reduced the available office space and would have also required that the building be vacated during construction, disrupting operations. Instead, to minimize the disruption of daily operations, the decision was made to utilize seismic isolation.The project involved the use of a technique known as seismic isolation retrofitting. This entails separating the existing building from its foundations and interposing seismic isolation devices. This is done without altering the building's external appearance or damaging the interior or any interior facilities. The existing foundations were removed, new concrete was poured, and the seismic isolation devices were installed. Beneath the building, which weighs about 73,400 tons, THK CLB Linear Rolling Supports and lead-laminated rubber pads provide seismic isolation.

In this way the building was reincarnated as the focal center of the prefecture's disaster-control system, without any change to its external appearance.

Protecting essential data

THK's seismic isolation devices

Protecting customer data in the event of a major earthquake

One important aspect of corporate social responsibility is maintaining the ability to quickly resume business operations in the aftermath a major earthquake. Financial institutions, for example, must do everything possible to prevent earthquake damage from disabling their servers, providing unauthorized access to customer information, or shutting down their ATMs. Servers are usually bolted down, but this is not sufficient to protect them in a major earthquake. THK manufactures seismic isolation devices that can be placed right on the floor and provide the effect of having the entire floor seismically isolated.

Naoki Nakamura
Manager
MISHIMA SHINKIN BANK

Testimonial Construction incorporating seismic isolation

Customer information must be regarded as an asset, which can be thoroughly protected by seismic isolation devices.

The MISHIMA SHINKIN BANK's head office and branches are linked by a private computer network, and customer information is compiled and managed by the servers at the head office. The bank has a highly reliable security system in place to prevent unauthorized access to confidential business information and customer data by someone trying to hack into the network, but we have still had concerns. The data is all backed up, of course, as a countermeasure against the occurrence of a natural disaster, but it would take some time for the network to recover. I saw a demonstration video for THK seismic isolation devices and learned about how they work. I realized how important it is to protect information against the occurrence of a natural disaster, and we concluded that simply anchoring servers to the floor was insufficient for effective business continuity planning. We decided to have seismic isolation devices installed.

When the Suruga Bay earthquake struck, the very first order we received was to ascertain the safety of our servers. Although the earthquake registered a low level five in the city of Mishima, our servers were not affected in any way, thanks to our seismic isolation devices.

For a financial institution, customer information is an essential asset, so we naturally have an obligation to protect it, despite the cost. To ensure business continuity, we plan to increase the number of seismic isolation devices we have installed from three to five, and to further reinforce our safety and security systems.

THK's evolving seismic isolation systems

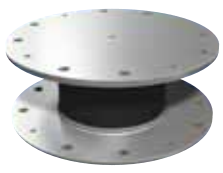
Limiting earthquake damage inside buildings by preventing the transmission of seismic vibrations

Generally speaking, there are three types of measures used to protect buildings from being damaged in an earthquake: (1) quake-resistance, (2) vibration-damping, and (3) seismic isolation. Quake-resistance measures are designed to enable a structure to withstand an earthquake by increasing the strength of its walls; seismic vibrations can nevertheless be transmitted to the interior of the building, and vibrations will increase in amplitude as they move upward. Vibration damping measures employ devices incorporated into columns, walls, and other structural components to absorb seismic vibrations; these measures are most effective in high-rise buildings and similar structures. Seismic isolation entails the use of seismic isolation devices installed between the building and its foundation, which prevent seismic vibrations from being transmitted directly to the building.

THK's seismic isolation systems are made up of three different mechanisms: seismic isolation devices, which utilize LM Guides to help support the building; viscous dampers incorporating Ball Screws, which absorb an earthquake's impact; and laminated rubber pads, which help restore the building to its original position.

In the event of a major earthquake, THK's objective is to protect people from being injured by furniture or other falling objects inside their homes, as well as to protect buildings and other structures that have been designated as cultural properties, along with the artwork and cultural assets inside them. These efforts, it is hoped, will provide people with a sense of security.

CLB Linear Rolling Support



Seismic Laminated Recovery System

RDT Viscous Damper

The frightening experience of an earthquake: The seismic isolation simulating vehicle

THK's seismic isolation simulating vehicle is a truck equipped to enable people to sample the frightening experience of an earthquake and the effectiveness of seismic isolation devices. The vehicle can simulate an earthquake registering a high six in intensity, as well as major earthquakes that have occurred in the past, and it can also simulate the effects of major earthquakes expected to occur in the Tokai, Tonankai, and Nankai regions in the future. In addition, the vehicle can demonstrate how seismic isolation works. THK's seismic isolation simulating vehicle is often featured at exhibitions on countermeasures against disasters—experiencing a simulated earthquake is highly recommended.

THK's seismic isolation simulating vehicle

Feature section

THK supports the world

The site of demand as the optimal site for production: Developing *monozukuri* on a global scale

THK's WUXI Plant making its presence felt in the booming Chinese market

As economic globalization advances, the ranks of consumer countries are beginning to change. The focus has clearly shifted from consumption centering on the developed countries to the purchasing power of emerging nations, exemplified by China. THK is actively pursuing global expansion based on the belief that production develops at the site of demand—that the emerging countries that will play a leading role in future consumption will also be important producing countries.

Global vision

"Global 10 21" is THK's shorthand term for the goal of becoming one of the world's top ten machinery component manufacturers in the twenty-first century. Based on the idea that the site of demand is also the optimal production site, THK has established frameworks for production and sales in 4 territories—Japan, the Americas, Europe, and the rest of Asia—and has expanded its activities to 66 sites in 23 countries. Particular attention is being devoted to improving production operations in Asia, which has attracted worldwide interest for its highly promising markets. In China, a market that is expanding with remarkable speed, THK already operates 4 plants and 19 sales offices. THK has gradually expanded its production capacity in China. DALIAN THK began operating in 1996.The WUXI Plant commenced operations in 2005 as the first LM Guide manufacturing plant in China. In 2006 the WUXI Plant was expanded and the LIAONING Plant commenced operations. DALIAN THK's second plant opened in 2008.

The WUXI Plant: Producing LM Guides for the whole world

The WUXI Plant, the first LM Guide manufacturing plant in China, opened in 2004 and became fully operational in 2005. The plant set about supplying the world with top quality products, obtaining ISO 2000/9001 certification only two years after it opened. The plant's presence in international markets as a producer of LM Guides and related products has increased with each passing year. In addition to contributing to China's economic progress by boosting the regional economy and creating jobs, the WUXI Plant also makes an effort to promote various types of interaction between Japan and China.

The THK WUXI Plant

Profile

• Company name	THK MANUFACTURING OF CHINA (WUXI) CO., LTD.
• Date established	March 23, 2004
• Number of employees	294 (as of March 31, 2010)
• Site area	155,256 square meters
• Main products	LM Guides, LM Guide actuators, Ball Splines

History

March 2004	Establishment of THK MANUFACTURING OF CHINA (WUXI) CO., LTD.
April 2004	Start of first construction phase
December 2004	End of first construction phase, trial production
January 2005	Start of full-scale operations
April 2006	Start of second construction phase
November 2006	End of second construction phase
November 2006	ISO 2000/9001 certification
January 2007	Awarding of Azalea Prize by city of Wuxi
January 2008	ISO 14001: 2004 environmental management system certification

The heart of THK quality: *Monozukuri*

The WUXI Plant's quality control operations are based on the same system THK employs in Japan. This means that the local employees have to maintain the same commitment to quality that THK requires of its employees in Japan. For this reason, candidates for managerial and supervisory positions undergo three months of training in China and another two months of training in Japan in order to become thoroughly educated in the practice of Japanese-style *monozukuri*. During their time in Japan the trainees learn about work flows and processes as well as the specific tasks involved in quality control, and they are encouraged to experience Japanese-style work practices with all five senses, to help them grasp the true significance of their duties.

Each year the WUXI Plant institutes its own policies in accordance with the progress of its operations. The plant also cultivates its human resources, promoting the attitude that *monozukuri* involves not only technology and precision but high quality in the broadest sense, which means meeting the customer's needs, constantly pursuing improvements, and keeping costs to a minimum. In addition, the WUXI Plant has developed its own set of activities to promote improvements in quality, some of which go beyond the activities seen in Japanese plants, in an effort to encourage the ongoing pursuit of quality.

Employees take part in quality improvement activities.

The local community: Showing respect and earning trust

Japanese companies operating in China should set an example as law-abiding businesses, strictly adhering to the provisions of laws protecting the environment and the rights and interests of consumers and labor. They should manage their business in a manner that engenders trust and take the lead in communicating with the local community. The WUXI Plant has contributed to economic development and helped generate employment in the Wuxi region, and it has also played a role in the technological development of Chinese industry as a whole, promoting greater awareness of the need for technological innovation.

In 2007 the plant was awarded the Azalea Prize by the city of Wuxi for its contributions to the city's development and for expanding interaction with the local community. The WUXI Plant will continue to conduct its operations with respect for both Japanese and Chinese culture and lifestyles and will continually seek to earn the community's trust.

Awarding of the city of Wuxi's Azalea Prize

Creating a satisfying work environment

The WUXI Plant has created a special section to help educate employees about safety and the environment as part of a concerted effort to establish an occupational health and safety management system. The plant provides thorough safety education, conducts hazard-forecasting and other safety-related activities, continually encourages 5S activities,* and organizes safety patrols. By these and other means the WUXI Plant has created a work environment embodying the principle of safety first.

Attention is devoted to improving employee skills and developing multiskilled workers through on-the-job training. In addition, the plant enlists the cooperation of external educational institutions and training organizations to equip employees with special skills and qualifications. Embracing the principle that *monozukuri* itself is a great incubator of human resources, the WUXI Plant has established a mutually beneficial relationship with its employees through its educational and training activities.

* The 5S rule calls for *seiri* (order), *seiton* (tidiness), *seiketsu* (cleanliness), *seiso* (cleaning up), and *shitsuke* (discipline).

A leadership training session

In their own words **A local employee's training experience at the YAMAGATA Plant**

Zhang Ping
KR assembly employee
THK MANUFACTURING OF CHINA (WUXI) CO., LTD.

The THK WUXI Plant was about to start producing KR-type LM Guide actuators, so I was sent to the YAMAGATA Plant for a month of training. During the training period I learned how to assemble KR-type actuators and also learned a lot about other aspects of my work. People at the YAMAGATA Plant work very fast and don't waste any time doing things that aren't necessary. Watching them work so efficiently was very educational.

I received training in assembling standard KR-type actuators, which are completely different from the type I had been working on previously. There were a lot of parts, and they were difficult to assemble. I received warm encouragement, however, so my training went smoothly and I was able to learn the basic procedures and work flow. The training only lasted for a month, though, and I feel that I still have a lot to learn. When I get back to the WUXI Plant, I'm going to devote myself to the successful start-up of KR-type actuator production and try very hard to pursue top quality in everything I do. I'll never forget the valuable experience I had in Japan, and I intend to make use of what I learned in my future work, to keep raising the WUXI Plant's profile within the THK Group.

Zhang Ping, at left, undergoing training at the YAMAGATA Plant