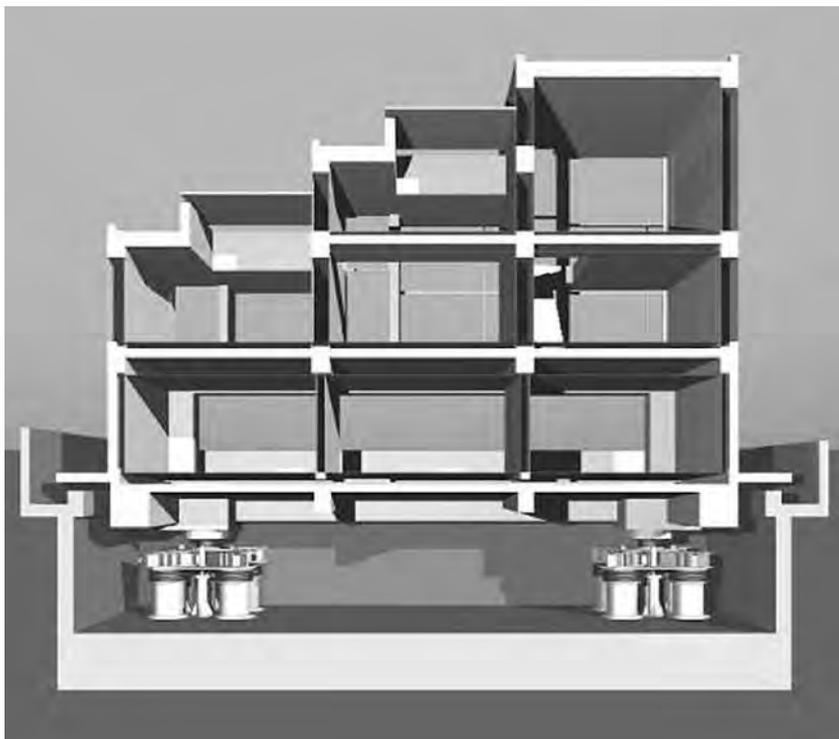


## WECC2015



Clockwise from top left; an image of the seismic isolation system KKE installed in a residential building in Tokyo's Suginami Ward; Rikkyo Gakuin University Main Dining Hall retrofit by KKE; the Faculty of Law Bldg. 3, University of Tokyo, also retrofit by KKE KKE

# More seeking disaster-risk reduction technologies

Kozo Keikaku Engineering (KKE) Inc.'s disaster-risk reduction technology is needed globally, especially in those Asian countries prone to earthquakes.

After the 8-magnitude earthquake hit Nepal in April, KKE, which has consulted on the structural designs of various well known buildings, including the Guam Palace Hotel, Shanghai World Financial Center and Istanbul's Swissotel The Bosphorus, has received a number of inquiries on its technology and services. Businesses and governments in countries that do not have Japan's level of quake-resistant technology are asking KKE to evaluate their key structures.

In addition to others, this year KKE has received inquiries on school buildings in Nepal and fire stations in Bangladesh. To meet growing demand and pursue the possibility of providing its engineering technology in Asia, the company established a subsidiary in Singapore this year.

KKE employs a variety of technologies to reduce risks of earthquakes, tsunami and other disasters. It designs structures, evaluates and retrofits existing structures and provides new structures with solutions with respect to seismic isolation.

Quake-resistance evaluations for existing structures and subsequent structure reinforcements are among



Mio Mochizuki

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KKE's areas of expertise.

The company has inspected about 1,700 buildings so far. The types of structures evaluated range from hotels, residential complexes and hospitals to historic structures, one of which is the Faculty of Law Bldg. 3, University of Tokyo, built in 1927 and registered as a Tangible Cultural Property of Japan in 1998.

Since the disaster in March 2011, demand rose in and outside of Japan for quake-resistance evaluation due to a general increase in awareness of disaster risk reduction.

KKE has received an increasing number of such requests, especially from schools and hospitals that typically become shelters in case of emergency.

Mio Mochizuki, a young architect with KKE, has been working with the company's core technology and currently works on evaluating the quake resistance of structures and providing advice to solve customer problems.

Mochizuki says that most structures that were built before the amendment of Building Standard Act in 1981 do

not meet the current standard or could be more vulnerable in a major seismic event. Old buildings that underwent remodeling or expansion could also have a low seismic performance, thus seismic evaluation is considered significant nowadays, especially with facilities such as hospitals, hotels and schools where many people gather.

Based on requests from customers such as factories, hospitals and residential building operators, KKE conducts evaluations and retrofits in a way that allows them to continue regular operations, by using its seismic-isolation equipment.

With such constraints and limits KKE adopts the best approach to address the structural deficiencies by considering continuity of building operations, functionality, cost and constructional workability.

For example, in a project on the Tajima Joint Government building in Fukushima Prefecture, the retrofit construction was carried out with most of the furniture and building contents unmoved, allowing office work not to be disturbed by the retrofit work.

"There are some cases when a client with cultural value structures, such as brick buildings erected more than a hundred year ago, wishes to maintain the structure's exterior appearance. In such cases, we make proposals after discussing how the client plans to use the structures. For instance, we have proposed reinforcement construction that involves installing support devices or building support walls inside," she said.

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Evaluating and retrofitting cultural heritage sites contributes to the preservation of landmark structures and the revitalization of remote areas. It is not easy to find the best solutions for cultural heritage structures, which have no guidelines on quake resistance, by using analytical technology.

But KKE makes it possible with its expertise to combine professionals in not only structural design, but also ground solidity evaluation and structural analysis.

"There are many cultural structures that have never been inspected. I would like to be more involved in those kinds of jobs in the future," Mochizuki said.

Before her work on evaluation retrofitting for existing buildings, Mochizuki was in a department dealing with KKE's seismic isolation systems for new buildings,

giving her valuable experience for her current job.

Seismic isolation systems function as a cushion between the earth and a structure, reducing the shaking of the structure dramatically during a major earthquake.

In 2009, KKE installed a 3-D seismic isolation system, which reduces both horizontal and vertical shaking using "Hyper Air Suspension" technology, under a residential building in Tokyo's Sugunami Ward. That was the first instance in the world in which a residential building had a 3-D seismic isolation system installed.

The company had begun the project of 3-D seismic isolation systems after a huge quake hit Niigata Prefecture in 2004, when a designated national treasure, Jomon pottery, fell and broke from a seismically isolated table designed to mitigate horizontal vibration. In Japan, there are many active fault lines that could possibly experience inland quakes, which could cause heavy damage due to vertical

vibration. Because of this, prompt and effective countermeasures were needed.

KKE has close connections with universities, including one with a professor who has been working on a 3-D seismic isolation project.

When it was thought the 3-D seismic isolation system became technically viable, KKE raised its hand to test it and built a building that implemented the 3-D seismic isolator.

"In one of our engineering teams, more than half of its members are non-Japanese. As the world requires earthquake-resistant technologies more than ever, we are increasingly interested in expanding business overseas," said Mochizuki, who is planning to obtain further architectural certifications to broaden the scope of her career.

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