

Stronger than 1923

Great Kanto Earthquake may have registered a higher magnitude on the Richter scale, but it pales in comparison in terms of gravity measurement, acceleration

Just as death toll continued to mount, new revelations came out each day about the massive energy of the Jan. 17 earthquake, which seems to have gone beyond the long-established assumption of civil engineers.

On Jan. 20, the Meteorological Agency revised upward the intensity of the quake for part of Kobe and northern Awaji Island to seven, the maximum, on the Japanese scale. It was the first time since the seventh scale was adopted in 1949.

Three days later, the Construction Ministry reported that the gravity measurement registered in the temblor in Kobe was more than twice that of the Great Kanto Earthquake of 1923.

In terms of magnitude on the Richter scale, the Jan. 17 quake registered 7.2, smaller than 7.9 registered in the 1923 quake.

But the gravity measurement registered by the Jan. 17 quake was as high as 833 gals in Chuo Ward, Kobe, compared with an estimated 300-400 gals in the case of hardest-hit area in the 1923 disaster.

One gal is a unit of acceleration equivalent to 1 cm per second squared.

Three weeks after the earthquake, a scientist came up with other data showing that the quake was the most violent in modern Japanese history, shaking the ground with a horizontal acceleration of 8.17 meters per second per second.

Fumio Yamazaki, an associate professor at the University of Tokyo's Institute of Industrial Science, said the temblor's vertical acceleration was 3.32 meters per second per second.

Peter Hadfield, author of "Sixty Seconds That Will Change The World," a book that examines the likely effects of a major quake hitting Tokyo, said the horizontal shock recorded in Kobe was roughly equivalent to a gravitational force of 0.8 G.

Such a force, he explained, "would be like being thrown sideways at the speed you would reach when jumping off a building."

According to Yamazaki, the quake also featured a horizontal velocity of 89.3 cm per second and a vertical velocity of 39.6 cm per second.

Yamazaki calculated the quake's acceleration, velocity and displacement using data provided by the Kobe Maritime Meteorological Observatory.

No wonder the unimaginable should happen.

Nine bridges collapsed in the quake, including part of the Hanshin Expressway linking Kobe with Osaka. A 500-meter-stretch of the expressway fell on its side when support pillars snapped at their bases.

The earthquake damaged the main steel pillars of high-rises in Ashiya, Hyogo Prefecture, shaking the assumption that tall buildings are temblor-proof, according to officials of an Osaka-based

contractor Takenaka Corp.

Of 52 apartment buildings in Ashiyahama Seaside Town built on reclaimed land, 21 that are between 40 and 70 meters tall suffered damage to their main pillars, according to officials of the firm, which designed and constructed them.

It is the first known instance of quake-caused damage to this type of support structures for skyscrapers, experts said.

Stricter design criteria are applied to buildings of 60 meters or higher, but some experts said that Japan should review its tendency to construct higher buildings as well as its criteria for making skyscrapers quake-resistant.

Takenaka officials said they will repair the pillars by welding on sheets of steel.

The apartment buildings, completed in 1979, each have eight main hollow pillars made of steel up to 5 cm thick. They measure up to 50 cm by 50 cm.

The damage will be repaired quickly, but some residents have evacuated on their own initiative.

In one of the 70-meter skyscrapers, six of eight pillars were damaged.

Hisao Mukai, vice director of the design department at Takenaka's Osaka headquarters, said that even in their present condition, the buildings can withstand an aftershock registering 5 on the Japanese intensity scale of 7.

Mukai said the earthquake showed that the current design criteria for skyscrapers, aimed at preventing their collapse, are suitable.

Kiyoaki Takeyama, an assistant professor of construction planning at Shoin Jogakuin Junior College, said some of the buildings have become dangerous, and he added that skyscrapers other than those in the Ashiya housing complex may have also suffered damage to their main pillars.

Kobe city officials also reported that about 16 percent of the pillars in the city subway's section between Sannomiya and Shin-Nagata stations were severely cracked in the quake.

It is said to be unusual for subway structures to be damaged by an earthquake, and Transport Ministry sources said they plan to review quake-resistant standards for subways.

Approximately 30 steel and concrete pillars supporting Sannomiya Station in Chuo Ward were found to be cracked. In Kamisawa Station, Hyogo Ward, 40 pillars were damaged.

Fifty pillars were severely damaged each between Kamisawa and Nagata stations and between Nagata and Shin-Nagata stations, the officials said.

However, platforms and concourses at the stations of the city subway have been left almost intact, they said. (Kyodo)