

MORE ROBUST BUILDING TO PROTECT OUR CHILDREN IN THE SEISMICALLY ACTIVE COUNTRY, JAPAN

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Earthquake Disasters Will Not Stop Even In the 21st Century

Many technologies have been developed in the 20th century and researches on seismic engineering also had notable progress. However, painful and terrible earthquake disasters do not stop even in the 21st century. There is no meaning of doing research or writing papers if these do not strengthen our house, school, hospital, and company. I regret not being able to spread out simple messages; not to live in a weak building and housing, and not to live in tsunami hazard zones.

Building is one of the basic human needs. Building needs sufficient toughness and weight to act as a shelter and protect privacy of weak and soft human. If we truly try to mitigate damages from earthquake, the shelter should not collapse.

Seismic Design Standard in Kumamoto Prefecture

The zone factor that represents the risk of earthquake used for seismic design defined in the Building Standard Law is 1.0 for Tokyo and Osaka. 0.8 is the zone factor of Fukuoka, Saga and Nagasaki prefectures in Kyushu region, while Kumamoto uses the factor of 0.9, and this suggest that Kumamoto has relatively high risk of earthquake amongst other Kyushu prefectures.

By looking at the damages from the recent Kumamoto earthquake in Mashiki City, the destructive force of the main shock was equivalent or large to the one of Great Hanshin/Awaji Earthquake. Therefore, the actual power of earthquake in Kyushu is not any smaller than Tokyo or Osaka. Only the difference is the frequency of earthquake occurrence is lower. It is questionable that if it is correct to construct a building that is relatively weaker only because the frequency is lower.

In California State, there are certain areas on the faults where buildings are prohibited to be constructed. Seismic design level changes with respect to the distance to the nearest faults. These design concepts should be introduced to Japanese Building Standard Law, considering local disaster from the recent earthquake in Mashiki-cho, Kumamoto.

Building Standard Law Is a Minimum Standard

Building Standard Law is a minimum standard that is based on the sentence "The right to own or to hold property is inviolable" from The Constitution of Japan. Hence, the national standard cannot impose to the citizens excessively regarding the enough strength of the buildings against biggest earthquake expected in construction site. The aim of the standard is for building to withstand against one big shake such as the recent Kumamoto earthquake event, and under this standard, the building is allowed to have permanent large deformation

and end up being demolished after the earthquake, as long as it does not collapse instantly. Japan is located in a very active seismic zone, there are chances of having the next big earthquake once in hundreds or even thousands of years anywhere. The number of partially or completely collapsed houses suggested that the buildings are required to be built stronger, and evaluation of building seismic capacity and seismic retrofitting of old buildings and houses should be carried out and completed.

Consecutive Earthquakes

Kumamoto earthquake began at the night of 14th April, followed by a series of aftershocks. The main shock occurred only 2 days later in the early morning of 16th April, and more aftershocks continued on. These consecutive earthquakes are not being considered in current seismic design procedures.

Such consecutive earthquakes progressively weakened the ground, foundations and even causes partially collapsed buildings to fully collapsed. If second earthquake was to strike next day, there will be no time for emergency safety inspection on many buildings or housings. As a building is a place for people to live-in, it is natural for residents to return to their houses after the earthquake. It is a big problem that ordinary residents return to their houses without knowing that severe structural damages had occurred to their houses.

Loss of Trust in Building Structure and Persistent Effort by the Structural Engineers

It was very disappointed that while building structures are being built to protect people's lives, it turnout to be what people fear the most, because buildings are vibrated, deformed and even collapsed after a series of attacks from each round of earthquake.

The earthquake-resistant technology is slowly developed by structural researchers and engineers. Base isolation and passive controlled buildings are becoming more common. There are 22 base isolated buildings in Kumamoto, and the isolation layer have moved a lot during the earthquake, but there were no damage to the buildings. There was also no loss of trust to the buildings.

We should not get lost in the middle of a large natural disaster, but we need to develop better technologies and spread to the world.