RECENT RESEARCH ACTIVITIES

Experimental seismic response of a full-scale Japanese conventional wooden post and beam building

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Introduction

While Japanese conventional wooden post and beam buildings have been designed to perform well with regard to life safety requirements in regions of moderate to high seismicity, it was found these types of low-rise structures have sustained significant structural and nonstructural damage in recent earthquakes, such as 2016 Kumamoto Earthquake. However, load path and dynamic response in post and beam construction arising during earthquake shaking are not well understood.

Figure 1. Test buildings with different seismic performance.

We have conducted some shake table tests to discuss the dynamic characteristic and the seismic performance of a full-scale, two-story, Japanese conventional wooden post and beam townhouse buildings. These test buildings have different seismic performance (Figure1) and the damages observed from the tests were compared with the damage observed near seismic station (KiK-net, Mashiki-town, Kumamoto).

Research subjects

Damage comparison with test buildings

Shake table tests were conducted for the building in accordance with the minimum requirement of the Building Standard Law of Japan. As a result of the tests, the extent of damage almost agreed with the result of the survey in the disaster area, and this test building which complied with the standard law did not collapse even two mainshocks were input (Figure 2).

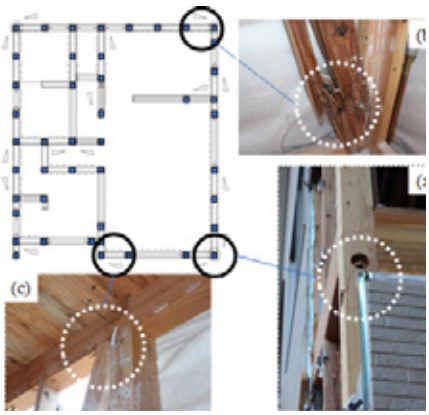

Figure 2. Observed damage to the test building with minimum requirement.

High performance building twice the minimum requirement

On the other hand, the test building with high seismic capacity performed quite well during all earthquakes and there was no damage to structural components but some failure on gypsum boards or sidings. The inter-story drift was 80 mm, which is below the safety limit even input more than 20 major earthquakes recorded in Japan.

Future plan

In the place 350 m away from KiK-net station, the building based on the new standard after 2000 collapsed, but other buildings following the old standard around it did not collapse (Figure 3). The cause of collapsed house seems to be the local site effect of ground motion or inadequate seismic design or construction, and further consideration is required for this cause.

Figure 3. Collapsed building near the KiK-net station.

References

[1] BRI (Building Research Institute) and NILIM (National Institute for Land and Infrastructure Management), “2016 Kumamoto Earthquake Building Survey Report”, 2016. http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0929.htm.