

JAPAN

The Tohoku Earthquake and Tsunami of March 11, 2011 and their Impact on Cultural Heritage

The March 11, 2011 earthquake measured a magnitude of 9.0 on the JMA intensity scale. The subsequent tsunami was 8–9 m high, which eventually reached an upstream height of up to 40 m, causing vast and heavy damage over a 500 km span of the Pacific east coast of Japan. Numerous cultural properties were devastated by the earthquake and the tsunami, including about 600 nationally designated cultural properties. The earthquake was characterised by relatively minor damage to buildings, including wooden buildings, caused by ground motion. Instead, short-period structures such as masonry constructions, mud-wall warehouses and stone-retaining walls over a wide area were greatly affected. In addition, ground motions with a long duration lasting more than three minutes caused liquefaction of soils. Some of the “Important Preservation Districts for Groups of Traditional Buildings” were seriously affected by such liquefaction.

Wooden Structures

On the whole, damage to structures built according to traditional timber framework methods was only minor. Nevertheless, there are some sad exceptions:

The main building of the old Yubikan (Japan’s oldest school located in Osaki City, Miyagi Prefecture, built in 1691) collapsed. It is located in the region with the strongest measured tremor. The main building had little earthquake-resistant elements; therefore, it is believed that it was fundamentally lacking in horizontal resistant capacity. The building had already suffered damage during another earthquake in 2008.

The former Baba Family Residence (mid-Edo era) located in Aizu-gun, Fukushima Prefecture, has little earthquake-resistant elements and therefore the building is now tilting.

Other national treasures made of wood, such as the Zuigan-ji temple in Matsushima, or the Osaki Hachimangu Shrine in Osaki City, were only slightly damaged.

Quite a number of dozo (mud-wall warehouse) buildings were damaged. The Mori Goshi Gaisha storehouse shows that the eaves have collapsed and the earthen wall has cracked.

Some wooden buildings were not destroyed or damaged by the earthquake, but by the ensuing tsunami. For instance, in the harbour town of Kesenuma City, Miyagi Prefecture, home to many registered cultural properties built at the beginning of the 20th century, the Kakuboshi shop was swept away.

A recovery program making full use of this historical landscape will be required for this district in the future.



Yubikan, main building of the historic site, before the earthquake (top) and after (bottom)

Fukushima City, United Church of Christ in Japan before the earthquake, now demolished (photo: Otraff wikimedia.com)





Damaged house in Makabe



Collapsed masonry walls of Komine Castle

Masonry Structures

On the whole, the earthquake had a larger impact on buildings with a short natural period such as stone and brick-constructed buildings. However, the total number of masonry buildings in the affected area is lower than the number of wooden buildings.

There are a lot of structures made of oya-stone (tuff) across the region; many of them suffered serious damage. Damage to stone

pagodas vulnerable to ground motions could be seen in various regions. For example, many stone pagodas designated as important cultural property collapsed at the Toshogu Shrine in Sendai City. In Fukushima City, the brick-constructed and registered tangible cultural property, the United Church of Christ in Japan, was damaged and subsequently demolished by the owners due to concerns for the safety of the church goers. In Tsuchiura City, Ibaraki Prefecture, there is a district with brick storehouses from the Taisho era to the Showa era. One of those, the Machikado Kura Nomura storehouse, sustained significant damage with cracks appearing in the walls.

Reinforced Concrete Structures of Modern Heritage

In the Tohoku region there are seven reinforced concrete structures selected by Docomomo Japan, three of them in the strong motion zone. One of them is the Furukawa Civic Hall built in 1966 where non-structural components cracked and underwent deformation. At the Ishioka No. 1 Power Plant in Ibaraki Prefecture completed in 1911 and designated a nationally important cultural property in 2008 the structure itself was not destroyed, but the virgin soil supporting the bottom of the tank collapsed and the tank was unable to hold out. Since the recovery of this tank is impossible, the important cultural property status was removed.

Groups of Traditional Buildings

Two preservation districts with groups of traditional buildings, Makabe, Sakuragawa City (Ibaraki Prefecture) and Sawara, Katori City (Chiba Prefecture) sustained extensive damage. At Makabe, 70% of the 106 traditional structures were affected by the disaster (damages to ceilings and walls). However, collapsed buildings were scarce, demonstrating that Japanese traditional houses are resistant to earthquakes. Also at Sawara, approximately 70% of the 92 historic structures were affected. The damage to roofs was particularly extensive, including caved-in ridge tiles, falling tiles, cracks, and caved-in external walls.

Historic Sites

Castle remains dating back to the early modern period (late 16th to early 17th centuries) are usually made up of masonry walls. Some of these walls sustained considerable damage during the earthquake. For instance, at Komine Castle, Shirakawa City (Fukushima Prefecture) the walls collapsed in ten places and other parts suffered damages such as loosening, bulging, and cracks. Apparently, some damages were also due to previous flawed restoration methods, as the shape and stacking method of newly added stones were faulty.

Places of Scenic Beauty

The Takata-Matsubara scenery is backed by beautifully shaped mountains. It also includes a reef formed by a sandy beach as well as by pine trees growing densely there. The eastern half was greatly eroded by the tsunami, and the few surviving trees were harmed by salt water. Moreover, it is believed that



Takata-Matsubara, only one red pine survived

the width of the reef from north to south has reduced to one third.

The Rikuchu Kaigan National Park stretches 180 km from Iwate Prefecture to Miyagi Prefecture. Its entire coastal region sustained extensive damage due to the tidal wave, and out of a total of 124 facilities 18% were totally destroyed and 31% partially.

The Matsushima Nobiru Area sustained the largest damage among the designated districts. There, along the Matsubara Coast pine trees were literally uprooted and carried away by the tsunami so that considerable efforts and patience are required to restore this place of scenic beauty.

In the gardens of the already mentioned Yubikan not only the buildings were damaged. Also the river wall on the shoreline subsided and suffered cracks. Furthermore, the river banks required extensive repairs.

*Statements taken from the information brochure
The Great East Japan Earthquake – Report on the
Damage to the Cultural Heritage, published
by ICOMOS Japan in November 2011*