

## Tohoku Pacific Earthquake on 11 March 2011 Reports by ICOMOS Japan

This document includes reports up to 27 March 2011, and will be updated with follow-up reports

### Flash report on damages to cultural properties and buildings, sceneries and historic sites - 27 March 2011

by Dr. Toshikazu Hanazato, representative of ICOMOS Japan on the ICOMOS International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage (ISCARSAH)

#### 1 Overview of the earthquake disaster

The overall picture of the disastrous effects of the Tohoku Pacific Earthquake that struck on 11 March 2011 has not yet been established after 12 days. However, its main characteristics can be outlined as follows:

- The total number of deaths and missing persons brought about by the tsunami amounts to about 23,000 as of 22 March, and this number could further increase.
- Unlike the devastating Kobe earthquake of 1995, whose shallow focus directly underneath the metropolitan area caused damage to a concentrated area on the fault line, this earthquake has had an impact on a much broader area. It not only directly affected a massive area of Eastern Japan but also triggered nuclear disaster.
- Most of the areas damaged by the 11 March earthquake had already experienced great earthquakes of magnitude 7 in the recent past: Miyagiken-oki Earthquake of 12 June 1978 (Mag. 7.4), Iwate Miyagi Nairiku Earthquake of 14 June 2008 (Mag. 7.2), Chibaken-Toho-oki Earthquake of 17 December 1987 (Mag. 6.7)
- Most of the buildings were destroyed or washed away by the tsunami and not so much due to strong ground motion. Some traditional wooden buildings are reported to have collapsed, however the percentage of houses that collapsed due to strong ground motion is comparatively lower than for the Kobe Earthquake of magnitude 7.3. This is due to the fact that in the affected areas the earthquake resistance capacity of buildings had been ensured following the relatively recent large earthquakes mentioned above, which reached intensity X under the Modified Mercalli Intensity Scale (MMI) which corresponds to intensity scale 6 positive under the Japan Meteorological Agency Intensity Scale (JMA).
- Damages to reinforced concrete buildings, built before the revision of seismic design regulations under the Japanese Building Code of 1981, have been recorded.

#### 2 Features of the earthquake's ground motion

The 11 March earthquake was an interplate earthquake located around the boundaries of two tectonic plates, caused by the subducting of the Pacific Plate into the North American Plate. Its Moment Magnitude was 9.0, which is similar in size to the Sumatra Earthquake of 26 December 2004, and the rupture area of the fault is estimated to measure 500km x 200km (according to NIED).

Areas that experienced the earthquake at a scale of intensity X or greater (according to the MMI scale) spread out from Iwate prefecture to the northern part of Ibaraki prefecture. Strong ground motions, with acceleration levels exceeding 0.5G, were recorded at a number of seismogram stations across this wide area. Furthermore, acceleration levels of ground motions as high as 1.0G were recorded at some places. However, according to the Earthquake Research Institute of the University of Tokyo, the spectral characteristics of records of strong motions – reaching intensity X or greater – show that the component of 1 to 2 second periods (which have a great impact on traditional wooden houses) was about 1/3 of that witnessed for the Kobe Earthquake in 1995. On the other hand, in comparison to the Kobe earthquake, the component of short periods (less than one second) predominated. This suggests that progressive collapse is unlikely to happen for the

traditional wooden buildings. Places distant from the epicentre, such as Tokyo, were affected by the ground motions with longer periods. Tokyo Tower, a cultural heritage structure constructed in 1958 which measures 333m, suffered the bending of its tip.

### **3 Damage to cultural properties and buildings, sceneries and historic sites**

Damages caused by the earthquake to officially designated cultural sites were reported for an area spanning over 600km from Aomori prefecture to Kanagawa prefecture. As of 22 March, damages to around 296 designated sites were reported, but this number will increase as the site surveys continue.

Following the 1995 Kobe Earthquake, the impact of earthquakes on historic buildings has attracted increasing attention in Japan. Therefore, following the 11 March earthquake, the media immediately reported damages suffered by cultural sites. Furthermore, a list of damaged buildings was also set up within a few days by the Japanese Government Agency for Cultural Affairs.

According to that list, most of the officially designated cultural sites have escaped major destruction. Besides damage at some sites to stone lanterns, mud-walled warehouses and gravestones, the only two sites that suffered major damage are: Ibaraki University, Goura Bijutsu Bunkazai Research Center, Rokkakudou Hall (Ibaraki prefecture), lost due to the tsunami, and Kyu Yuubikan in Miyagi prefecture, which recorded the strongest intensity on the earthquake scale.

As described above, one of the characteristics of this devastating earthquake was its great magnitude accompanied by strong short-period motions, which affected buildings with short natural life-spans such as mud-walled warehouses. Most of the damages reported are cracks on mud-walls or on plaster finishing, fallen roof tiles, fractured glass windows and three collapsed ceilings. In particular, non-structural elements of such roof tiles, windows and ceilings were affected.

Protected areas of important traditional buildings (Makabe, Sakuragawa City, Ibaraki prefecture) also experienced damages to mud-walled/stone warehouses. A similar situation has been recorded in the traditional townscape of Kiryu City, Gunma prefecture, where many of the registered cultural properties suffered the collapse of mud-walled houses and roof tops.

In areas where the earthquake intensity exceeded X on the MMI scale, no major destructions have been reported as they did not contain historically valuable masonry buildings. On the other hand, heritage linked to industrial modernization, such as a powerhouse aqueduct, have been included on the list of damaged government registered civil structures.

However, the collection of data on damages to cultural properties and registered buildings at Prefecture and Municipality level is still underway. Damages to unregistered historically/culturally valuable properties and historic townscapes have not yet been ascertained. A complete survey to comprehend the overall impact on cultural heritage should be undertaken as early as possible, in cooperation with the Institute of Architecture and other organizations.

On the Pacific coast, devastated by the tsunami, Tohoku, whose 200km coastline was registered as a National Park, included beautiful areas. The cities and settlements located along the coast having witnessed many disastrous tsunamis in the past; not many heritage structures remained in the area.

The State registered special scenic beauty area of Matsushima, bearing both natural and cultural values, was also devastated by the earthquake. Its beautiful natural scenery of tiny islands floating in the bay has been damaged by the tsunami. Luckily the cultural sites escaped major destruction; both Zuigan-ji Temple, a national treasure built in 1609, and the important cultural property of Godaidou Temple, escaped the tsunami.

### **4 Activities in support of the recovery of damaged cultural properties, townscapes and natural sceneries**

Activities underway are focused on emergency rescue and lifesaving. Simultaneously, over 200,000 refugees require help to continue their lives. However, in the coming reconstruction period, the

restoration of historic sites and sceneries will also need to be addressed. Sites registered at State, Prefecture or Municipal level will be protected by law. However, damaged unregistered historic buildings are likely to be demolished and dismantled. Following the 1995 Kobe earthquake, many historic buildings were classified as “dangerous” during the rapid inspection of damaged structures and were dismantled.

Therefore, Hyogo prefecture established a “Heritage Management Institution” to train experts to conserve historic buildings regardless of whether or not they are registered at the State or Prefecture level. This institutional system has not yet been introduced in the areas affected by the 11 March earthquake. Current operations are focusing on rapid inspection of damaged structures, in order to ensure that wooden houses cope with aftershocks. However, the preservation of historic sites and cultural sceneries needs to be taken into account in the coming period of reconstruction and emergency countermeasure.

ICOMOS Japan has resolved to cooperate with the ICOMOS International Scientific Committee on Risk Preparedness (ICORP) and other international organizations to support the restoration of damaged cultural properties, townscapes and sceneries and to cooperate with international assistance and support.

## **5 Websites with related information**

Japanese Agency for Cultural Affairs: Damages to cultural properties in the “2011 Tohoku - Pacific Ocean Earthquake” (As of 24 March 2011 at 5:00 am)  
[http://www.bunka.go.jp/english/pdf/2011\\_Tohoku\\_ver5.pdf](http://www.bunka.go.jp/english/pdf/2011_Tohoku_ver5.pdf)

**Damages to national properties caused by the 11 March earthquake  
First report on 22 March 2011**

By Kazuyuki Yano, Secretary General, ICOMOS Japan

A huge earthquake of magnitude 9.0 hit North Eastern Japan at 2:46 pm on 11 March 2011. This disaster caused the death of a large number of persons and loss or damage of many properties, including many cultural properties.

I appreciate all the care shown and words of encouragement sent by ICOMOS colleagues. Fortunately, I can report that no ICOMOS Japan members were killed or are missing. However, over 20,000 people may have died or are missing due to the earthquake and Tsunami, which can be considered to be one of the largest natural disasters Japan has suffered.

Most victims were caused by the Tsunami, rather than the earthquake. Considering that Japan has witnessed so many Tsunamis in the past, that even the word "Tsunami" used to describe this phenomenon is Japanese, some may wonder why the damage has been so devastating this time. This earthquake has been the biggest recorded in Japanese history since earthquake measuring systems have been introduced, and the resulting Tsunami exceeded all predictions; reaching 10-15 meters, or even 20 meters in places.

The Japanese Agency for Cultural Affairs is now working to collect all information on damage to cultural properties, however the situation remains unclear. So far almost 240 nationally designated or registered properties have been found to have been damaged. This number could double or triple once cultural properties designated by local government and unregistered properties are included in the count. Among the damaged properties identified so far, only few are severely damaged or have totally collapsed. Most suffered minor damages, such as cracks in walls or damaged roof tiles.

However, the famous "Matsushima", one of three representative sceneries in Japan, has been severely damaged by the Tsunami, and some of its cultural properties suffered collapse (although they are repairable). Major damages are less compared to those caused by the Han-shin Awaji Earthquake which struck Japan 16 years ago. The reason for this could be the difference in the earthquake's frequency. However, damaged properties are spread over a wide area (over 700km in the north and south, and 100-200 km in the east and west). Although most of the damage is minor, the cultural properties affected are many.

The "Shrines and Temples of Nikko", one of Japan's UNESCO World Heritage sites, did not suffer much damage, and "Hiraizumi - Temples, Gardens and Archaeological Sites representing the Buddhist Pure Land", currently on Japan's Tentative list, was also spared major damage.

We can expect to encounter many problems during the recovery process. For now, we are making all possible efforts to collect information and to analyze it. We will report back once these analysis have been made, based on the Agency of Cultural Affairs' information.

Lastly, the critical situation at a nuclear plant caused by the Tsunami is being broadcast all over the world, and people should be very worried about it. However, Tokyo has so far not been affected by radiation and we continue our normal activity.

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