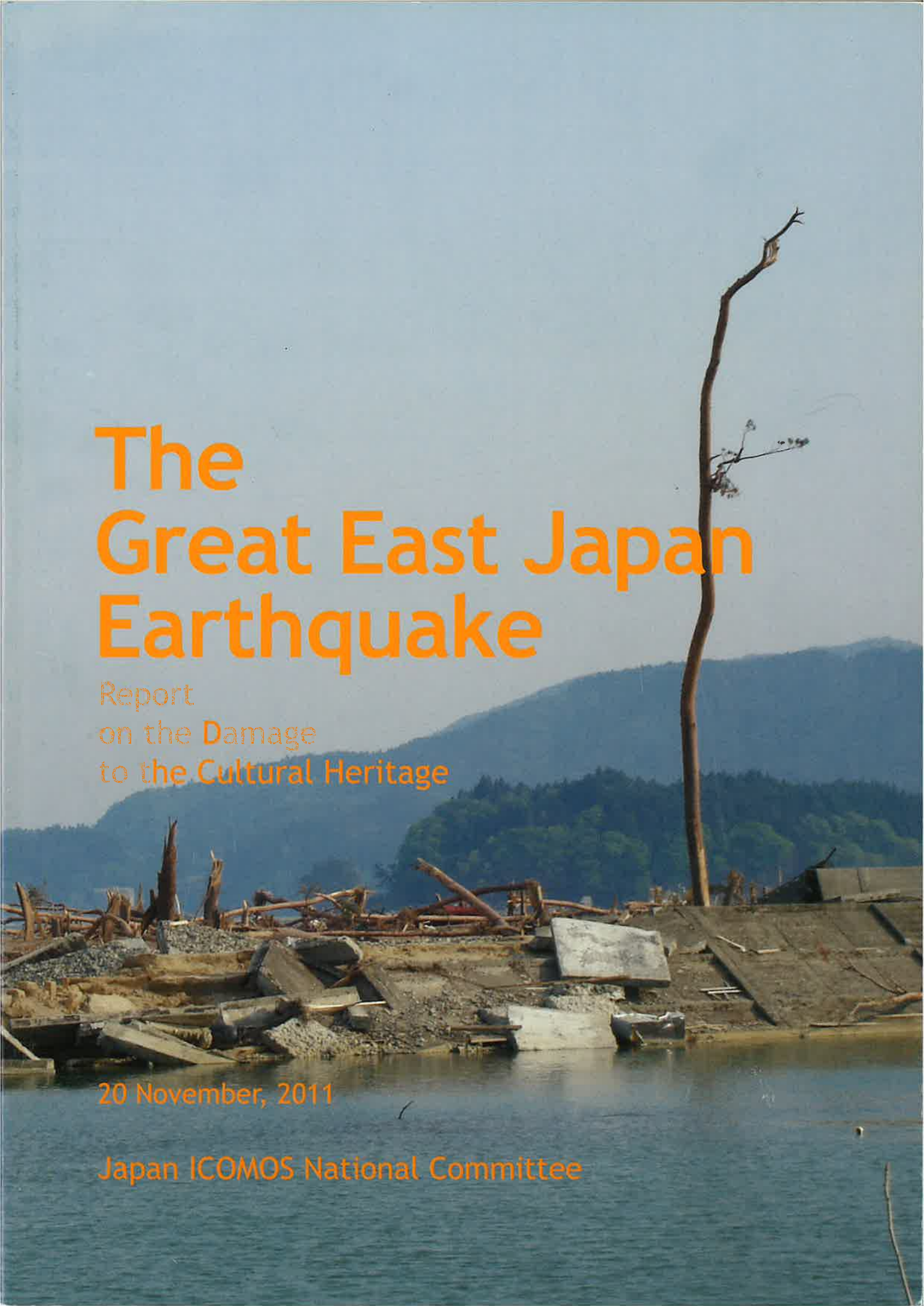


The Great East Japan Earthquake

Report on the Damage to the Cultural Heritage

20 November, 2011

Japan ICOMOS National Committee

The
Great East Japan Earthquake
Report
on the Damage
to the Cultural Heritage

A ship washed up on the rooftop of an building by Tsunami (Oduchi Town, Iwate Prefecture)

Collapsed buildings (Kesennuma City, Miyagi Prefecture)

Introduction

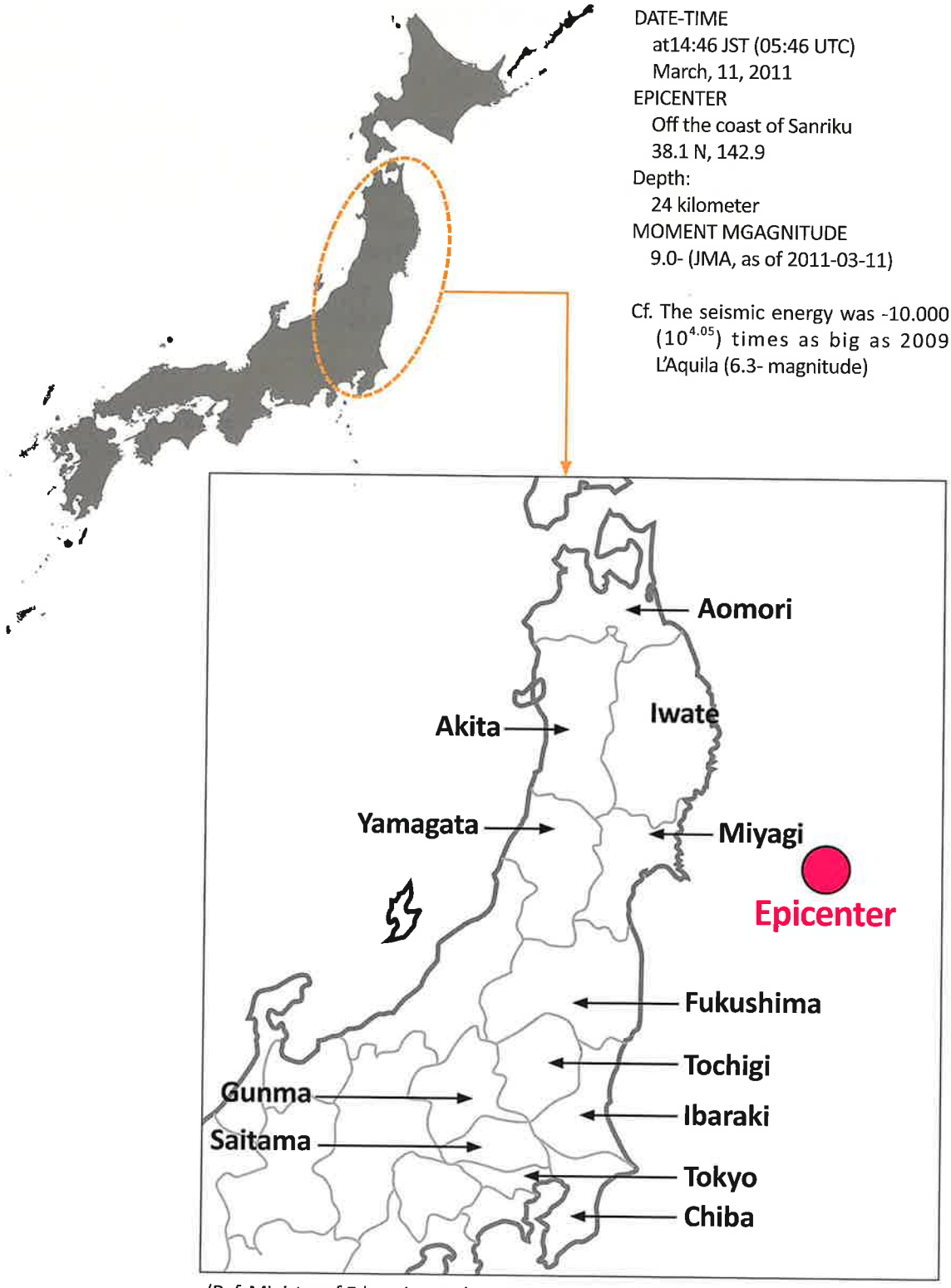
The Tohoku Earthquake (East Japan Great Earthquake) which occurred on 11th March 2011 was a tremendous earthquake measuring magnitude 9.0. The tsunami caused by this earthquake was 8-9m high, which subsequently reached an upstream height of up to 40m, causing vast and heavy damage over a 500km span of the pacific east coast of Japan (the immediate footage of the power of such forces now being widely known throughout the world). The total damage and casualties due to the earthquake and subsequent tsunami are estimated to be approximately 19,500 dead and missing persons; in terms of buildings, 115,000 totally destroyed, 162,000 half destroyed, and 559,000 buildings being partially destroyed.

Immediately after the earthquake, starting with President Gustavo Araoz's message entitled 'ICOMOS expresses its solidarity with Japan', we received warm messages of support and encouragement from ICOMOS members throughout the world. On behalf of Japan ICOMOS, I would like to take this opportunity again to express our deepest gratitude and appreciation to you all.

There have been many enquiries from all over the world about the state of damage to cultural heritage in Japan due to the unfolding events. Accordingly, with the cooperation of the Agency for Cultural Affairs, Japan ICOMOS issued on 22nd March 2011 a first immediate report regarding the state of Important Cultural Properties designated by the Government, and sent it to the ICOMOS headquarters, as well as making it public on the Japan ICOMOS website. Following this, on 29th March 2011, the Flash Report on the Situation of Damage on Cultural Properties and Buildings, Scenery and Historic Sites was also sent to the ICOMOS headquarters and made public on our website.

We now have this opportunity to bring to the public, a comprehensive report of the state of damage to cultural properties which has been made possible by further detailed information provided by members of Japan ICOMOS. It is our hope and wish that this report may become an important reference for experts in the many countries throughout this world which shares and lives side-by-side with the threat of such natural disasters. At the same time, we would like to take this opportunity to ask for your continued support to the people and professionals in every part of Eastern Japan and Tohoku regions, as they continue to walk the path to recovery.

Yukio Nishimura
President,
Japan ICOMOS National Committee,
6th November 2011



(Ref. Ministry of Education, Culture, Sports, Science and Technology)

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1. Outlines and Characteristics of the Great East Japan Earthquake

1.1 Outlines of the Earthquake

The Pacific Ocean offshore the Tohoku and Kanto regions of Japan is home to the Japan trench, and is a zone where the Pacific Plate is subducting into the North American Plate. As will be described later, this region has been subjected by a large number of major earthquakes over the years. The Plate is subducting at a speed of approximately 10cm per year, and the displacement rate on the western side is said to be 3 to 7cm per year. Earthquakes occur when an accumulation of these differences are suddenly released. On 11th March, 2011, a devastating earthquake of the moment magnitude 9.0 (Mw) struck with an epicenter off the Pacific Ocean of Japan from the Tohoku to the Kanto region. This 2011 Tohoku Area Pacific Offshore Earthquake is the largest earthquake to have hit Japan since records began. Even from a global perspective, the only earthquakes exceeding a magnitude of 9.0 over the past 60 or so years since earthquake measurements began are the followings:

1952 Kamchatka Earthquake and Tsunami (Mw=9.0);
1960 Chile Earthquake (Mw=9.5);
1964 Alaska Earthquake (Mw=9.2);
2004 Indian Ocean Earthquake and Tsunami (Mw=9.3).

The fault that caused the main shock of the 2011 Tohoku Area Pacific Offshore Earthquake was a low-angle reverse fault as shown in Figure 1.1. It was estimated to be approximately 450km long, approximately 200km wide, with a maximum strike slip of 20 to 30cm (Japan Meteorological Agency)[1]. Furthermore, dividing the main rapture area was divided into three, it is estimated that the depth of the epicenter (Miyagi Prefecture offshore) was 24km, and the duration of the rapture was approximately 3 minutes (Japan Meteorological Agency)[1]. There have been a number of aftershocks, which occurred over a wide area as far away as the Chubu region hundreds of kilometers away. There were 500 aftershocks exceeding magnitude 5[2].

1.2 Ground Motion Characteristics

Since 1996, the Japan Meteorological Agency has conducted the mechanical measurement of seismic intensity and announced the instrumental seismic intensity. Based on this, regions where the seismic intensity of the main shock is X or exceeds X under the modified Mercalli intensity scale (6 or more under the JMA intensity scale) were widely distributed

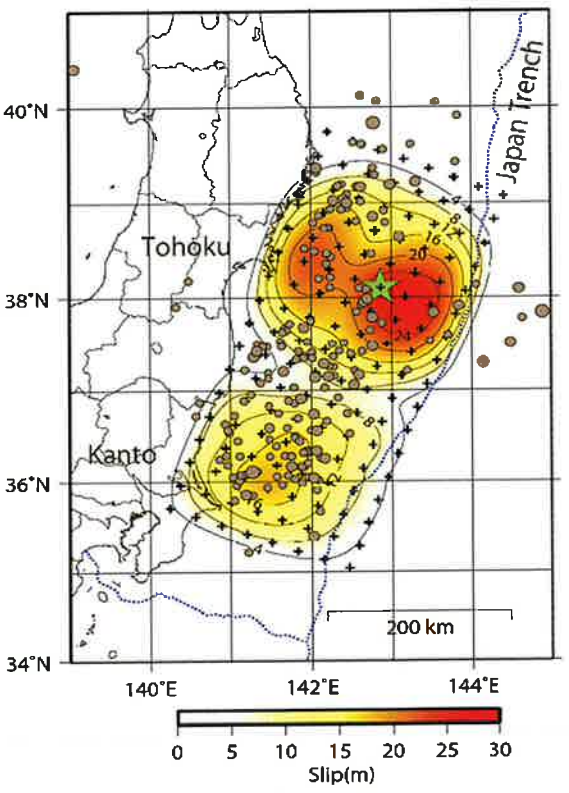

Figure 1.1 Epicentral area of the main shock of the Tohoku Area Pacific Offshore

from Iwate Prefecture to the Pacific coast of northern Ibaraki Prefecture. Furthermore, the National Research Institute for Earth Science and Disaster Prevention (NIED)'s strong-motion seismograph networks (KNET) surround the whole country (Figure 1.2), and national research institutions and universities have also placed strong-motion seismographs in the Tohoku Pacific Ocean side region where there the seismic activity is high. According to seismic records collected by these strong-motion seismographs, there were approximately 20 stations with peak acceleration exceeding 1.0G. However, these records show the effect of short period components was large, and it was reported that the predominant frequency was higher than 5Hz[2]. This is exemplified by Figure 1.3 which shows records of KNET (by NIED) in Kesennuma City, Miyagi Prefecture. Although the seismic intensity according to the JMA intensity scale was 6, the damage to buildings around the Kesennuma station was minor. According to the acceleration response spectrum for these earthquake records, the predominant period was within a short-period range from 0.3 to 0.5 seconds, and at the same time, 3 to 4 second long-period components were predominant. It has been pointed out that these ground motion characteristics, which combined short-period and long-period ground motion, are very common in other observation points. It has also been pointed out that the ground motions for this earthquake were generated by a huge long-period slip along an ocean trench and by a strong short-period ground motions in the coastal area[2]. This earthquake was characterized by the relatively minor damage to buildings by the ground motion despite its extremely large peak acceleration[2]. There was even little damage to conventional wooden dwellings, which were particularly affected in the case of the 17th January, 1995 Great Hanshin-Awaji Earthquake, a.k.a. Kobe Earthquake (southern Hyogo Prefecture earthquake, M=7.3). This was because the damage to general buildings such

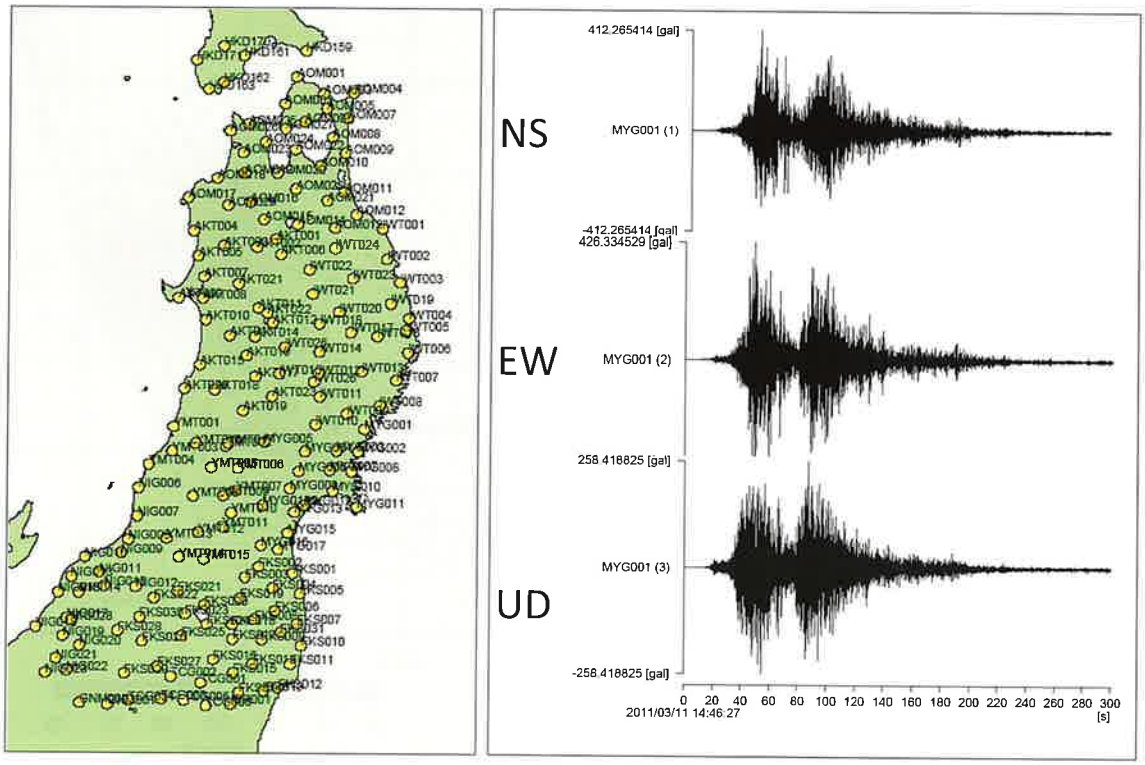

Figure 1.2 National Research Institute for Earth Science and Disaster Prevention's KNET observation points and the Kesennuma station's accelerogram

as wooden dwellings caused by 1 to 2 second cycle ground motion components was minor. It is believed that the ground motion characteristics made the progressive destruction of traditional wooden buildings difficult. Contrasting with the Kobe earthquake, it was reported that 1 to 2 second cycle components were less than about 1/3-1/5[3]. On the other hand, long-period ground motion of more than a few seconds propagated as far as distant major cities as a surface wave, causing high-rise buildings in Tokyo and Osaka etc. to shake significantly with amplitude reaching tens of centimeters. The top of the modern heritage, Tokyo Tower (built: 1958, height: 333m), suffered deformation. The effect of such ground motion characteristics on historical buildings is that the impact on traditional wooden buildings was minor. Instead, short-period structures such as masonry constructions, mud-wall warehouses and stone-retaining walls over a wide area from the Tohoku to Kanto were greatly affected. In addition, ground motions with a long duration lasting more than three minutes caused liquefaction of soils due to cyclic shear deformation of loose saturated sand deposits. Some of "Important Preservation Districts for Groups of Traditional Buildings" were seriously affected by the disaster caused by the liquifaction.

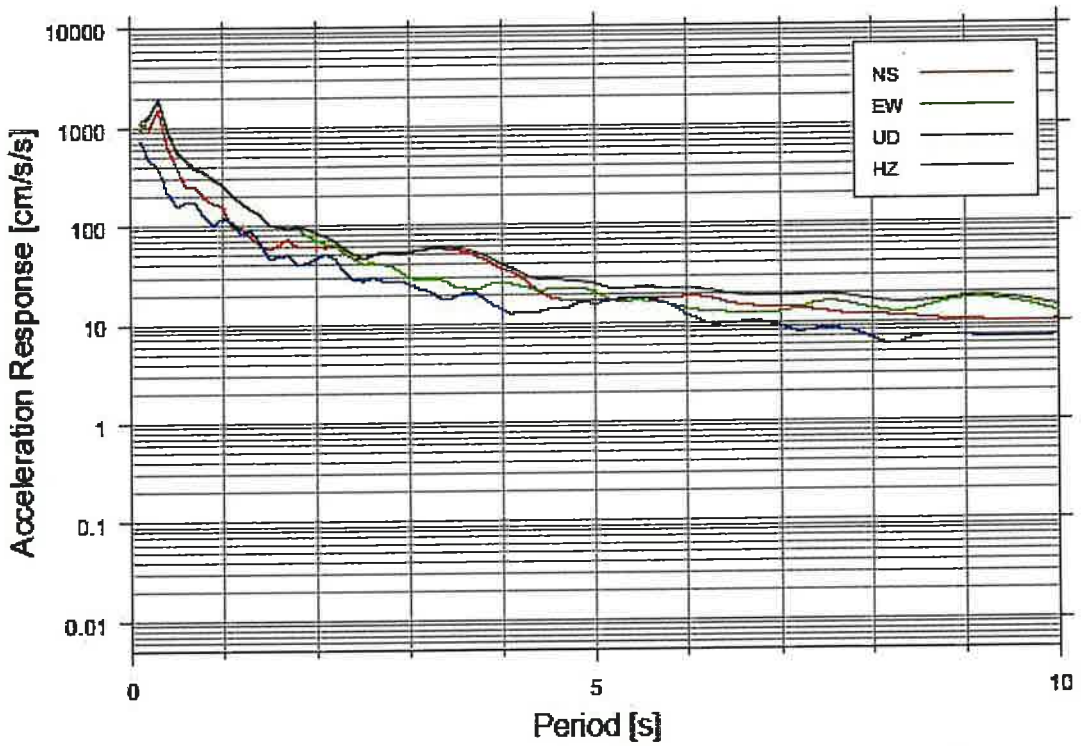

Figure 1.3 Acceleration response spectra of KNET Kesennuma station's strong motions (h=5%)

Table 1.1 Modified Mercalli intensity scale and peak acceleration level (gal=0.001G)

Modified Mercalli Intensity Scale	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Acc (gal)	0.5 ~ 1.0	1.0 ~ 2.1	2.1 ~ 5.0	5.0 ~ 10	10 ~ 21	21 ~ 44	44 ~ 94	94 ~ 202	202 ~ 432	432 <	-	-

While the JMA intensity scale is used in Japan, the modified Mercalli intensity scale is used in most foreign countries. The relationship between modified Mercalli intensity scale and acceleration level are shown in Table 1.1.

1.3 Tsunami

The main cause of damage due to this earthquake was the tsunami as shown in the following section. The height of the tsunami was reported to be an average of 8 to 9m along the coast from Miyako City, Iwate Prefecture to Soma City, Fukushima Prefecture. The tsunami height was not uniform, exceeding 10m south of Kuji City, Iwate Prefecture, and reaching 10 to 15m at the Sanriku shoreline up to the Oshika Peninsula in Miyagi Prefecture. It was reported that it reduced to 5m at the scenic spot, Matsushima Bay, but was approximately 10m from Sendai Bay to Soma[4]. A study by the Japan Society of Civil Engineers reported that the tsunami hit the Miyako city shore at a height of 39.7m. This height is a new record for Japan. The total wetted surface area extended to 560km2, of which 60% was in Miyagi Prefecture.

1.4 Outlines of the Damage

The 1995 Kobe Earthquake caused concentrated damage because it was a local earthquake (Local earthquake means that Kobe is in the epicentral area), but the 2011 Great East Japan Earthquake caused damage over an extremely wide area of the eastern Japan.

The human damage caused by the Great East Japan Earthquake as of September 16 was 15,790 dead, 4,056 missing, and approximately 5,500 injured. Furthermore, according to the Preliminary Reconnaissance Report on the 2011 Tohoku-Chiho Taiheiyo-Oki Earthquake by the Architectural Institute of Japan[2], approximately 105,000 houses were completely damaged and approximately 107,000 were partially destroyed. Most of this human and residential damage was caused by the tsunami. Another characteristic specific to the present earthquake was that the number of injured was significantly lower than the number of deceased because the tsunami was responsible for the greater part of the damage. Approximately 31,000 cases of damage to non-dwellings were reported[2]. With regard to reinforced concrete structure buildings, there was damage to buildings built before the Building Seismic Code was revised in 1981, being similar to the damage aspect of 1995 Kobe Earthquake. Because there was considerable damage to lifelines and the earthquake affected a wide area, it was announced just after the earthquake that electricity was cut off to about 8,600,000 houses; the gas supply was cut off to approximately 2,000,000 houses; and around 2,300,000 houses were without water. Transport was also affected with damage to 5,000 places along the Tohoku Shinkansen and a number of standard railway lines. Standard coastal railway lines were affected by the tsunami with 23 railway station buildings and approximately 60km of railway track being swept away or buried under the water. In regard to civil engineering facilities, a total of 190km of approximately 300km sea embankment was completely or partially destroyed by the great tsunami. Farmland was also affected. Approximately 5% or 23,000 ha (ha:100m x 100m) of cultivated acreage was flooded by the tsunami. The total cost of damage was reported to be approximately 17 trillion yen (220 billion US dollars). Further, the Fukushima Nuclear Power Plant accident caused by the Tohoku Area Pacific Offshore Earthquake has become an extremely large problem socially, and it is said that recovering this situation may take up to tens of years.

1.5 Past Earthquake and Tsunami Damage

The majority of the regions that sustained significant damage due to this earthquake are regions with high seismic activity. Over the last 30 years or so, a number of regions have undergone magnitude 7-class-earthquake ground motions that has damaged buildings, including the 1978 Miyagi Prefecture Offshore Earthquake (MJ=7.4); the 1987 East Chiba Prefecture Offshore Earthquake (MJ=6.7); and the 2008 Iwate-Miyagi Inland Earthquake (MJ=7.2). One of the reasons damage caused by ground motions was comparatively minor despite sustaining strong motion exceeding X under the modified Mercalli intensity scale (upper 6 under the JMA intensity scale), was largely attributable to period characteristics as shown in "1.2 Ground Motion Characteristics", but one could also argue has this region has been subjected to those major earthquakes in recent years, so buildings with low earthquake resistance had been weeded-out and the earthquake resistance of buildings was secured to a certain extent.

Furthermore, the region affected by this earthquake is actually overlapping to the region that has sustained significant tsunami damage in the past. Main tsunami earthquakes include the 869 Jogan Earthquake (MJ=8.3); 1611 Keicho Sanriku Earthquake (MJ=8.1); 1896 Meiji Sanriku Earthquake (MJ=8.25); 1933 Showa Sanriku Earthquake (MJ=8.1); 1952 Tokachi-oki Earthquake (MJ=8.2); 1960 Chile Earthquake (MJ=9.5)[2]. In the case of the 869 Jogan Earthquake, it is possible that the area flooded by the tsunami was of a similar scale to the Earthquake of March 11, 2011, and studies are ongoing to identify the tsunami-flooded area from traces of that earthquake. The tsunami damage caused by the 1896 Meiji Sanriku Earthquake was extensive, and the number of victims reached more than 20,000 people. One of the reasons why there are comparatively few historic buildings along the coast from Iwate Prefecture to Fukushima Prefecture is probably because of the frequent major tsunamis that have struck the region. An old city area located behind Kesennuma Bay has a traditional streetscape made up of nationally-recognized cultural property structures built at the beginning of the twentieth century, but most of it was swept away or wrecked by the tsunami. No major tsunami damage was caused by the 1933 Showa Sanriku Earthquake, which shows that the recent tsunami was one of the largest from a historical perspective. However, the main hall of the Zuigan-ji temple (1604) and Godaido (1605) facing Matsushima Bay east of Sendai were not affected by the tsunami caused by the this earthquake, and tsunami damage has not been recorded even in the past earthquakes. It is possible that the topography of Matsushima Bay and its islets controlled the height of the tsunami.

[Reference Literature]
1) 25th March, 2011 (5.30 p.m.) press release by the Japan Meteorological Agency: Re: The 2011 Tohoku Area Pacific Offshore Earthquake (28), http://www.jma.go.jp/jma/press/1103/25b/kaisetsu201103251730.pdf

2) Architectural Institute of Japan: Preliminary Reconnaissance Report on the 2011 Tohoku-Chiho Taiheiyo-Oki Earthquake2011, p. 25, 2011

3) Yuki Sakai: Ground motion caused by the 2011 Tohoku Area Pacific Offshore Earthquake and preliminary damage report http://www.kz.tsukuba.ac.jp/~sakai/113g.htm

2. Damage to Cultural Properties

2.1 Damage to Cultural Properties

2.1.1 Overview

Figures 2.1 and 2.2 sort the number of damage cases relating to nationally-designated or registered cultural heritage as of 3rd August into prefectures and damage types. Damage extended as far as Kochi Prefecture which is more than 1000km away. There have been over 700 cases of damage. Note that this figure does not include cultural property designated by prefectures and municipalities. It is believed that a total number of such cultural properties damaged by the earthquake exceeds 1,000. According to a detailed survey by Iwate Prefecture; a prefecture with significantly large human damage; 25 prefecturally-designated cultural properties (including 7 structures and 9 art objects) and 70 municipally-designated cultural properties (including 27 structures including historical sites and 10 art objects) were affected by the disaster. A statistical survey of the number of such damaged cultural properties did not categorize damage caused by ground motion or the tsunami, so the percentage of tsunami-caused damage is unclear. Therefore, further studies are required. Furthermore, fire damage to cultural property caused by ground motion has not been reported. A study of damage to cultural property not designated or registered at national, prefectural or municipal levels, or in other words undesignated cultural property, is being conducted by the Architectural Institute of Japan.

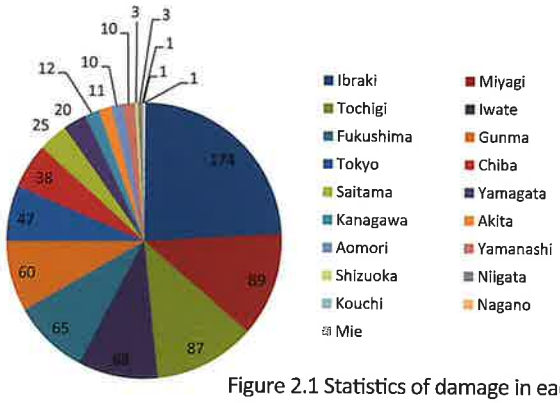

Figure 2.1 Statistics of damage in each prefecture

Figure 2.2 Statistics of damage to categorize into type of cultural properties

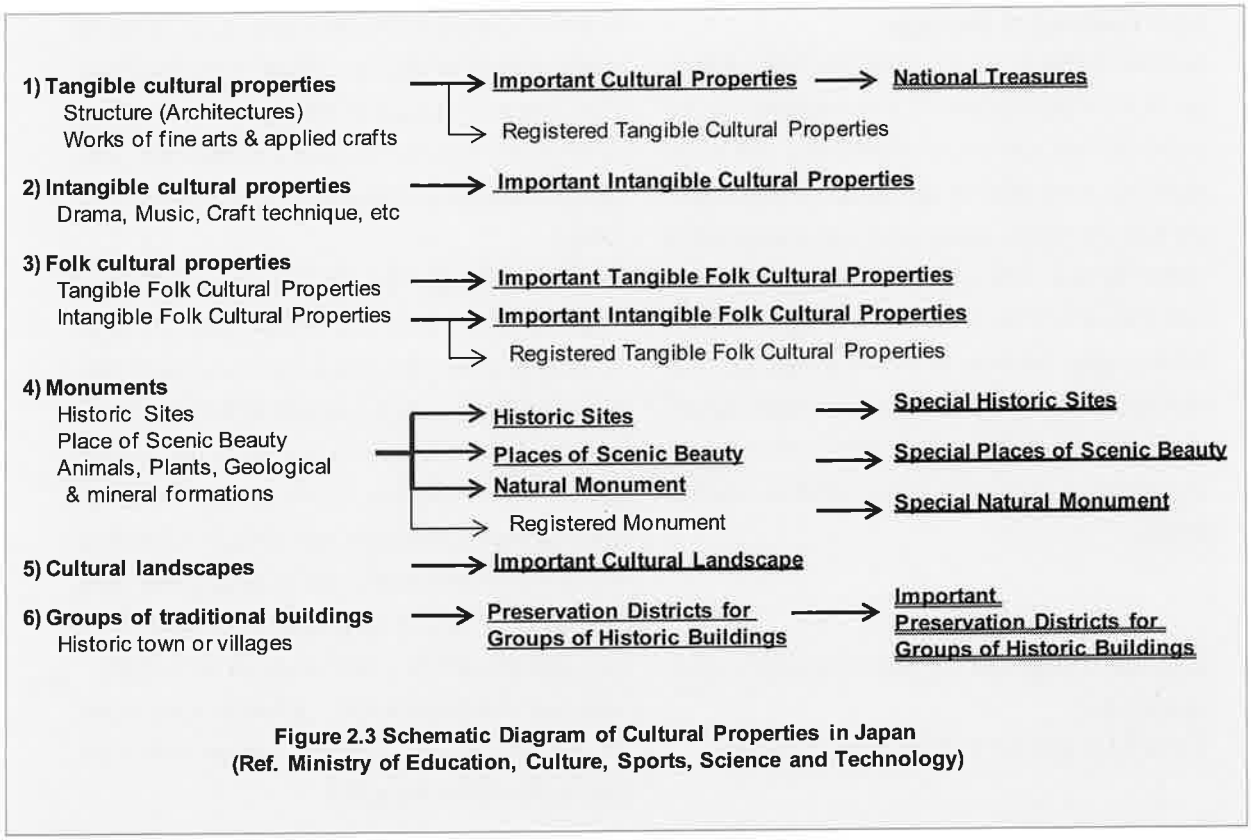

Figure 2.3 Schematic Diagram of Cultural Properties in Japan (Ref. Ministry of Education, Culture, Sports, Science and Technology)

Table2.1 Number of Damaged Cultural Properties (As of August 15th, 2011)
(Ref. Ministry of Education, Culture, Sports, Science and Technology)

Type of cultural properties	Tangible		Folk		Monument			Cultural Landscape (area)	Groups of Traditional Buildings (area)	Sum
	Works of Fine Arts & Applied Crafts	Structures	Tangible	In-tangible	Ancient sites	Places of Scenic Beauty	Animals, Plants, Geological and Mineral Formations			
Designation or Selection by national Government	22	142	3	4	96	22	16	1	6	312
National Treasures and Special Monuments	0	5	-	-	6	5	0	-	-	
Important Cultural Properties	22	137	33	4	96	17	16	-	-	
Registration	0	420	-	1	0	2	0	-	-	423

*some of these have multiple designations

Total 735

2.1.2 Features of Damage

As shown in Figure 2.1, the number of cases of damage to nationally-designated and registered cultural properties has regional characteristics. The Kanto region has more cases of damage to cultural properties than the Tohoku region which was devastated by human damage. This is because the number of cultural properties in the Kanto region is higher than the Tohoku region. Similarly, as shown by Figure 2.2, the number of cases involving registered tangible cultural properties is remarkably high. This is also because the number of registered tangible cultural properties is high.

2.2 Architectural Monuments and Structures

The status of damage is shown by structure type.

2.2.1 Wooden Structures

(1) Damage Caused by Ground Motions

Damage caused by the ground motions to residential buildings built by traditional timber framework methods was either minor or intact. As well as, damage to historical buildings from temples and shrines to houses were, albeit with some exceptions, minor or intact. In addition, many buildings with a short natural period such as *dozo* (mud-wall warehouse) were severely damaged. This was largely attributable to period characteristics as shown in "1.2 Ground Motion Characteristics" in Chapter 1. Furthermore, there was also damage by deformation such as soil liquefaction caused by the ground motions with long period. Examples of damaged buildings are shown as follows.

The main building of the old Yubikan (Japan's oldest school located in Osaki city, Miyagi Prefecture; built in 1691) which is a designated National Historic Site, collapsed (Figure 2.4). It is located in the region with the strongest measured tremor of by the present devastating earthquake. As the main building had little earthquake-resistant elements, it is believed that it was fundamentally lacking in horizontal resistant capacity. This building suffered damage when the Iwate-Miyagi Inland Earthquake struck in 2008.

Very few traditional wooden buildings such as the old yubikan sustained significant damage despite the large scale of this earthquake.

The national treasure, Zuigan-ji temple, located in Matsushima facing Sendai Bay was not affected by the tsunami, but the main hall and priest's quarters (1609) sustained minor damage to the mud walls with plaster finishing breaking away from the walls (Figure 2.5). The nationally-designated important cultural property, Godaido (1604, Figure 2.6), located on an islet in the Bay was not damaged even though the stone pagoda collapsed. The national treasure, the Osaki Hachimangu Shrine (Figure 2.7), which

Figure 2.4 Main building of the historic site, the Yubikan (Left: Before earthquake; Right: After earthquake)

locates in Osaki city, Miyagi Prefecture, was slightly damaged. In this Osaki City, Yubikan completely collapsed as described above. Although this building of Osaki Hachimangu had been partly dismantled and repaired five years before, it was not seismically strengthened. Damage to the Sendai City important cultural property, the Mutsu Kokubun-ji Yakushido (1607), was limited to part of the lath wall falling down.

The nationally-designated important cultural properties of timber or brick masonry were damaged as the Horaguchi Family House (mid 18th century) located in Natori City. This family house suffered significant damage such as broken pillars and cracked mud wall. Aside from that, the Agatsuma Family Residence (mid-18th century, Miyagi Prefecture) was damaged by the soil deformation. The important cultural property, the former Baba Family Residence (mid-Edo era), which is located in Aizu-gun, Fukushima Prefecture, has little earthquake resistant elements, and therefore, the building is now tilting (Figure 2.8).

Furthermore, western-style nationally-designated important cultural properties also sustained damage such as breaking to lath wall finishing. These damaged cultural properties included the former Date-gun City Hall (1883, Date-gun, Fukushima Prefecture) and the former Fukushima Prefecture Jinjo Junior High School (Koriyama City, Fukushima Prefecture,

Figure 2.5 The Zuigan-ji temple priest's quarters, which sustained damage to the plaster wall

Figure 2.6 The important cultural property, Godaido, standing in the beauty spot of Matsushima: Undamaged

Figure 2.7 The national treasure, the Osaki Hachimangu Shrine - sustained very minor damage

Figure 2.8 The important cultural property, the former Baba Family Residence, which is tilting (Top: Exterior; Bottom: Tilting interior)

1889; Figure 2.9).

Hiraizumi structures such as the Konjikido, which was inscribed on World Heritage List in 2011, were subjected to the earthquake strong motions, which measured at weak 6 on the JMA intensity scale. Very slight damage was sustained by part of the building, but it was virtually undamaged. While Hiraizumi sustained minor damage to the main hall of the Chusonji Temple as a result of the June, 2008, Iwate-Miyagi Inland Earthquake which measured at strong 6 (JMA intensity scale), no significant damage was reported.

Dozo (mud-wall warehouse) buildings spreading from a wide area from Tohoku to Kanto were damaged. Figure 2.10 shows typical damage to classic *dozo* (the registered tangible cultural property, the Mori Goshi Gaisha storehouse). The eaves have collapsed and the earthen wall is cracked. Figure 2.11 is an example of damage in the Tohoku region (Sekinoichi Shuzo, *tori-kura* (walk-through storehouse)). The building is slanted and the eaves are damaged. It was renovated by a *sake* brewery to be used as a *dozo*, and is a registered cultural property that was still being put to use. This heritage structure is a registered tangible cultural property and is still being put to use. Devising measures to keep utilizing it while securing safety have become a challenge. The registered tangible

Figure 2.10 Damage to classic *dozo* (mud-wall warehouse) - the registered tangible cultural property, the Mori Goshi Gaisha storehouse

Figure 2.9 Damage to the important cultural property, Fukushima Prefecture Jinjo Junior High School (Top: Building exterior; Bottom: Peeling lath wall)

Figure 2.11 The registered tangible cultural property, Sekinoichi Shuzo and damage to the *tori-kura* storehouse (mud-wall timber structure)

cultural property, the Sekinoichi Shuzo buildings, will be discussed in greater detail in Chapter 4.

(2) Damage Caused by the Tsunami

The registered tangible cultural property, the "Izura Institute of Arts & Culture, Ibaraki University" (1905) in Kita-Ibaraki City, Ibaraki Prefecture, was destroyed by the tsunami. The port town of Kesennuma City in Miyagi Prefecture is a historical town facing the harbor, and home to many registered tangible cultural properties built at the beginning of the 20th century. Cultural properties such as the Kakuboshi shop (Figure 2.12) and the Sato Family Residence timber storehouse were swept away by the tsunami. Figure 2.13 shows the collapse of the first story of the 3-story registered tangible cultural property, the Otokoyama Shuzo original store (1912). A recovery program that makes full use of this historical landscape will be required for this district in the future.

On the other hand, there are wooden cultural property structures that withstood the tsunami. The Ishinomaki City-designated cultural property, the St.Haristos Orthodox Church (1880), which is located in the Nakaze Park close to the mouth of the Kitakami River, was hit by a tsunami with height of approximately 5m. While it sustained substantial damage, it survived from being swept out to sea. This building of interest will be discussed in Chapter 4.

2.2.2 Masonry Structures (stone and brick construction)

(1) Damage Caused by Ground Motions

The strong motion zone caused by the Great East Japan Earthquake (X or higher under the modified Mercalli intensity scale) encompassed a wide region from the Tohoku region to the inland from the Pacific Ocean coast of the Kanto region. However, its ground motions were characterized by predominant short-period components as shown in Chapter 1. Therefore, it was an earthquake with a large impact on buildings with a short natural period such as

Figure 2.13 Tsunami-caused damage to the registered tangible cultural property, the Otokoyama Shuzo original store

Figure 2.12 The registered tangible cultural property, the Kakuboshi shop, which was swept away by the tsunami

Figure 2.14 Collapse of stone storehouse in Makabe, an Important Preservation District for Groups of Traditional Buildings

stone and brick-constructed buildings. Many of the structural styles of cultural property in this strong motion zone were wooden. Masonry structures are also widely distributed across this region even though their numbers are less than wooden buildings. Buildings built with tuff stone called nobiru-stone (shiogama-stone) produced in the Shiogama City region of Miyagi Prefecture are widely distributed across the Tohoku region. This nobiru-stone was used to build the Sekinoichi Shuzo registered tangible cultural property building (Ichinoseki City, Iwate Prefecture), which will be discussed in more detail in Chapter 4. Moreover, structures built with oya-stone (tuff) produced in Utsunomiya City, Tochigi Prefecture, are widely distributed across the North Kanto region. In the case of the present earthquake, many structures made from such stone suffered serious damage. Makabe (Ibaraki Prefecture), which is an Important Preservation District for Groups of Traditional Buildings, also sustained serious damage but structural damage was largely restricted to *dozo* and stone storehouses built with oya-stone. One example of damage to such stone structures is shown in Figure 2.14. As to brick structures, modern heritage structures can still be found in prefectural capitals in the Tohoku region such as Morioka City, Sendai City, and Fukushima City. They are also widely distributed across North Kanto such as Mito City, Tsuchiura City, and Kiryu City. Most of these structures sustained damage although there were differences in the level of damage. Examples of damage to cultural property masonry structures are shown below.

Nobiru-stone was used as wall material for two of the Sekinoichi Shuzo structures (Ichinoseki City) registered as tangible cultural property, but the unreinforced masonry wall sustained damage as shown in Chapter 4. The registered tangible cultural property in Shiogama City, the Takahashi Family Residence (1922), is in part a two-story stone building that uses local nobiru-stone. This building sustained significant damage such as horizontal cracking starting from the entrance due to ground motions (Figure 2.15). According to a survey of the exterior, damage was concentrated in the two-story building section. The district where the Takahashi Family Residence is located was submerged under a tsunami approximately 1m deep, but the damage was caused by the earthquake ground motions. The dimension of piece of stone was 87cm x 29cm x 27cm. Cement mortar was used for the joints. The building was unreinforced structurally, but according to a survey of buildings (Kesennuma City buildings built with similar stone materials) that collapsed due to the tsunami, it seems that cramp steel bars approximately 6mm in diameter were inserted to connect stones. This implies necessity for conducting more detailed surveys of damage and reinforcement in the future. There are also machiya (traditional wooden townhouses) style buildings surrounding in the area surrounding the Takahashi Family Residence. While some buildings have stone walls between adjacent residential buildings, no damage was sustained by the strong ground motions. At the Hashino Blast Furnace (Kamaishi City, Iwate Prefecture, 1958), which is Japan's oldest western-style blast furnace and a nationally-designated historic site, there was damaged such as displacement of the ashlar stone that made up the furnace (Figure 2.16). Generally, many stone constructions, such as stone lanterns vulnerable to ground motion, were affected by the strong ground motions. In the case of the Shiogama Shrine in Shiogama City where strong 6 on the JMA intensity scale was recorded, wooden important cultural property structures including the Migimiya (right shrine) main hall, the Hidarimiya (left shrine) main hall, and the Betsumiya (separate shrine) main hall (beginning of the 18th century) were not affected externally (Figure 2.17), but there was damage to many stone monuments such as stone lanterns. This damage included displaced stones and fallen top stones.

Damage to stone pagodas vulnerable to ground motions could be seen in various regions. Many stone pagodas designated as important cultural property collapsed at the Toshogu Shrine in Sendai City (Figure 2.18).

The damage to brick structures will be shown as follows. In Iwate Prefecture, there was no damaged to the brick-constructed silos at Koiwai farm (1907-08), which is registered as tangible cultural property. In the old town of Morioka City, there are two remaining important cultural property brick structures. One of those is the "Former 99 Bank Head Office" (1910, Figure 2.19), which is currently being used as the Morioka Takuboku and Kenji Museum. The seismic intensity in Morioka City was reported to be weak 6 on the JMA intensity scale. The building sustained damage such as cracked and discolored plaster wall and ceiling inside the second floor. Morioka City's "Former Covered Parade Ground" building (1909, Figure 2.20) is a brick structure that has been nominated as a modern heritage, but cracks appeared in the entrance area and emergency measures are being taken to prevent the building from collapsing. In Sendai City, the 3-story brick architectural museum in the Tohoku University campus (before 1910) sustained damage such as cracks in brick walls. In Fukushima City, the brick-constructed and registered tangible cultural property, the United Church of Christ in Japan, was damaged by the disaster. It was subsequently demolished and removed by the owners due to concerns for the safety of the church goers[1]. In North Kanto, there was no structural damage to the timber framed brick structure, the former Tomioka Silk Mill, which is registered as an important cultural property. The Kiryu City-designated cultural property, the Yurinkan, sustained some damage to the roof tiles and the brick wall was slightly cracked. In Tsuchiura City, Ibaraki Prefecture, there is a district

Figure 2.15 Damage to the Takahashi Family Residence, a registered tangible cultural property

Figure 2.16 Displaced and cracked stone masonry at the Hashino Blast Furnace, a historic site in a Kamaishi City

where there are still brick-constructed storehouse buildings from the Taisho era to the Showa era. One of those, the Machikado Kura Nomura brick storehouse, sustained significant damage with cracks appearing in the walls (Figure 2.21). This brick-constructed structure was being used as a cafe before it was damaged by the earthquake. The Architectural Institute of Japan is involved in the conservation of this building due to its historical value, although it is not a designated cultural property. The S kindergarten building in central Mito City, Ibaraki Prefecture is a brick-constructed structure built in 1912 (undesignated), and in recent years it has undergone reinforcement work. However, as shown in Figure 2.19, inplane shear cracks have appeared in the English bond brickwork wall, and other major damage has occurred such as the wall collapsing in out-of-plane. This building had been structurally reinforced with a steel frame. Nearby residential housing and commercial facilities were undamaged. The first winery in Japan, the Chateau Kamiya in Ushiku City, Ibaraki Prefecture, is a brick structure that was built in 1903. Designated an important cultural property, it was significantly damaged by this earthquake (Figure 2.22).

(2) Damage Caused by the Tsunami

In coastal regions where houses were swept away by the tsunami, there are very few designated cultural property masonry structures. However, there were undesignated historic brick structures damaged by the tsunami. Once of those was the Joban line, Sakamoto station oil warehouse which was swept away by the tsunami. Although not a building, the Ishii lock (1880) at the entrance of the canal was damaged by the tsunami. The Ishii lock is on the canal beside the Kitakami River and is brick-constructed modern heritage designated as an important cultural property. The damage to the Ishii lock is shown as "2.2.4 Modern Heritage".

Figure 2.17 The Shiogama Shrine, an important cultural property: Undamaged

Figure 2.18 Collapse of stone lanterns at the Toshogu Shrine, Sendai City, an important cultural property

Figure 2.19 Former 99 Bank Head Office, an important cultural property: Minor damage to internal walls and ceiling

2.2.3 Reinforced Concrete Structures

Damage to reinforced concrete-constructed architectural heritage caused by ground motions has been surveyed by the Architectural Institute of Japan. In the Tohoku region, there are seven reinforced concrete-constructed architectural heritage selected by Docomomo Japan, and three of those were in the strong motion zone[2]. One of those is the Furukawa Civic Hall, built in 1966 (Furukawa City, Miyagi Prefecture, Figure 2.23[3]). This building is located near Osaki City, Miyagi Prefecture, where the strongest ground motion during this earthquake was recorded. As a result, non-structural components cracked and underwent deformation[2]. Similarly, the Fukushima Prefectural Educational Hall, a reinforced concrete building, sustained damage to its non-structural components.

[Reference Literature]

1) Nikkei Shimbun (evening edition), 29th March, 2011

2) Architectural Institute of Japan: Preliminary Reconnaissance Report on the 2011 Tohoku-Chiho Taiheiyo-Oki Earthquake, 2011

3) http://www.city.osaki.miyagi.jp/people/kurashi/manabu/manabu04/03.html

Figure 2.21 Disaster-affected brick storehouse, the Machikado Kura Nomura (Top: Building exterior; Bottom: Cracked gable wall)

Figure 2.22 Disaster-affected Chateau Kamiya winery building, an important cultural property Top: Building exterior; Bottom: Cracked gable wall)

Figure 2.20 Disaster-affected modern heritage, the former covered parade ground building

2.2.4 Modern Heritage

Some industrial heritage and civil engineering monuments, which helped to modernize Japan for a century from the mid-19th to the mid-20th century, were affected by the disaster. These monuments include many canal facilities such as locks, electrical power facilities, filtration plants, blast furnace sites and so on. They can be restored with minor repairs, but there was one case of devastating damage in Ishioka Elctric Power Plant.

(a) Civil Engineering Monument

The Ishioka No.1 Power Plant in Ibaraki Prefecture is a conduit type power plant that was completed in 1911 and is in operation even today. It was designated as a nationally important cultural property in 2008 for its high value in terms of Japanese industrial technology, and because it was the first facility to make use of reinforced concrete technology in Japan. It consists of 10 places: a diversion weir, grit chamber, No.1 and No.2 aqueduct bridges, water tank, water tank spillway, pressure-controlled tank, main building's dynamo room, main building's former transformer room, and the main building's switchgear room. Of these, the water tank collapsed three and a half hours after the earthquake occurred (Figure 2.24). The structure itself was not destroyed, but the virgin soil that supports the bottom of the tank collapsed and the tank was unable to hold out. Since recovery of this tank is impossible, important cultural property designation status was removed.

The Ishii lock (Miyagi Prefecture) was completed in the thirteenth year of the Meiji era (1880) and consists of a stone lock chamber and brick lock gates. While it sustained partial cracking, the damage is not serious. The Yokotone lock gates were completed in the tenth year of the Taisho era (1921) together with repair work carried out at Japan's largest river, the Tone River. It did not sustain serious damage.

Additionally, canals, filtration plants, and steel bridges sustained minor damage.

(b) Industrial Heritage

The Hashino Blast Furnace site is the remains (circa 1860) of the first western-style blast furnace to succeed in iron-making in the twilight years of shogunate rule. The stone-constructed blast furnace base still remains today, and while distortion, cracks, and minor defects appeared in part of the rock work due

Figure 2.23 Furukawa Civic Hall which underwent damage to its non-structural components (from Furukawa city homepage[3])

Figure 2.24 Ishioka Electric Power Plant (Top: Before earthquake; Bottom: After earthquake) (Ishioka city, Ibaraki Prefecture)

to the recent earthquake, its value remains largely untouched.

The Former Tohoku Quarry Factory produces limestone, and is the factory where Kenji Miyazawa, a key poet of the Japanese modernization era, temporarily worked as an engineer. Due to the recent earthquake and an aftershock on 7th April, cracks in the ground appeared inside the factory and wood structure components became loose.

2.3 Groups of Traditional Buildings

There are currently 91 Nationally Selected Important Preservation Districts in Japan where groups of traditional buildings are protected. Six of those districts were affected by the recent earthquake (see Table 2.1)

Two of these preservation districts, Makabe, Sakuragawa City (Ibaraki Prefecture) and Sawara, Katori City (Chiba Prefecture) sustained extensive damage.

Figure 2.25 A traditional building in Makabe (Top: Before earthquake; Bottom: After earthquake)

(1) Makabe, Sakuragawa City, Important Preservation District for Groups of Traditional Buildings

After a massive fire in 1700, a rural town originated from a castle town, good numbers of traditional town houses with fire proof detached storehouses are preserved in Makabe district until today.

Approximately 70% of the 106 traditional structures were affected by the disaster, with ceilings and walls sustaining damage. Of those, two earthen wall storehouses and one stone storehouse collapsed. Destructive damage such as collapsed buildings was scarce, demonstrating that Japanese traditional houses are resistant to earthquakes, but it was a serious problem for groups of buildings in general.

Common roof damage was caved-in ridge tiles and falling tiles. Wall damage sustained included cracks and detachment of plaster wall and the collapsed pediment part of stone storehouses. (Figure 2.25, 2.26)

(2) Sawara, Katori City, Important Preservation District for Groups of Traditional Buildings

Sawara city was known as a commercial city developed along the Ono river, a concentration of modern and contemporary traditional buildings such as wooden machiya and storehouses.

Approximately 70% of the 92 historic structures were affected by the disaster, with ceilings and walls sus-

Figure 2.26 A damaged house in Makabe

taining damage and one gate collapsing. The damage to roofs was particular extensive including caved in ridge tiles; falling tiles; and cracks, peeling, and caved-in external walls.

This district is on soft ground and liquefaction has occurred, so the embankment of the river that flows through the center of the district caved-in, and substantial damage was caused by the movement of wood-framing due to uneven settlements along the river. (Figure 2.27, 2.28)

Figure 2.27 Traditional buildings in Sawara (Top: Before earthquake; Bottom: After earthquake)

Figure 2.28 Historic riverside damaged

2.4 Historic Sites

Damage to archaeological remains caused by the recent earthquake and tsunami included cracks in the ground in some areas and small-scale landslides, but there was no major damage. This is because remains, which were once the hub of human activity such as villages, and old temples and shrines are usually found on stable land and in places resistant to disasters such as floods and tsunami. However, this point requires special attention because land containing remains may be developed into residential areas because some areas damaged by the tsunami are transferred upland.

Castle remains that date back to the early modern period are mainly constructed from the end of the 16th century to the beginning of the 17th century. Many of those are made up of masonry walls. These masonry walls structure of gradient and warping were created by unique techniques developed in Japan. Although the masonry walls have been restored every time there was an earthquake or heavy rain over the past 400 years, many of the original masonry walls still remain intact.

However, these walls sustained considerable damage due to the recent earthquake. Nationally designated castles remains were in no small part affected by the disaster. This included the Edo Castle remains (Tokyo); the Sendai Castle remains (Sendai City, Miyagi Prefecture); the Wakamatsu Castle remains (Wakamatsu City, Aizu-gun, Fukushima Prefecture); the Nihonmatsu Castle remains (Nihonmatsu City, Fukushima Prefecture); and the Shirakawa Komine Castle remains (Shirakawa City, Fukushima Prefecture). This also applied to castle remains designated by local authorities such as the Soma-nakamura Castle; the Iwaki Taira Castle; and the Kasama Castle.

In particular, the masonry walls of Komine Castle sustained heavy damage, and collapsed in ten places

Figure 2.29 Collapsed masonry walls of Komine Castle

Figure 2.30 Collapsed masonry walls of Komine Castle

(Figure 2.29, 2.30). However, even the parts that escaped collapse suffered other kinds of damage such as loosening, bulging, and cracks, and a great deal of money and time is needed to restore them. Considering that hillside landslides occurred commonly in this region, it is believed this was due to strong horizontal oscillation. It is also believed that previous restoration methods prior to national designation were flawed considering that the sections collapsed on a grand scale were concentrated in these sections. As a cause of this, it could be argued that the shape and the stacking method of the newly added stone was faulty and that the masonry wall backfill was insufficient.

Sendai Castle sustained damage to various sections due to the 11th March earthquake and an aftershock on the 7th April. The masonry wall collapsed in 11 places, underwent bulging in 7 places, there was a landslide in 1 place, and a collapsed earthen wall in 1 place.

The masonry wall of Edo Castle sustained bulging and loosening in some parts. Also, the city entrance was made up of masonry walls, city gates, and bridges. Timber bridges were used up until the Edo era, but one of these is the Tokiwa Bridge which replaced a stone arch bridge in the tenth year of the Meiji era (1877). Instead of western technology, indigenous technology developed from Kyushu in Japan was applied to build this bridge. While it withstood the Great Kanto Earthquake of 1923 (M=7.9), there are fears it may collapse as a result of the recent earthquake.

The Yushima Seido and Shoheizaka Gakumonjo (Tokyo) are Confucianism-based educational institutions founded by the Edo Shogunate. Damage sustained by these institutions include tiles falling from wall roofs and cracks in the wall. The number of educational institutions educating the children of samurai families belonging to each clan was 255 at its peak in the Edo era, including the famous school, the Mito Kodokan. In addition to the collapse of the school alarm bell (belfry) within the campus, many buildings sustained damage such as falling tiles and cracked walls as a result of the recent earthquake.

The graves of feudal lords etc. exist in these regions, and damage to some gravestones was found. The Mito Tokugawa Family grave site (Ibaraki Prefecture) was located on a hillside, so some gravestones and part of the foundation masonry wall collapsed and cracks in the land in the embankment area were found due to strong horizontal oscillations.

2.5 Places of Scenic Beauty and Cultural Landscape

(1) Introduction

The Agency for Cultural Affairs created a list of damage caused by the Great East Japan Earthquake of 11th March this year to nationally-designated cultural property . This list includes places of scenic beauty (gardens etc.) that were affected by the disaster. The Motsu-ji Temple of Hiraizumi (Special Place of Scenic Beauty), which was inscribed on World Heritage List this year, and the tsunami-damaged Sanriku and Matsushima seashore will be given as case studies. As opposed to Hiraizumi which is located in inland Iwate Prefecture; the coastline place of scenic beauty, Matsubara (pine woods seashore), suffered devastating damage. Cedar and pine trees in districts where seawater swept inland are withering or dying. The whole picture relating to damage sustained straight after and subsequent to the tsunami is still unclear.

(2) Special Historic Site and Special Place of Scenic Beauty - Motsu-ji Temple (Hiraizumi-Town, Iwate Prefecture)

It is said that the Motsu-ji Temple Buddhist monk noticed in May that the standing rocks in the garden's pond were tilting more than before as a result of the earthquake and an aftershock (7th April). In late May, the place in question was looked over, and then fixed photographic observation was commenced to monitor movement (beginning of June). A support was added as an emergency measure (early June). At the end of July, a laser scanning was applied to survey the existing condition of the standing rocks, and a test trench survey was conducted at the base of the standing rock (Figure 2.31) until August. A committee meeting on the first round of repairs was held in mid-August, when the repair method was decided on. In early September, the rock was secured with a chain block, and an additional test trench survey was conducted. A second meeting was held in mid-September, and the standing rocks were repaired in the presence of committee members. Figure 2.32 shows the condition of the rocks on 20th September following repairs.

Figure 2.31 Test trench at the base of the standing rocks (Photo provided by the Center of the Cultural Heritage to Hiraizumi)

(3) Place of Scenic Beauty - Takata-Matsubara (Rikuzentakata City, Iwate Prefecture)

Facing Hirota Bay, the breathtaking Matsubara (pine woods) scenery is backed by beautifully-shaped mountains such as Mt. Hikami and Mt. Raijin. However, unfortunately it was greatly damaged by the recent earthquake, as shown in Figure 2.33. This damage included the topography of the reef, formed by a sandy beach extending approximately 2km from east to west and 300m north to south, as well as the pine trees that densely grow there. The eastern half was greatly eroded by the tsunami and large numbers of

Figure 2.32 Condition of the rocks on 20th September following repairs (Photo provided by the Center of the Cultural Heritage to Hiraizumi)

fallen pine trees are now scattered over the sandy area of the western half, which has retained its island shape. It is believed that the width of the reef from north to south has reduced to one-third following the disaster. Figure 2.34 shows, only one red pine on the western tip of the reef survived without being swept away. A three-story reinforced concrete building located in the Hirota Bay side acted as a buffer, so the red pine was able to avoid the effect of the tsunami. Accordingly, it is seen as a miracle that this red pine survived. Since the surrounding fallen trees were all shallow-rooted, it is believed that the surviving red pine has no axial root. A sand embankment was built to prevent the effect of seawater when a spring tide occurs, but the seawater came around behind the embankment and completely saturated it. As a result, the branches and leaves at the top of the pine tree are weakening. Considering that the administrative authorities of Rikuzentakata City are temporarily incapacitated, the Iwate Prefecture Development and Promotion Bureau is endeavoring to support the conservation of Matsubara. It is seen as important to leave behind regenerated pine trees from Takada-matsubara to revitalize the area. In order to increase the number of pine trees by taking cuttings of the

Figure 2.34 Survived only one red pine, Takata-matsubara

Figure 2.33 Tsunami-swept seashore, Rikuzentakata City

pine trees remaining in the island-shaped reef and grafting them elsewhere, it is seen as necessary to confirm the status of surviving trees. The topography and pine vegetation sustained serious damage due to the earthquake-induced tsunami, but part of the beach terrain certainly still remains. From hereon, it will be necessary to canvass the owner, Rikuzentakata City, as well as citizens and other concerned parties to confirm their willingness to preserve the area, while at the same time build consensus on restoring it to its status as a place of scenic beauty by restoring its topography and vegetation.

(4) Rikuchu Kaigan National Park, Jodogahama (The first prefecturally-designated place of scenic beauty, Miyako City, Iwate Prefecture)

The Rikuchu Kaigan National Park stretches 180km from Iwate Prefecture to Miyagi Prefecture. The entire coastal region sustained extensive damage due to the major tidal wave that struck in March, and out of the total 124 facilities, 18% (22 facilities) were totally destroyed and 31% (38 facilities) were partially destroyed (Figure 2.35, 2.36). These facilities included the picnic site and camping ground in the National Park. Emergency recovery work by the Ministry of the Environment has started at the Jodogahama collective facility area, which is a point for accessing the Park. However, a lot of the marine erosion and strangely shaped rocks that were formed over a long period have largely retained their appearance and go unchanged. The Jodogahama Visitor Center (core facility in Hitachihama-cho, Miyako City, Iwate Prefecture that introduces the National Park) held the special panel exhibit, "Rikuchu Kaigan National Park - Memories of the Disaster and Towards Recovery" for two months from August to September this year in order to relay the status of damage and recovery.

(5) Special Place of Scenic Beauty: Matsubara Coast, Matsushima Nobiru Area (Higashi-Matsushima City, Miyagi Prefecture)

There is a need now to combine activities preserving the landscape of the nationally-designated Special Place of Scenic Beauty, Matsushima, and restoring it after the Great East Japan Earthquake. The Higashi-Matsushima City, Nobiru area, known as "Oku-Matsushima", sustained the largest damage among the designated districts. As shown in Figure 2.37, the area where pine trees were literally uprooted and carried away by the tsunami has become a basin and water is still accumulated there (as of 22nd September, 2011). Half a year has passed since the tsunami struck, but a lot of time and patience is required to restore this place of scenic beauty.

Figure 2.35 Facilities destroyed by the tsunami (Jodogahama)

Figure 2.36 The conspicuous dying of pine trees that were engulfed by the tsunami

Higashi-Matsushima City publicly announced a scheme to develop and transfer the hill area designated as a protected region due to wide-scale relaxation of building restrictions in July. However, the proposed place of location is in a place that can be seen from Otakamori, one of the four views of Matsushima (viewing points to the sea and the islands of Matsushima), as shown in Figure 2.38. Mt. Otakamori is on Miyato island, but the elevated points of this island are virtually all in the special protection area. In fact, there have been moves principally among residents to select a new location that includes this protection area. However, rather than being reliant on relaxing restrictions, it is necessary to consider ways of minimizing the effect on the landscape and to individually examine the place and building scale.

Figure 2.38 Overlooking the Nobiru area beach and Matsubara from Mt.Otakamori (taken in September, 2010 - the year before the earthquake)

(6) Yubikan and Its Gardens

This cultural heritage consists of a garden with a pond and buildings including the Shoin style study. It was a han school for the Date clan who dominated the region in the 17th century and its gardens date back to the early 18th century.

Although the study collapsed due to the earthquake,

Figure 2.37 Current state of the Matsubara coast in the Nobiru area (half a year after the tsunami struck)

it had undergone temporary seismic reinforcement construction after it tilted due to the previous earthquake (Iwate-Miyagi Nairiku Earthquake in 2008). The building collapsed just when extensive repair work was planned to strengthen the building which has a lot of openings. The building collapsed toward the south east direction, its pillars broke and walls collapsed. Its Japanese-style thatched roof is currently lying on the ground. Fortunately, there were no casualties as it collapsed at the end of the long ground motion of the main shock. While it is currently protected by plastic covering (Figure 2.39), there are plans to dismantle it carefully and look into the damage status of the structural components in order to design and carry out the repair work (including structural reinforcement).

Other buildings (a subsidiary building, a corridor, and a tea room) sustained a strained framework and partial collapse of the walls although they did not entirely collapse.

The garden consists of a large pond and islands. The river wall on the shoreline has subsided and suffered cracks. The river banks need to be repaired extensively.

Figure 2.39 Yubikan (Top: Before earthquake; Bottom: After earthquake)

3. Efforts toward Recovery

3.1 Overview

As of 31st October, Agency for Cultural Affairs have grasped the status of damage to nationally designated, selected and registered cultural properties in each prefecture. An investigation into the status of damage to buildings of historical value, which have not been designated as cultural properties, has been conducted by the Architectural Institute of Japan and the Japan Society of Civil Engineers. A preliminary report has been submitted, yet the whole picture of the damage status has not been revealed. We have dispatched experts as "cultural property doctors" to not only investigate the damage to the immovable cultural properties but also provide technical assistance in developing plans to repair them. We also dispatched "cultural property rescuers" to the disaster-struck area immediately after the earthquake in an effort to preserve the movable cultural properties (Figure 3.1).

The water tank of the Ishioka No.1 power plant, which had been designated as an important cultural property, collapsed along with the virgin soil, resulting in its lifting of important cultural property desig-

Figure 3.1 Salvage of water-damaged documents

nation. This is the only case of delisting that has happened as a result of the disaster. The place of scenic beauty, Takada no Matsubara, suffered devastating damage with only 1 pine tree remaining. It has not been delisted, and efforts to protect the pine tree and to restore the pine forest have got underway.

It is possible that some of the registered cultural properties which broke up leaving only a foundation after being swept away by the tsunami or suffered extensive earthquake damage could be delisted. Of course we have been trying to preserve as many repairable properties as we can, but the situation remains severe.

Although the level of subsidy for disaster recovery repair of nationally designated cultural properties may differ according to type of ownership (i.e. public or private), the national government (Agency for Cultural Affairs) is going to provide subsidies for up to 85% of the expenditures. Since registered cultural properties receive support for design management only and are not eligible to receive construction fees, disaster relief funds provided by agencies other than the Agency for Cultural Affairs and private funds will be used in this regard. It is expected to take about 5 to 10 years to complete repair and reconstruction work.

Although some of the undesignated historical buildings have been dismantled and relocated, those which suffered extensive damage are expected to be dismantled.

As for locally designated cultural properties, it is impossible to cover repair and reconstruction efforts with just the budgets of disaster-struck prefectures and cities and city budgets. Therefore, it is believed that administrative efforts will be required, including the implementation of budgets regardless of national ministries and agencies.

Specialists from the Kansai municipalities including Hyogo Prefecture who dealt with the Kobe Earth-

quake 17 years ago will support disaster-struck prefectures such as Miyagi.

When it comes to reconstruction work, it will be necessary to investigate and preserve buried cultural properties. There are plans for archeologists from regions unaffected by the disaster to provide assistance in this regard.

3.2 Initiatives by the Japan National Trust

The Great East Japan Earthquake which struck on 11th March, 2011, not only took many lives and the gentle lifestyles of communities, the significant damage extended to region's historical culture and the natural and cultural heritage that coexist with it.

Following the earthquake, the Japan National Trust (hereinafter referred to as "JNT") was kept constantly updated with the status of damage to natural and cultural heritage in all regions. The shocking information that the "Rokkakudo" (Ibaraki City, Ibaraki Prefecture), which was constructed by Tenshin Okakura based on his own design, had been swept away by the tsunami was widely reported a few days after the disaster and had a great impact on many people. Information was received in late March that the Fukushima Church (Fukushima City, Fukushima Prefecture) designed by W.M. Vories was to be torn down rapidly as a result of this major earthquake, which had dealt a lethal blow to the already dilapidated Church abbey building.

As revealed by the fact that both of the structures were registered as nationally-designated tangible cultural properties; it became gradually clear through subsequent information-gathering and field surveys that there was particularly extensive damage to cultural heritage which could not be recovered or restored with government subsidies, making the situation more serious.

Further, damage to cultural heritage not only affected the Tohoku region, but extended over a wide range as far as the North Kanto region including damage caused by subsequent frequent aftershocks. It was reported that the majority of damaged cultural property in Kiryu City, Gunma Prefecture; which is developing a policy to establish an Important Preservation District for Groups of Traditional Buildings; was nationally-designated cultural property (of the 117 matters in 34 places, 41 matters in 17 places were affected by the disaster), and that the scale of the damage was more serious than expected (Figure 3.2).

In consideration of such circumstances, the JNT launched the "SEEDS OF FURUSATO - The Great East Japan Natural and Cultural Heritage Reconstruction

Figure 3.2 The Mori Goshi Gaisha storehouse, a registered tangible cultural property (Kiryu City, Gunma Prefecture)

Figure 3.3 A meeting for the "SEEDS OF FURUSATO - The Great East Japan Natural and Cultural Heritage Reconstruction Support Project" (29th August, 2011)

Support Project" (hereinafter referred to as the "Project") on 20th May. The JNT has promoted protection activities that go beyond protection measures by the government etc. throughout Japan for over 40 years. These activities aim to protect valuable natural and cultural heritage that requires protection and protect them itself without relying on national policy, and to promote the correct use of such heritage while passing them onto next generations (Figure 3.3).

By supporting the recovery and restoration of natural and cultural heritage as a regional "symbol", the Project aims to restore ways of life rooted in a regional culture and build a base to protect and utilize heritage. To achieve this, the Project is endeavoring to support the repair and recovery of tangible cultural property (structures) and Important Preservation District for Groups of Traditional Buildings; monuments (remains, places of scenic beauty, natural monuments) and cultural landscapes; and folklore cultural assets (irrespective of whether any of these heritage have been designated as cultural property by the national government, etc.).

This project is founded on three underlying principles. The first one is "REVIVE THE SYMBOLS", which refers to supporting natural and cultural heritage as a symbol of a region. The second is "DONATION CAMPAIGN", which aims to collect donations from domestic and foreign groups and individuals sympathetic with this theme. The third is "PARNERSHIP", which refers to making use of networks with the government, experts (academic society, engineers, etc.), and domestic and foreign action groups. Approximately seven months have passed since the earthquake struck, and as recovery programs concerning upland transfer etc. are examined by various local governments, the circumstances surrounding natural and cultural heritage are constantly changing. Close collaboration with experts, NPOs, and local government is believed to be crucial to gather accurate information and link owners and regions with the support they truly need. The Architectural Institute of Japan is already carrying out disaster damage surveys of historic structures, mainly including registered cultural property in the various prefectures in the Tohoku and Kanto regions. But coordinating such achievements so that they encourage concrete protection measures has become a pressing issue for owners seeking technical as well as financial support. As well as continuing with the already-underway donation campaign, the Project is scheduled to carry out "support work" via a public offering every fiscal year over a 10 year period starting from 2012. To lighten the burden of owners etc. as much as possible, "partner projects" that will simultaneously carry out fund-raising activities and restoration and recovery work will be developed in the future through partnerships with groups (irrespective of corporate capacity) such as NPOs attempting to support the restoration and recovery of natural and cultural heritage.

Prior to commencing work, a preliminary survey of owner's requests was conducted from 22nd June via the boards of education in each city and prefecture (the preliminary deadline was 15th July, since when responses have been received on an as needed basis). According to this survey, 194 requests have been submitted by 55 municipalities in 12 cities and prefectures. The survey findings showed that approximately 70% of these (137 cases) relate to structures, of which 41 cases (approx. 30%) are nationally-registered tangible cultural properties and 52 cases (approx. 40%) are undesignated cultural properties. The survey findings also showed that an overwhelmingly large number of these are not eligible for public subsidies for repair and recovery work. In regard to intangible folklore cultural assets, 38 requests for recovery support have been received, most of which (36 cases) were concentrated in the Sanriku coastal region extending from northern Miyagi Prefecture to Iwate Prefecture. 26 cases (70%) of those requests

related to undesignated cultural properties.
The aim of this project is not simply to subsidize expenses required for restoration and recovery work. Through this project, everyone can contribute to the process for recovering a region's "symbol", leading to machi-zukuri (town-planning) that makes use of a region's historical culture. I deeply hope that we can nurture as many people as possible to maintain the "SEEDS OF FURUSATO".

« Donation for Japanese Earthquake »

We are extremely grateful to everyone making a donation by bank transfer. We would like to sincerely thank you.

Account name: JAPAN NATIONAL TRUST
Bank name: THE BANK OF TOKYO-MITSUBISHI UFJ, LTD.
Branch: MARUNOUCHI BRANCH (002)
Swift code: BOTKJPJT
Account No.: 002-00-1108049
Bank address: 7-1, MARUNOUCHI-2CHOME,CHIYODA,TOKYO JAPAN

3.3 Salvage Project of Cultural Properties Damaged by the Earthquake and Tsunami

The Great East Japan Earthquake, which occurred on March 11th, 2011, triggered powerful tsunami waves reaching heights of over 10 m and brought destruction along the Pacific coastline of the Tohoku and Kanto regions. The tsunami waves destroyed and swept away countless buildings; left more than 15,000 people dead; nearly 4,000 people missing; and about 100,000 people seeking shelter. It was one of the worst natural disasters this country has ever experienced.
Numerous cultural properties were devastated by the earthquake and the tsunami including about 600 nationally designated cultural properties (figures reported by the Agency for Cultural Affairs). It took a tremendous amount of time to grasp the whole picture of the damage caused by the disaster immediately after it happened and it was deemed virtually impossible to investigate the status of damage to these cultural properties. However, under these circumstances, the Agency for Cultural Affairs emphasized the importance of initiating national efforts to relocate the damaged cultural properties to safe places not long after the disaster struck. The commissioner for Cultural Affairs sent out a message to seek cooperation from people all over the world on April 1st. Also, a special committee to salvage cultural properties damaged by the Great East Japan Earthquake was organized on April 15th.
The committee consists of national research institutes involved in cultural administration including the National Institutes of Cultural Heritage, the Independent Administrative Institution National Museum of Art, the National Institutes for the Humanities, the National Museum of Nature and Science, the National Diet Library and academic institutions including the Japanese Council of Art Museums, the Japanese Association of Museums, the Japanese Society for Scientific Studies on Cultural Properties, and the Japan Society for the Conservation of Cultural Property as well as NPO organizations involved in rescuing historical materials damaged by disasters. The committee dispatches workers to the disaster-struck areas in order to carry out salvage activities in response to requests made by the boards of education of the prefectures affected by the disaster.
The committee initiated its activities in Miyagi Prefecture in April and then extended its activities to Iwate Prefecture in May and to Ibaraki/Fukushima Prefectures in August. Its major projects include the "Ishinomaki Cultural Center", which has over 10,000 items including the Mouri Collection, and the "Ri-

kuzentakata Municipal Museum", which specializes in history, art and science. Since these institutions are situated along the coastline, the first floor of the Ishinomaki Cultural Center was completely submerged by the tsunami and a whole two-story building of the Rikuzentakata Municipal Museum was completely submerged.

For example, at the Ishinomaki Cultural Center its work started by removing the sea bottom sludge and rolled paper from the neighboring paper factory, which occupied the entire floor. We salvaged all the works including artworks, archeological artifacts, articles for everyday use, and the Mouri collection materials, and stored them in several facilities in Miyagi Prefecture after securing a route to transport these items.

We are still dispatching workers from the committee in response to rescue requests while taking measures to temporarily store the salvaged goods by vacuum freeze drying or washing them in order to prevent wet items from deteriorating.

Figure 3.4 Salvage activities at the Ishinomaki Cultural Cneter

4. Status of Damage to Individual Cultural Properties and Future Issues

(1) Ishinomaki St. John the Apostle Orthodox Church

The Ishinomaki St. John the Apostle Orthodox Church, which is a municipal-designated cultural property, stands on a sandbank close to the estuary of the Kitakami River (2 km from the estuary). The building was originally built in 1880 and is said to be the oldest wooden church in Japan. The tsunami reached a height of about 5 m around the church. It is clear from the water mark that the tsunami reached as high as the ceiling of the 2nd floor. The area around here has suffered devastating disaster along the Kitakami River. Almost all the wooden houses were swept away by the tsunami and only the Ishinomori Manga Museum, which is made of reinforced concrete and steel frame, survived. The church suffered damage and deformation but miraculously survived without being swept away. The reason why the church survived the disaster is to be investigated by future research.

This wooden church was built in 1880 in Sengoku-cho (about 600m inland from the current location) but relocated to the current location after suffering severe damage during the 1978 Miyagiken-oki earthquake (M=7.4). It has been utilized as a museum since it was relocated. The current structure employs the traditional Japanese timber framework method of utilizing braces. Before the relocation, the outer walls adopted the shitami itabari style (wooden board siding with battens), but mortar with a thickness of about 20 to 30mm is now used for finishing. Reinforced concrete is used for the strip footing and is connected well to the base of the frame. It is considered to be fortunate that since the church stands on the sandbank of the river, it might not be struck by the houses that were swept away. A combination of several factors seemed to contribute to the survival of the building. (Figure 4.1, 4.2)

(2) Sekinoichi Brewery

Sekinoichi Brewery, which is located in Ichinoseki City in Iwate Prefecture, owns 7 buildings built in the early 20th century, all of which have been registered as tangible cultural properties. Currently, these buildings are open to the public and utilized as a beer factory, a restaurant and a museum etc. to serve as tourist attractions. Two of these buildings are made of stone. The stone material used is called "Shiogama Ishi" (also called Nobiru Ishi in Shiogama) which is a tuff-based stone material produced in Shiogama. Shiogama is close to the estuary of the Kitakami Riv-

Figure 4.1 Ishinomaki St. John the Apostle Orthodox Church (Ishinomori Manga Musuem in the back)

Figure 4.2 Damage caused by the tsunami around the Ishinomaki St. John the Apostle Orthodox Church

er and the river was utilized to transport the stones at the time of construction of these buildings. The buildings contain wooden frameworks. Although the building was built in stone walls with inner wooden frames, structurally the stone materials provide the main resistance and rigidity elements. The dimensions of the stone are 87cm × 29cm × 23cm, which is approximately the same as those used in the historical stone buildings in Shiogama city. Of the two stone buildings, the one which is used as sake tasting area and a direct sales spot suffered serious damage as a result of the 11th March earthquake in which the top part (triangular part) of the stone walls of the gable on the south side collapsed (Figure 4.3). This is a typical type of damage seen in masonry construction and highlights the importance of seismic safety for an out-plane response. Although the walls on the north side of the building suffered no visible damage, they were converted to brick walls after flood damage suffered in the mid Showa-era (1960s-1970s). The other stone building, which is utilized as a beer hall, suffered distinctive vertical cracks on the stone gable walls. The earthen warehouse, which is called *Torigura* and hosts events such as ceramic art exhibitions and concerts, tilted toward the west (Figure 4.4). This earthen warehouse was deformed as a result of the earthquake and tilted toward the west at an angle of approximately 1/30. Although it is called an "earthen" warehouse, it has a wooden framework and high deformability. Tile roof did not suffer any particular damage but it was slightly displaced as a result of the aftershock. Although the roof was covered with soil, the roof tiles were secured with pins. The Sekinoichi Brewery is located close to the Hiraizumi area. Also, it is considered to be an important cultural property to the area.

Registered tangible cultural properties can be preserved and maintained by utilizing them. In this regard, owner judgment is also important. The disaster-affected buildings of Sekinoichi Brewery are being utilized again after emergency response measures were applied. These buildings symbolize the high level of awareness of the owner to keep the regional culture alive. Also, a symposium on the utilization of cultural properties was held here. The event was hosted by the Regeneration of Architectural Heritage and supported by the Japan ICOMOS. In the future, the ICOMOS is expected to actively support these initiatives.

Figure 4.3 Collapsed stone gable wall

Figure 4.4 External appearance of the Sekinoichi Brewery's earthen warehouse (*Torigura*)