The Kumamoto Earthquake

Report on the Damage to the Cultural Heritage

1 December 2017

Japan ICOMOS National Committee

The Kumamoto Castle. Kumamoto City

The main building of the Eto family home (Important Cultural Property), Ozu Town, Kumamoto Prefecture

A huge sloping the main hall and collapsed the worship hall, Hachiosha Shrine

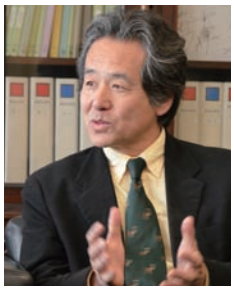
Introduction

Two earthquakes of a seismic intensity of 7 on the Japanese seven-stage seismic scale occurred in Kumamoto, the first at 9 p.m. on April 14th, 2016, and the second at midnight on the 16th, causing enormous damage at various places in Kumamoto Prefecture. More than 180,000 people were forced to evacuate for several nights. With regard to cultural heritage, the damage was severe. For example, the Ro-mon (tower gate) and Haiden (hall of worship) of the Aso shrine and two Yagura (turrets) of the Kumamoto Castle collapsed entirely: both the shrine and castle have been designated as Important Cultural Properties in Japan.

A year and a half since the Kumamoto Earthquakes, a major issue is how historic buildings can be preserved, such as valuable traditional houses and small shrines in historic settlements that escaped collapse.

ICOMOS Japan publishes this report in the hope that, by sharing its information, which is concerned with earthquake disasters and the efforts toward recovery, it will be a valuable guide for other countries that have the possibility of similar earthquake damage in finding desirable ways to preserve their cultural heritage from natural disasters.

Yukio Nishimura,
President of Japan ICOMOS National Committee



Japan is a country where many earthquakes have occurred in the past. For instance, 1,036 earthquakes of a magnitude of 6 or higher on the Richter scale were recorded between 2000 and 2009 globally. Of these, 212 occurred in or near Japanese territory. In 2016, two earthquakes that registered 7 on the Richter scale hit Kumamoto Prefecture within three days. Many cultural heritage sites were damaged as a result and are still in a critical condition. Local communities and residents in Kumamoto immediately set to work to recover the damaged sites. Full recovery will take time and will be a long and complex process. ICOMOS Japan is determined to work closely with local communities and authorities to support their activities in recovering the sites and will contribute to the discussions on reconstruction.

This report is the first documentation of the immediate post-trauma situations in Kumamoto. I hope that more will be reported to present the recovery process to the international community, and that people in other countries affected by similar disasters will be encouraged to take recovery actions.

Toshiyuki Kono,
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Map of Japan

The Kumamoto Earthquake
-Report on the Damage to the Cultural Heritage-

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1. Overview of the earthquakes

The 2016 earthquakes, which caused major damage to the Kumamoto Prefecture region, characterized by a series of earthquakes, with the ground motions of intensity of 1 or higher in Japan Meteorological Agency (JMA) Seismic Intensity Scale measured more than 1,000 times. They consisted of a fore-shock earthquake that occurred at around 21:45 on April 14, a main-shock earthquake at around 01:25 on April 16, and many after-shock earthquakes. Both the April 14 fore-shock earthquake and the April 16 main-shock earthquake recorded JMA seismic intensity of 7. Since 1996 when Japan started to operate a system in advance of the rest of the world to measure instrumental seismic intensity, this was only the third time an earthquake of JMA seismic intensity 7 has been recorded (the previous two times were the 2004 Niigata-ken Chuetsu Earthquake and the 2011 Great East Japan Earthquake). The fault zone extending from the western end of the Median Tectonic Line crosses the central part of Kyushu and runs, basically, in a northeast-southwest direction; these were the inland earthquakes caused by this active fault zone. In order to show the seismic activity in the Kumamoto Prefecture region, the historical earthquakes are shown in Table 1.1, a list of the earthquakes that have affected the Kumamoto region since the 17th century.

As shown in Table 1-1, in the 400 years since the 17th century, the current type of earthquake, an inland underground earthquake with a magnitude of over 5 (defined by JMA), has occurred only five times, with the largest being 6.5. Consequently, the region has not been regarded as having a high level of seismic activity, and its earthquake region coefficient, as prescribed by the Enforcement Ordinance of the Japan Building Code, is 0.8, which is the lowest value other than that of Okinawa (it is 1.0 for cities, including Tokyo, Osaka, and Kyoto). The 2016 Kumamoto earthquakes occurred in such earthquake environment.

The April 14 fore-shock earthquake is considered to have occurred by rupture of the Hinagu fault, and the April 16 main-shock earthquake due to the Futagawa fault. Both are right lateral faults. The depths of their epicenters were approximately 11km and 12km, respectively (See Figure 1.1). According to the new edition of Japan's Active Faults, these are classified as having a certainty level of I (it is certain that they are an active fault)[3)], and an activity level of class B (a displacement rate per 1,000 years of 0.1-1.0m). The Hinagu fault's displacement speed was estimated to be 0.7m/1,000 years. The Earthquake Research Committee has indicated that if the Hinagu fault and Futagawa fault become active, it is possible that they would cause earthquakes of magnitude M6.8 and M7.0, respectively.

Next, the earthquakes' seismic intensity distribution and peak acceleration distribution are shown. Figure 1.2 shows the instrumental seismic intensity distribution of the fore-shock earthquake and the main-shock earthquake, as measured by the Japan Meteorological Agency. Figure 1.3 shows the main-shock earthquake's peak acceleration distribution, as measured by the National Research Institute for Earth Science and Disaster Resilience.

Response spectra are generally used to evaluate the earthquake response of a building, as not only the earthquake ground motion characteristics but also the response characteristics are taken into account. In this report, the earthquake-motion characteristics recorded at the Mashiki Public Office, where JMA seismic intensity of 7 was measured, at KiK-net (KMMH16) Mashiki, and at the Nishihara Public Office are shown. The earthquake ground motion amplitudes recorded in the present earthquakes were in more of the east-west (EW) direction than the north-south (NS) direction.The peak acceleration

Table 1.1 Earthquakes that have caused damage in the Kumamoto region since the 17th century[1)]

Date	Region and Name	M*	The main damage
1619. May. 1	Higo and Yatsushiro	6.0	Destruction of Mugishima Castle and other public and private buildings.
1625. Jul.21	Kumamoto	5-6	Explosion of the Kumamoto Castle explosives warehouse. Near to the castle keep, the castle's stone wall was damaged. Approximately 50 fatalities.
1707. Oct.28	Houei Earthquake	8.4	
1723. Dec. 19	Higo, Bungo, and Chikugo	6.5	In Higo, 2 fatalities, 25 injured, 980 collapsed houses.
1769. Aug. 29	Hyuga, Bungo, and Higo	7 3/4	Major damage to Nobeoka and Oita Castles. Within the Kumamoto region, 1 fatality, 115 collapsed houses.
1792. May. 21	Unzendake	6.4	The eastern part of the front of the mountain collapsed. Approximately 5,000 fatalities and more than 2,000 houses washed away by a tsunami.
1854. Dec. 24	Ansei Nankai Earth-quake	8.4	
1889. Jul.28	Kumamoto	6.3	Major damage near Kumamoto City, with 20 fatalities, 54 injured, and more than 200 houses completely destroyed.
1941. Nov.19	Hyuga-nada Sea	7.2	Two fatalities, 7 injured, and 19 houses completely destroyed.
1946. Dec.21	Nankai Earthquake	8.0	Two fatalities, one injured, six houses completely destroyed.
1975. Jan.23	Northern Edge of Mt. Aso	6.1	Damage was concentrated in the Mino District of Ichinomiya Town. Ten injured, 16 houses completely destroyed.

M*: magnitudes are from the Japan Meteorological Agency (JMA)

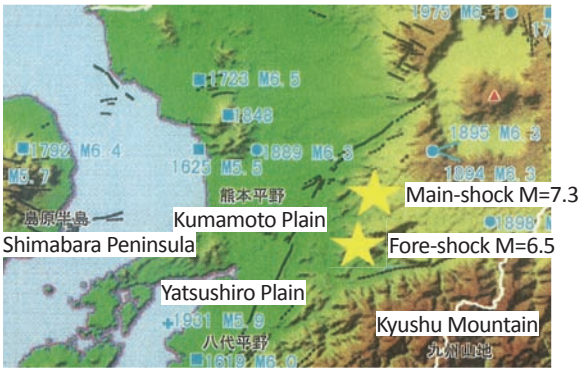

Figure 1.1 Historic earthquakes and active faults in the Kumamoto region[1)].

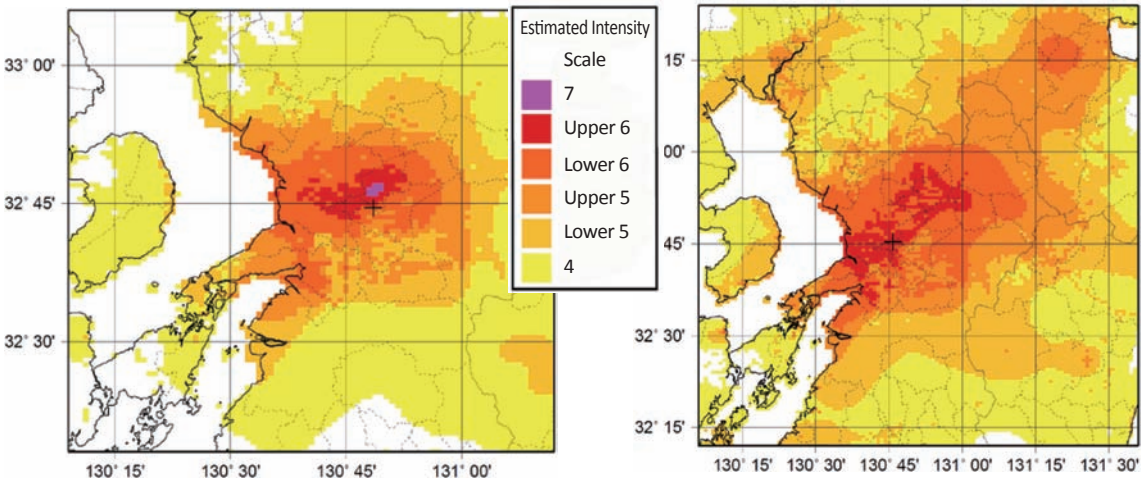

Figure 1.2 Seismic intensity distribution of the fore-shock and main-shock earthquakes (Japan Meteorological Agency website).

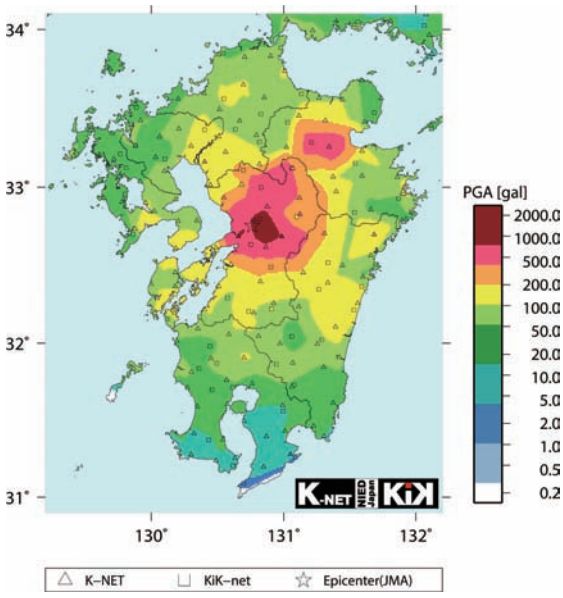

Figure 1.3 The main-shock earthquake's peak acceleration distribution
(from the website of the National Research Institute for Earth Science and Disaster Resilience).

is as described below. At the Mashiki Public Office measurement station, the EW direction amplitude of the peak acceleration was 0.83G and the NS direction was 0.53G; at the Mashiki KiK-net measurement station, the EW direction was 1.15G and the NS direction was 0.65G; and at the Nishihara Village Komori measurement station, the EW was direction 0.77G and the NS direction was 0.72G.

Regarding the records of these earthquakes, Figures 1.4, 1.5, and 1.6 show the acceleration waveforms of EW and NS directions as well as the velocity response spectra (h=5%). The response spectra diagram also shows the spectrum provided by Enforcement Ordinance of the Japan Building Code for Type 2 ground condition.

Table 1.2 shows the main-shock earthquake's peak

acceleration (three-component composition) for the region in which the cultural properties described in this report are located. It is not shown in the present table, but the Mashiki Town KiK-net measurement station measured as high as 1.362G for the three-component composition.

As we can understand from Figures 1.4, 1.5, and 1.6, from the records of Mashiki Town's earthquake, which had measured seismic intensity of 7 in JMA Scale, and from Nishihara Village's records, there were major differences in the response spectra characteristics. In addition, even within the records in the same town of Mashiki, the Public Office response spectra values were approximately twice those of the KiK-net records. The Nishihara Public Office's response spectra can be seen to have predominant peaks at short period of less than one second, as well as broad peaks of rather longer period of two to three seconds. The spectra at rather longer period of two to three seconds exceeded 300cm/s, which may express the movement of the fault. In the present earthquakes, the depths of the epicenters were shallow, and it is understood that there were significant differences in the seismic intensity characteristics of the epicenters, depending on their locations. Furthermore, the amplitude of the EW direction was large relative to that of the NS direction. It is known from theory and from measurement records that in the hypocentral region of a floating earthquake, the fault's orthogonal-direction component is predominant, and in the recent Kumamoto Earthquakes, it has been noted that the parallel-direction component was larger than the orthogonal-direction of the fault. This phenomenon was a feature of the earthquake ground motion characteristics from the Kumamoto Earthquakes.

According to the KNET earthquake-motion records within Kumamoto City, the 0.3-0.5 second short-period component was predominant (See Figure 1.7). In the Nishihara Public Office's earthquake-motion records, the power of the short-period component was also large (See Figure 2.6). This short period area had a major impact on the masonry structures, which are short-natural period structures. Kumamoto Castle's stone walls suffered major damage, considered to have been caused by the result of the response of these stone wall structures induced by the predominance of the short-period component. This tendency was also seen in the damage resulting from the 2011 Great East Japan Earthquake, in which masonry structures suffered major damage. The cultural properties described in this survey report, at the PS Orangerie, the Honmyo-ji Shrine Deva gate, and Yasemegane Bridge, are also characterized by short-period structures. A feature of the present earthquakes was that at the hypocentral region and their vicinities, the earthquake-motion characteristics differed greatly with depending on the site, and in the areas with many historic buildings (within Kumamoto City), it was observed that the short-period component that affects masonry structures was predominant, while in the vicinity of the fault, the long-period component was observed, due to fault slippage.

At the end of this section, we note the damage statistics compiled by the Cabinet Office. As of May 31, 2016, the human damage consisted of 49 deaths and 1,663 severe and minor injuries. As for damage to buildings, 6,090 houses suffered complete destruction, 20,219 houses suffered partial destruction, 85,635 houses suffered fragmentary damage, 1,042 non-inhabited buildings suffered damage, and there were 16 incidents of fires. Aside from these, there were 57 incidents of debris flows, 10 incidents of landslide, and 115 incidents of cliff landslide.

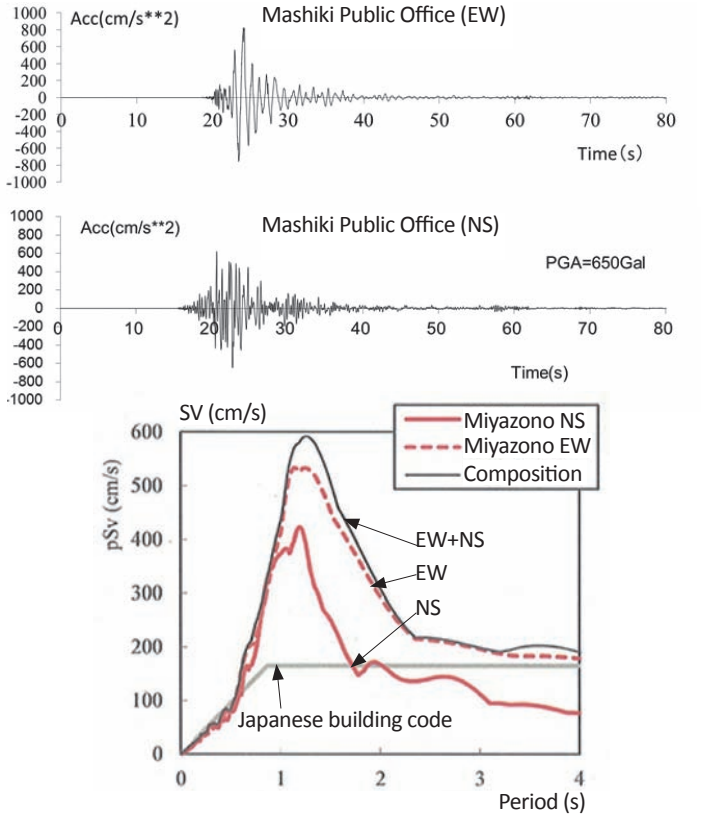

Figure 1.4 The seismic waveform and the acceleration response spectrum measured at the Mashiki Public Office (provided by Dr. Nakagawa).

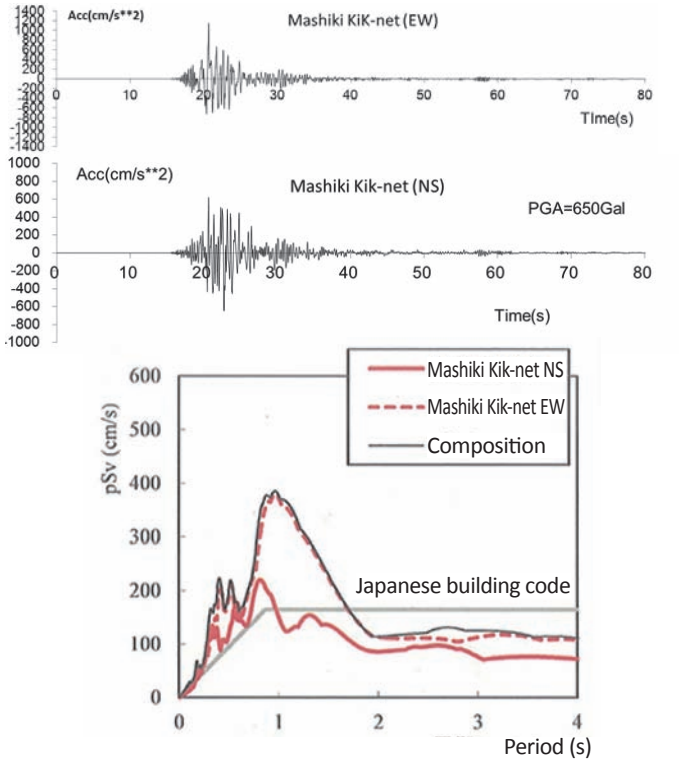

Figure 1.5 The seismic waveform and the acceleration response spectrum measured at the Mashiki Town KiK-net (provided by Dr. Nakagawa).

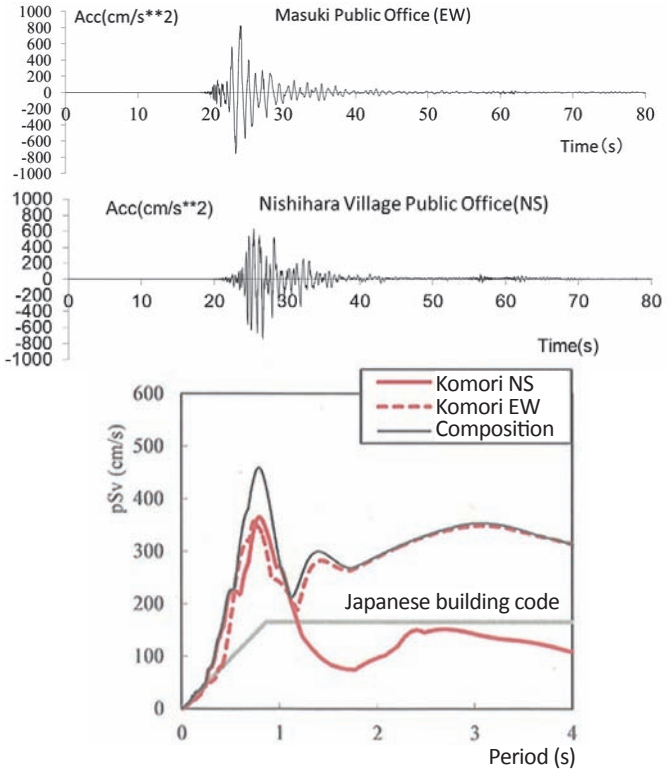

Figure 1.6 The seismic waveform and the acceleration response spectrum measured at the Nishihara Public Office (provided by Dr. Nakagawa).

Table 1.2 Instrumental seismic intensity and peak acceleration of the regions with a damaged cultural property indicated in this report (main shock, the National Research Institute for Earth Science and Disaster Resilience K-Net, KiK-Net)

Measurement station	Instrumental seismic intensity (JMA Scale)	Peak acceleration (cm/s^2)	Measurement station's distance from epicenter (km)
Nishihara Village Komori	6.6	904	15.8
Aso City Ichinomiya	5.5	403	35.5
Kumamoto City Chuo Ward	6.0	657	6.3
Kumamoto City Higashi Ward	6.0	843	4.2
Kumamoto City Nishi Ward	6.0	678	7.5
Kumamoto City Minami Ward	5.9	595	9.0
Kumamoto City Kita Ward	5.8	1027	9.0
Otsu Town Hikigi	5.7	669	17.1
Mifune Town	5.7	499	6.2

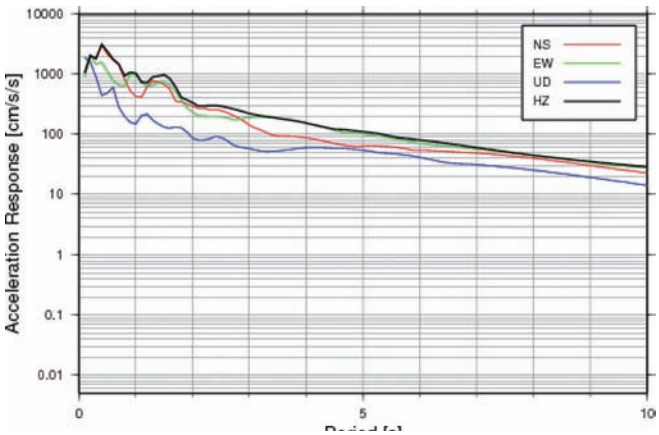

Figure 1.7 The acceleration response spectrum measurement records of K-net Kumamoto (KMM006) (from the National Research Institute for Earth Science and Disaster Resilience website).

Acknowledgments

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References

1) The Prime Minister's Office, the Headquarters for Earthquake Research Promotion, the Earthquake Research Committee, ed.: Japan's seismic activity—Characteristics by region as seen from earthquake damage, pp. 330-333, 1997
2) Usami Tatsuo, author: Overview of Japan's Earthquakes, new edition, University of Tokyo Press, 1991
3) The Active Fault Study Group, ed.: Japan's Active Faults, New edition, distribution diagrams and materials, University of Tokyo Press, pp. 358-363, 1991
4) The Headquarters for Earthquake Research Promotion, the Earthquake Research Committee: Evaluation of the 2016 Kumamoto Earthquakes, May 13, 2016 (the Japan Meteorological Agency homepage)
5) The National Research Institute for Earth Science and Disaster Resilience: Strong tremors from the April 16, 2016, Kumamoto Prefecture Kumamoto region
6) The Cabinet Office disaster prevention website: The damage situation relating to the 2016 Kumamoto Prefecture Earthquakes whose hypocenter was in the Kumamoto region (as of 10:00 May 31, 2016)

2. Overview of damages to cultural properties

This section will provide an overview of the damage that affected cultural properties as a result of the series of earthquakes whose hypocenter was the Kumamoto region, Kumamoto Prefecture. Figure 2.1 shows the number of properties damaged as of May 30, 2016, including Important Cultural Properties and Registered Tangible Cultural Properties (a total of 150 properties) designated by the national government, as well as details of composition ratios. The most hit were Registered Tangible Cultural Properties, with a total of 57 properties damaged, followed by nationally designated Important Cultural Properties, with 39 properties affected; these properties accounted for around two thirds of the total of damaged properties. If one adds to these damaged Historic Sites and Places of Scenic Beauty, the total accounts for more than 90% of all damaged properties.

In figure 2.2, the 150 damaged cultural properties and other properties under national protection mentioned in Figure 2.1 are sorted according to their type and the prefecture in which they are located. Cultural properties and other properties located in Kumamoto Prefecture account for around two thirds of the total number of damaged properties, followed by those in Oita Prefecture and Fukuoka Prefecture, where many cultural properties and other properties were also damaged. Together, these three prefectures account for 90% of the total.

Figure 2.3 summarizes the number of damaged properties that had received a designation in Kumamoto Prefecture, in the municipalities in Kumamoto Prefecture, and in Oita Prefecture. The number for damaged properties in Kumamoto Prefecture was the number as of April 28, 2016, while the number in Oita Prefecture was as of May 23, 2016. Damaged Buildings and Historic Sites were reported in similar numbers. While no information was available on the types of cultural and other properties damaged in Fukuoka Prefecture, it was reported that as of May 10, 2016, 11 cultural and related properties designated by Fukuoka Prefecture

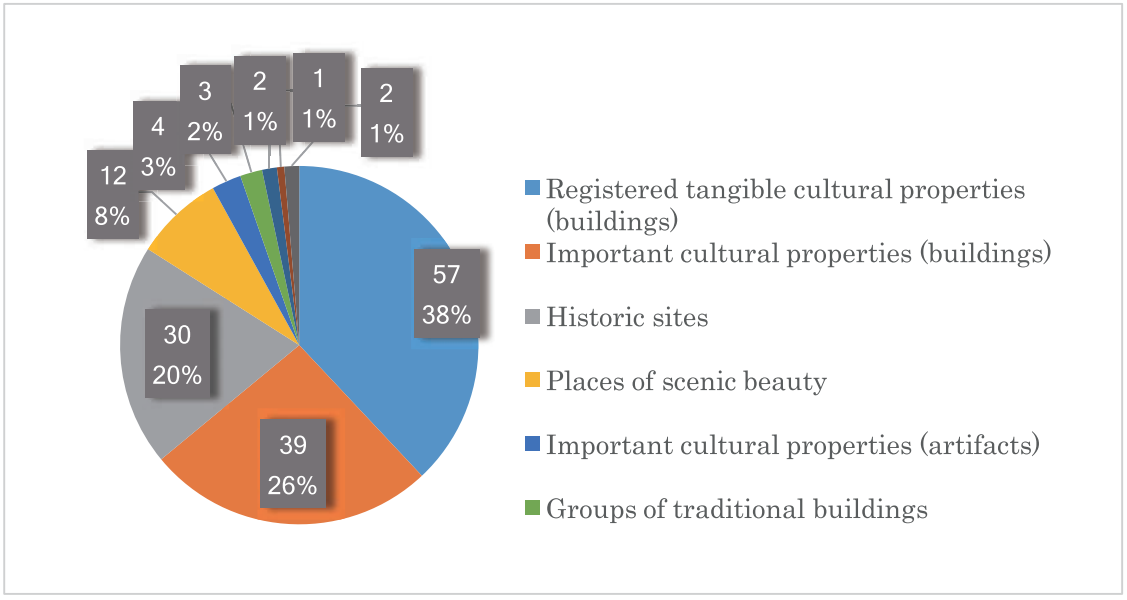


Figure 2.1 Number of damaged cultural properties designated by the national government (by type)

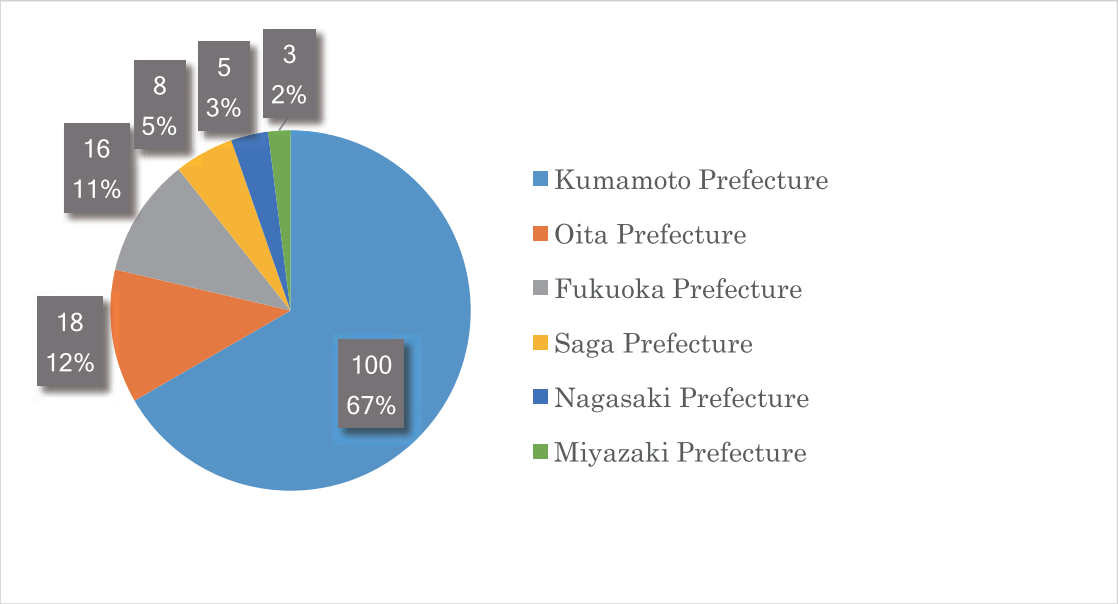


Figure 2.2 Number of damaged cultural properties designated by the national government (by prefecture)

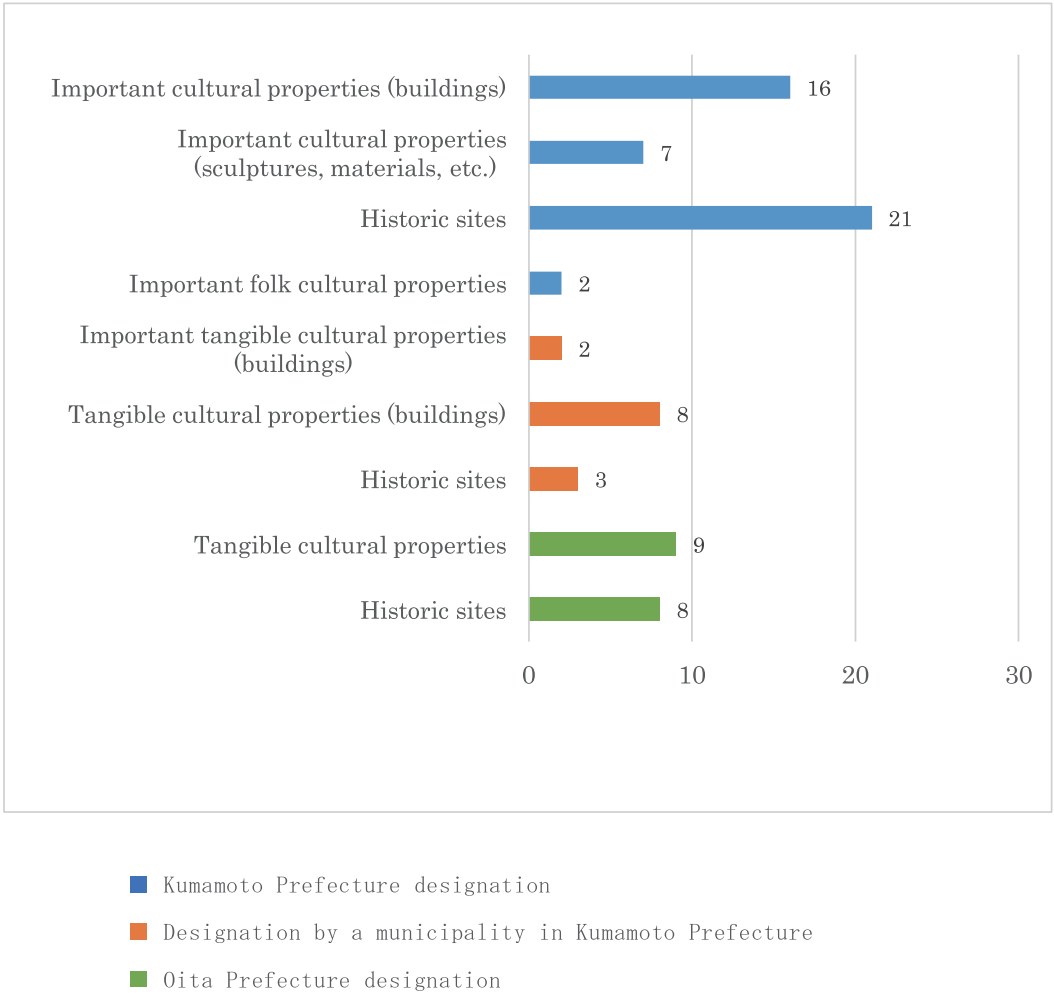


Figure 2.3 Number of damaged properties: cultural properties designated by prefectures and municipalities

were damaged, as well as 11 municipality-designated cultural and related properties located within the Prefecture.

In Kumamoto Prefecture, there were also great damages to historic buildings located in Nishihara Village and Mashiki Town which recorded two earthquakes of seismic intensity 7, in Kumamoto City which recorded seismic intensity of more than 6, as well as in other places and especially those historic buildings located along the fault. Although damages to brick and stone masonry structures were significant, and while some of the shrine buildings, modern-western style buildings and old residences collapsed, most buildings survived with merely large-scale partial collapse or small-scale partial collapse with some deformations because the majority of them were built with the wooden framework construction method.

Among these buildings, the restoration of Kumamoto Castle is likely to cost some tens of billions of yen. The cost for other buildings will be on a scale of several billion yen in total. As for the duration of works, it will probably take 20 years to restore Kumamoto Castle and close to 10 years to restore the other buildings.

One year and a half after the earthquake: while some of the repair works have begun, most of them have yet to be started.

References
1) MEXT: Report on the damage by the earthquakes whose hypocenters were in the Kumamoto region, Kumamoto Prefecture (Report No. 32), 2016.5.30.
2) Kumamoto Prefecture: Summary of the situation of damages to cultural properties from the earthquake of April 14, 2016, 2016.4.28.
3) Oita Prefecture, Education and Cultural Affairs Section: The situation of damages cultural properties in Oita Prefecture due to the 2016 Kumamoto Earthquakes, 2016.5.23.
4) Mainichi Shimbun, regional edition: The total cost of the Kumamoto Earthquakes will be 373 million yen; a summary of damages in the Prefecture/Fukuoka, 2016.5.11.

3. Damage to cultural properties and subsequent restoration

3.1 Wooden structures

3.1.1 The Eto family home (nationally designated Important Cultural Property)

The Eto family home is located in Jinnai, Otsu Town, Kikuchi District of Kumamoto Prefecture. In 2005, it was designated an Important Cultural Property (building) because it has maintained to this day the premises layout of elite class homes of the Higo region. At the center of a square site measuring roughly 80 meters per side, the main building faces the south; in the southwest corner there is a *Nagayamon* gate (long house gate) and a stable. The central storehouse stands to the southeast of the main building, the rear gate is located centrally in the western section of the site, and stone walls border the site's boundary on the north side and part of the west side. In addition to the main building, four buildings and one ancillary building (including a hut, stone wall, waterways and residential land) are designated properties. Among them, surveys conducted until now allow one to consider that by the 13th year of the Bunsei period (1830), the main building had probably reached a form that is close to its current one. While it continued to function as a family home over time, the Eto family home has arrived to its present configuration through repeated additional construction works carried out over the Meiji, Taisho, and Showa periods; to this day it has preserved in good condition high-quality interior designs from each of these periods.

Damage in the fore-shock earthquake was limited to the collapse of the chimney on the north side of the main building and the partial collapse of the earth walls of the central storehouse. Effects of the main-shock earthquake extended to the main building: the building inclined up to more than 1/8 towards the west side, roof tiles and earth walls fell down. As for the interior, parts of the ceiling above the large room (*hiroma*) fell, the reception room (*zashiki*) inclined towards the south, and the walls attached to the alcove were damaged. In terms of structure, the main building is divided into three buildings: one centered on the earth floor doma, another on the south side centered on the *zashiki* reception room, and another comparatively new one to the north side; it is the connections between these buildings that broke, with fractures up to some 50cm where large. The stable's west side outer wall fell and the building inclined greatly towards the road on the west side. At the central storehouse, the pillars came off their foundation stones and the structural frame inclined towards the west side. Also, most of the earth walls fell. The rear gate collapsed onto the road on the west side. Protrusions occurred at parts of the stone wall on the north side of the site. The Eto family home is located to the northeast of the Futagawa River fault, which was the epicenter of the main-shock earthquake. The main building and other buildings on the site inclined to the west side or the west-southwest side due to the main-shock earthquake; this inclination shows a direction similar to the direction of displacement of the Futagawa River fault, which extends from east-northeast to west-southwest.

As emergency response measure to prevent collapse, temporary reinforcements were installed to the main building's interior and exterior on the west side, which had acquired a significant incline. Also, because there were concerns that during the rainy season leakage from broken roofs into the interior of the building would seriously damage the pictures on the partition walls, these were removed as a priority and stored separately. The stable had greatly inclined

Photo 3.1.1.1 The main building (before the earthquakes)

Photo 3.1.1.2 The main building (after the earthquakes)

Photo 3.1.1.3 The central storehouse (before the earthquakes)

Photo 3.1.1.4 The central storehouse (after the earthquakes)

Photo 3.1.1.5 The stable (before the earthquakes)

Photo 3.1.1.6 The stable (after the earthquakes)

Photo 3.1.1.7 Interior of the main building, the hiroma (before the earthquakes)

Photo 3.1.1.8 Interior of the main building, the *hiroma* (after the earthquakes)

towards the road side, up to as much as 1/8, and the deterioration of the bases of its pillars was also significant; it was temporarily dismantled for safety and preservation. At the central storehouse, the remaining earth walls were dismantled and removed, and temporary reinforcements were installed inside the building to control the incline. As for the stone wall, only sections with protrusions were dismantled, and the stones were put in storage.

From now on, measures will aim at making the structural frame of the main building sound after completely dismantling the building's west part that was significantly damaged. There are plans to build back the buildings centered on the reception room and that on the north side. Additionally, diagnosis of seismic resistance will be carried out and measures to strengthen the earthquake-resistance performance will be taken. The structural frame of the central storehouse will be temporarily dismantled to carry out conservation and repair works. Restoration works will be carried out for the stable, the *nagayamon* gate, and the rear gate. Works are scheduled to last around 4 years (until fy2020) for the main building. Repair works of the central storehouse and the stable are expected to start in fy2019 and take 3 years, up to fy2021. After that, the plan is to continue work on the other structures, including the *nagayamon* gate, the rear gate, the hut, and the outer structure, until fy2022.

Even after repairs, the Eto family home will continue to serve its original function as a home and will continue its life as a living *minka*. For that purpose, the plan is to carry out maintenance works and disaster-prevention works in parallel to repairs.

One year before the earthquake, local volunteers had formed the "Society for the Protection of the Eto Family Home" (with currently 47 members). Although in the recent earthquakes the Eto family home suffered serious damages, the bond that had been nurtured between its owners and the local community has grown even stronger.

3.1.2 The Yano family home (nationally Registered Tangible Cultural Property)

Hontaku

The Yano family home (*Hontaku*, or main home) was built in 1873, following the premises layout of a *zaigokenin* (vassal who lives in the countryside instead of living in the Lord's castle town) home of the Edo Period. In 1999, it became a Registered Tangible Cultural Property. It consists of seven structures in total: the main building, the storehouse, the miso storehouse, the shed, the front gate, the rear gate, and the middle gate. The three fissures that run on the premises (at the shed, the main building, and the storehouse) along the east-west direction indicate that there were significant tremors in the north-south direction, and that the ground moved towards the south. Thus, while in many places the structural frame has come off the stones and other parts of the building's foundations, it is probably more adequate to understand this as due to the ground's movement, rather than the movement of the structural frame.

The tiled roof of the main building had been re-done prior to the earthquake, and survived the quake practically sound. However, the building sustained major damage such as the collapse of parts of the walls, and if one is to take into account those parts that have fissures, the majority of walls is not in sound condition. As for the structural frame, pillars are inclined in some parts, and in many places, they have come off the center of the foundation stones. Due to the fissure running under the main building, a dislocation appeared in the ground in the north-south direction, which caused various problems, such as the fall of the alcove lintel in the reception room and the dislocation of threshold members and head jambs.

Inside the storehouse, a fissure runs along the

Photo 3.1.2.1 The road in front of the shed of the Yano family home (*Hontaku*)

Photo 3.1.2.2 The fissure at the shed of the Yano family home (*Hontaku*)

Photo 3.1.2.3 The shed pillars have come off their foundation stones at the Yano family home (*Hontaku*)

Photo 3.1.2.4 The middle gate collapsed at the Yano family home (*Hontaku*)

Photo 3.1.2.5 The wall of the formal room collapsed at the main building of the Yano family home (*Hontaku*)

Photo 3.1.2.6 The wall of the reception room at the main building of the Yano family home (*Hontaku*)

Photo 3.1.2.7 The thresholds have become misaligned at the main building of the Yano family home (*Hontaku*)

Photo 3.1.2.8 The fissure in the earthen floor of the main building of the Yano family home (*Hontaku*)

Photo 3.1.2.9 The storehouse of the Yano family home (*Hontaku*)

Photo 3.1.2.10 The storehouse of the Yano family home (*Hontaku*)

earthen floor, the groundsill and the structural frame are significantly out of alignment, and the beams are pushing the pillars: there are concerns of collapse.

As the front gate is a *Yakuimon*-style gate (a gate with a gable roof constructed with two main posts and two light secondary posts), the structure inclined heavily to the front side (west side). The rear gate's structural frame is basically sound, but some of the roof tiles have become misaligned. The middle gate, which had been reinforced by angle braces and diagonal braces prior to the earthquake, fell down even though it retained its shape.

It is extremely interesting to note that the structures built with the traditional construction method where structural frames are not connected to foundation stones and groundsills, are those who escaped collapse.

Shintaku

The *Shintaku* or Annex, located on the east side of the main home (*Hontaku*), is a partly two-story building constructed in 1929. It was registered at the same time as the Yano family's *Hontaku*. The roofs and the structural frame are basically sound. Some of the walls collapsed, have cracks, or have parts of their upper layer of plaster that have peeled off; the stairs moved towards the west, creating a misalignment.

With openings all around it instead of walls, this building has hardly any seismically resistant aspect to it, as it is often also the case for other traditional residential buildings. However, one may assume among other things that the building could maintain a mostly sound condition thanks to the fact that the large fissures of the *Hontaku* did not reach as far as the Shintaku, thanks to the proficient use of *sashigamoi* (heavy head jambs) which made the

Photo 3.1.2.11 The Yano family home (*Shintaku*)

Photo 3.1.2.12 A *sashigamoi* (heavy head jamb) of the Yano family home (*Shintaku*)

Photo 3.1.2.13 A fissure in the wall of the alcove of the Yano family home (*Shintaku*)

Photo 3.1.2.14 The wall's upper layer fell off at the Yano family home (*Shintaku*)

Photo 3.1.2.15 The Yano family home (*Shintaku*)

frame sufficiently strong, and because the structural balance of the building as a whole was good.

3.1.3 The Aso-jinja Shrine (nationally designated Important Cultural Property)

The surviving shrine buildings of the Aso-jinja Shrine were built as part of a restoration project that took place in the late Edo Period, from Tempo 11 to Kaei 3 (1840 to 1850). A total of six buildings within the precinct—the Romon Gate (tower gate) at the front of the site; the Kangyomon Gates (the return gates) to the left and right; the Shinkomon Gate (gate for transferring deities in a portable shrine); and, to the rear, the Ichi-no-shinden Shrine, Ni-no-shinden Shrine, and San-no-shinden Shrine (the first, second, and third sanctuaries)— are nationally designated Important Cultural Properties. All six of these Important Cultural Properties, including the Romon Gate that collapsed completely, were damaged in the recent main-shock earthquake. In addition, the Worship Hall within the precinct collapsed completely, and also the stone lanterns on the approach road collapsed.

The Romon Gate, which was one of the Three Greatest Romon Gates of Japan, had an upper structure that was extremely impressive. The main-shock earthquake that struck the Aso region on April 16th registered a weak 6 on the Japanese seismic scale and the Romon Gate is considered to have collapsed due to the inclination of the columns caused by the tremors and the P-Δ effects resulting from the heavy weight of its upper part.

It was reported that, at the Kangyomon Gate and the Shinkomon Gate, some of the decorative parts fell down and there were some overall distortions. At the three sanctuaries, the damage to the San-no-shinden Shrine was the most severe, consisting of a deep inclination in the direction of the west cliff, and it has

been reported that the shrine is in danger of collapsing. The damage at the other two shrine buildings included the lifting up of some of the columns.

In terms of the general damage to the buildings around the Aso-jinja Shrine, the columns of an extremely old wooden garage appeared to be deeply inclined, while the exterior wall materials in the vicinity of the ground-floor column bases of an old five-storied steel-framed building had fallen off. Apart from that, however, hardly any damage could be seen.

The policy for the repair works of these buildings, which have been designated as Important Cultural Properties, is repair through dismantling for the Romon Gate and through partial dismantling for the other damaged buildings. The work began in Heisei 28 (2016) and is scheduled to continue until Heisei 35 (2023). (Photos 3.1.3.1-5 Taken by the author.)

Photo 3.1.3.1 The collapsed Romon Gate of the Aso-jinja Shrine (the roadside approach).

Photo 3.1.3.2 The collapsed Romon Gate of the Aso-jinja Shrine (inside the site).

Photo 3.1.3.3 The Worship Hall of the Aso-jinja Shrine was damaged.

Photo 3.1.3.4 The emergency support at the San-no-shin-den Shrine building in the Aso-jinja Shrine.

Photo 3.1.3.5 The collapsed stone lantern of the Aso-jinja Shrine.

3.1.4 Shrines as core for local communities

Each of the settlements that have existed since the olden days, such as Otsu Town, Minamiaso Village, Nishihara Village, Mashiki Town, and Mifune Town, has its own shrine, and these structures were badly damaged. Many of these shrines were built in the late Edo Period or at its end, in the 18th and 19th centuries, and they represent the culture of their communities functioning as the hearts of their local communities by, for example, providing the bases for holding festivals and other events. In some cases, the stone gate of the shrine collapsed almost completely, in others the main sanctuary and the worship hall both collapsed, as in Kiyama Jingu Shrine, while in other cases the structures collapsed or are on the verge of collapsing, like at Nishihara Mura village's Shimokomori Shrine and Hachiosha Shrine.

Their repair and restoration are eagerly awaited, but even today, one year after the damage, it is still not sure whether these works will be carried out. The reason for this is twofold. On the one hand, local citizens are willing to repair the shrines because the festivals held there are important meeting opportunities where local citizens can come together, but they fell victims to the earthquake too and therefore are unable to carry out the work to preserve the shrines. On the other hand, there are no public funds for the shrines to be rescued because they are not regionally designated nor registered as Cultural Properties.

Kumamoto Prefecture decided to provide assistance through its Restoration Funds for those shrines that could be certified as representing their local communities, but this assistance was not sufficient, and it was decided that if the site will be aiming at being officially designated as Cultural Property, the repair works will be subsidized through the Cultural Properties Restoration Fund.

In future, the preservation of such undesignated and unregistered shrines and other structures will become a major issue.

Photo 3.1.4.1 The Kiyama Shrine

Photo 3.1.4.2 The Shimokomori Shrine

Photo 3.1.4.3 The Hachiosha Shrine

Photo 3.1.4.4 The Hachiosha Shrine

3.1.5 The vernacular architectures in Mashiki town

Overview

Mashiki town is located on the eastern edge of the Kumamoto plain. It is a commuter town adjacent to Kumamoto city with a combination of several rural and agricultural communities. There are a lot of vernacular traditional wooden housings and architectures, especially along Kiyamagawa River and North and South part of hilly area. Mashiki town is epicenter of two major earthquakes with a seismic intensity of 7. Damages to the architectures were devastating and it seems that there were little prospect for their conservation and restoration. However, it is revealed that there are some differences in damage degree not only by the distance from the epicenter or by the oldness of the architectures, but also by the characteristic of site ground, i.e.; geological feature and earth retaining walls.

There are a lot of vernacular architectures, farming-landowner's residences, farm houses, ware houses, gate houses"*Nagayamon*", clay plastered storage houses"*Dozou*," Shrines and Buddhist temples in earthquake damage area.

Most of these assets are non-designated or non-registered, although some of them has been built before Meiji era andconstitute a local scene in perfect harmony. Demolishing damaged structures by public expense causes disappearing incident of these scene, by destructing non-designated and non-registered architectures and cultural heritages that should be conserved or could be restored.

One and half year has passed since the earthquakes now, and public reports states that the demolition works by the public expense is almost finished (While totally 3,654 has been applied, 3,549 has been finished).

Damage to traditional buildings and their restoration Kiyama Jinguu, The Shinto Shrine

Kiyama shrine is located in the center of Mashiki town. It is officially called the "*Kiyama Kyuroku Kyuden Daimyoujin*" Shrine. Six generations of gods since Sun Goddess "*Amaterasu no Oomikami*" have been enshrined there. It has 19 subordinate shrines in Mashiki town and is worshipped as the central shrine "*Souchinju*" of the town. This shrine has been completely falling down by the earthquake, i.e.; main shrines, halls of worship, tower gates, Shinto shrine archway "*Torii*" and the lanterns on the shrine fence. None of these architectures have not been designated or registered as cultural assets. In spite of the strong local public opinions, there is no public fund aid so the prospect of preservation and re-construction still remains challenging. (Photos 3.1.5.1-3.1.5.2)

Photo 3.1.5.1 The remaining roof of worship hall of Kiyama Shrine after the earthquake.

Photo 3.1.5.2 The decorated structural element which joins columns and the beams of a roof. (Sculpture of Horeki Era.)

The Saionji family home and their gate house "*Nagayamon*"

Saionji family (Current family head is the 13th of Saionji clan) has the lord's title (*Sou-shouya*) in the southern part of Mashiki town, Togawa district which located at the foot of Mount Iida.

Saionji family is said to be a descendant of the chief priest "*Guji*" of the Togawa shrine (the Aso-jinja Shrine's subordinate shrine), according to the historical record of Mashiki town. The site area is about 7,000m2 including the forest fields at the east behind the residential area. Two wells that have been shared to the village people also remain in this area. The residence measures 14.5meters by 19.4meters. It originally had a thatched roof, and had replaced to the large hip-and-gable roof when the residence was renovated in 1857(Ansei 4, End of Edo era).

Due to the Kumamoto earthquakes, some of the columns and beams have been damaged and it appeared an incline of 1/5Rad. to west-northwest direction in maximum. It was barely avoid from collapse down.

The gate house"*Nagayamon*,", two-story traditional wooden building which measures 20.9 meters by 3.6meters , were used as a two storied gate with barn for horse or cow(ground fl.), and material storage(2nd fl.). The roof truss, which is consisted by hybrid structure of the Japanese hut and gable beam configured in turn, is one of characteristics of farm houses in this area.

The Footing of column which has been put on the traditional base stone was slipped on the stone base by the shock of the earthquake by about 40cm but safely remained. In contrast, at south part of the gate house, some columns of which has been coupled with reinforced concrete base foundation were cracked and about to falling down.

The owner wants conservation and utilization of Saionji residence.

The residence continues to search for Purchaser (sponsor, charitable person) by the power of cultural property experts with the consent of the owner, however, the status is unsure whether the transfer and preservation of these asset will be done or not.

Photo 3.1.5.3 The Saionji family home

Photo 3.1.5.4 The Saionji gate house "*Nagayamon*"

In case of no purchaser is not going to be found, it will be demolished by public expense in the near future. (Photos 3.1.5.3-3.1.5.4)

The Kawabata family home, clay plastered storage house "*Dozou*", and gatehouse "*Nagayamon*"

The gate house "*Nagayamon*" on the boundary of the residential site, where a stone wall, maximum height of which is 3 meters on the south cliff side arranged in L-shape, was partially distorted and damaged.

Clay plastered store house "*Dozou*", which measures 5.9meters by 9.7meters, a girder height of 5.1meters, the center column of ridge beam has been broken in the vicinity of the 2nd floor-beam.

Surprisingly, in spite of the fatal damage in center column, there is less deformation. In the result of examining in detail, it is found that vulnerability was revealed by Kumamoto earthquake due to termites that originally existed in the column.

These two damaged architectures, Gate house and clay plastered storage house“Dozou”, were dismantled in February 2017. Even though all of these buildings can be technically restored, in considering repair costs and subsequent maintenance costs, it is said that individuals cannot take a step of preservation and restoration.

Fortunately a lot of historical documents and old materials and tools, equivalent to cultural properties are rescued by the cooperation of the local cultural property experts in collaboration with Agency for Cultural Affairs before dismantling.

Photos 3.1.5.5-3.1.5.6
Measures to investigate the layout plan, cross section view, construction technique and structure of these vernacular architectures has carried out at the Kawabata family house before they were demolished.

And at the same time, investigation of layout plan, cross section view, construction technique and structure of these vernacular architectures has been carried out by our group members.

(Photos 3.1.5.5-3.1.5.6 and 3.1.5.9)

The new attempt to conserve, watch over, disaster relief activities of cultural properties in Mashiki town.

In the earthquake disaster areas, there is a high possibility of massive disposal of cultural asset, including antique art goods and historical documents that had been neither designated nor registered as a cultural heritage. However, these historical ancient goods have stories of the family and are considered to be very important. It was a matter of course that the members of cultural property protection committee distressed themselves in the situation where items and architectures which telling a vast amount of historic culture were abandoned without being investigated or evaluated. In face to the crisis in Mashiki town, a cultural property conservation committee (local government cultural property section and outsourcing specialist staff of the board of education) who gained lessons from disaster areas in the past made a call of paying attention to the local resident.

This has started as volunteer activities after half a year of earthquake while in an emergency beyond the limits of the public administration's correspondence.

The cultural property conservation committee, as specialists in conducting activities rooted in the local community on a daily basis, can be expected to generate synergies through cultural asset rescue projects that provide disaster relief to individual disaster citizens, while sharing roles with each local community.

In result, more than 10 of the historic architectures that are rescued and whose numerous record

documents are conserved. They have value from the point of the conservation and rescue of the historical materials stored within them.

It seems to be a very useful reference as a disaster relief model for conservation of historical and cultural heritage in the disaster areas in future.

(Photos 3.1.5.7-3.1.5.9)

Photo 3.1.5.7 Disaster citizens and experts who felt a sense of crisis about the loss of the memories and historical and cultural assets in their local communities gathered and discussed. And it triggered to form the civil society organization. (November 8, 2016, Kiyama, Mashiki town)

Photo 3.1.5.8 On the leaflet, they indicates the name of the cultural properties conservation committee members allocated to each regions and their contact details. And it was delivered throughout the disaster areas.

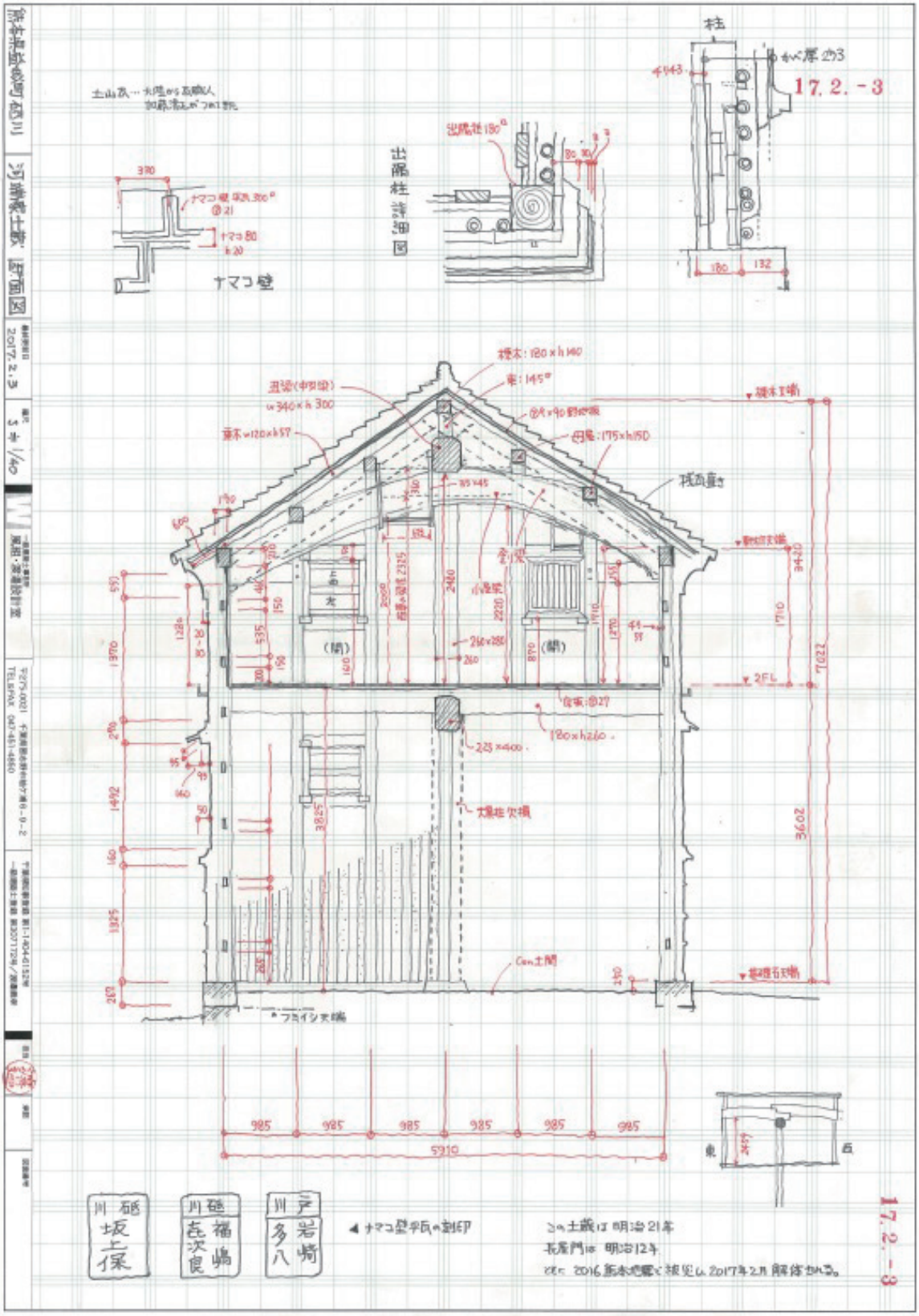


Photo 3.1.5.9 Field note recorded at the site of demolition. (Cross section of Clay plastered storage house “Dozou” of Kawabata family.)

3.1.6 The Janes' Residence (prefecture designated Cultural Property)

History and structure of the Janes' residence

The Janes' Residence, which was built adjacent to Suizenji Park, Kumamoto City, was first built near Kumamoto Castle as the house of Leroy Lansing Janes and his family. Janes came to Japan as a teacher in the school of western learning established by Higo Domain in 1871. His house, the present Janes' Residence, is considered to have been constructed by carpenters invited from Nagasaki that was open to the foreign countries even during the time Japan was a closed country and had western style residences. Its usage changed along with its owners, and after being relocated three times, it was moved to the current location in 1970 and is owned by Kumamoto City, which has opened it to the public as a museum. Over its long history of more than 140 years, it has been used as government army headquarters during the Satsuma Rebellion in 1877, as rooms for prefectural government officials and high school staff, and as a detention center for Russian soldiers during the Russo-Japanese War that occurred from 1904 to 1905. In 1932, it was acquired by the Japanese Red Cross Society and became a memorial hall, and after World War II, it was used as a clinic and a blood donation center. In 1970, it was moved to its current location and became a city designated cultural property. In the following year, Kumamoto Prefectural government designated it as a prefectural tangible cultural property.

It is a two-story wooden building with a Western-style design, and the main building is a wooden structure constructed using the traditional post-and-beam method. The building has an external appearance in the veranda colonial style. In particular, one of its features is its use of *Giyofu* architecture (a style of Japanese architecture that outwardly resembles Western-style construction but relies on traditional Japanese techniques), such as the spandrel decorations between the pillars of the veranda on the second floor. The building has an area of 17.7m x 12.8m and a roof height of 12.2m.

Structurally, the mud-plastered walls were its earthquake resisting elements. The roof that was renovated in 1991 has a *wagoya* structure and is tiled placing soil underneath. Since 1970, there have been no structural renovations, and insect damage and other problems became apparent. Prior to the recent earthquakes, it also had earthquake-resistance problems, and its relocation had also been considered, along with the introduction of seismic isolation design.

Earthquake damage

In the fore-shock earthquake of April 14, as is shown in Photos 3.1.6.1 to 3.1.6.4, the earthquake-resisting element of the mud-plastered walls suffered major damage.

It was then completely destroyed in the April 16 main-shock earthquake, as shown in Photos 3.1.6.5 to 3.1.6.6. There were other wooden houses and buildings around this building, but, at least in terms of their external appearance, they did not suffer any damage, and only this historic property specifically was damaged. In addition, many of the archival documents that were stored inside as the museum collection were damaged. Since the earthquakes, rescue efforts for the documents have been continued by the Janes Promotion and Education

Photo 3.1.6.1 The damage caused by the fore-shock earthquake (front).

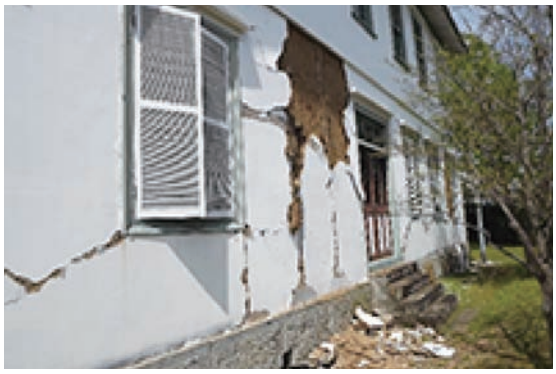


Photo 3.1.6.2 The damage caused by the fore-shock earthquake (rear).

Photo 3.1.6.3 The damage caused by the fore-shock earthquake (left front).

Photo 3.1.6.4 The damage caused by the fore-shock earthquake (interior).

Photo 3.1.6.5 The building was completely destroyed in the main-shock earthquake (1).

Photo 3.1.6.6 The building was completely destroyed in the main-shock earthquake (2).

Society that was established in 2010 to promote and educate Janes' efforts to the public.

Citizen activities for the reconstruction of the Janes' Residence

There are many examples of efforts by citizen groups to rescue and restore earthquake damaged historic buildings in Kumamoto. However, there are few examples that citizen groups like the Janes Promotion and Education Society dedicated itself to rescue and conservation works immediately after the disaster, building on their previous activities.

In May 2016, when the investigation team on the earthquake damage of Japan ICOMOS National Committee visited the site of Janes' Residence in

the inside the Suizenji Park, many volunteers of the Janes Promotion and Education Society also gathered, regardless of the rain. In front of the great pile of wood that was rescued from the completely destroyed Janes' Residence which is a Kumamoto Prefecture designated tangible cultural property, and covered in blue vinyl sheets, the method of reconstruction was discussed. Japan ICOMOS team informed the volunteers of the case of the former Kobe Foreign Settlement 15th building. This nationally designated important cultural property was also completely destroyed in the 1995 Great Hanshin-awaji Earthquake. At that time the original positions of each recused material were checked for the restoration and 70% of the original timber was re-used in order to minimize the loss in its value. Having heard that story, volunteers understood the importance of first taking measures to prevent the wood materials from rotting in preparation for the upcoming rainy season and typhoons.

The Janes Promotion and Education Society considered various activities to raise funds for the reconstruction of the residence, including funds from overseas, but it turned out soon that the building was a component of the public urban park of Kumamoto City and therefore two-thirds of its rebuilding expense was eligible for subsidies from the Ministry of Land, Infrastructure, Transport and Tourism. Consequently, in the half-year until the construction work by the government to rescue the building's materials began in full-scale, the volunteers, mainly members of the Janes Promotion and Education Society worked on extending the lifespans of the building parts. They erected temporary tents as a storage, and worked by turns to minimize rotting by ensuring ventilation. In this way, they were able to keep the damage down to the absolute minimum.

Kumamoto municipal government efforts

As the owner of this building, Kumamoto City, aiming at keeping its values as a cultural property for the time being, concluded an agreement with the Japanese Association for Conservation of Architectural Monuments (JACAM) for the materials survey and the conservation work as a nationally subsidized project. As a part of the project, it also constructed three prefabricated buildings within the site of the Kumamoto City Waterworks Bureau; it is now at the stage of cleaning and transporting all of the materials and carrying out the drying and preservation measures, while checking their former positions. After the 1995 Great Hanshin-awaji Earthquake, JACAM was responsible for supervising the survey and design for the work to rescue and conserve the materials and to rebuild the important cultural property of the former Kobe Foreign Settlement 15th building, which had been completely destroyed. In the same way, at Kumamoto, it surveyed the state of the damage of each of the materials and prepared for the reconstruction and restoration work.

In the August 2017 during the second field investigation of ICOMOS Japan team, with the cooperation of the Culture Promotion Section, Kumamoto City, the team inspected the materials within these prefabricated structures. More than 10 members of the Janes Promotion and Education Society were in attendance, and seemed to be relieved on observing for the first time that the construction materials had been kept safe and taken care of.

Also within Kumamoto City, the Japan ICOMOS team visited the two sites where the city was carrying out the cleaning and conservation work of moveable cultural properties that were rescued from the inside of the destroyed Janes' Residence. Various materials had been rescued, including documents, such as lecture notes taken by students attending Janes' class, some of the oldest examples of photographic-plate photographs in Japan, travel bags, furniture and tools, and a number of archival documents relating to the Japanese Red Cross Society. Some of

these documents appeared to have already been cataloged, but the tearing and rotting of the paper was so serious that some documents could not be repaired, and there was no choice but to throw them away. Many of the Society members are highly educated people, and were deeply moved by the sight of these precious materials. They appreciated the efforts of Kumamoto municipal government and placed their trust in its unchanged sincere attitude and works in the future.

For the work to rebuild and restore the Janes' Residence, Kumamoto City is considering the appropriate location it is to be rebuilt on. Given the building's history of having been relocated a couple of times, citizens have proposed that it should be rebuilt at a location that will be efficient for the regenerated Kumamoto in the future, not at its current location since its accessibility for citizens and tourists is not so much well.

Significance of the comprehensive recovery of the Janes' Residence

As previously mentioned, the Janes Promotion and Education Society is a volunteer group established in 2010 in order to honor the accomplishments and deepen the public's understanding of and empathy for L. L. Janes, an American who was invited to teach at the school of western learning opened by the Higo Domain in 1871. Janes, who was a veteran of the US Army, stayed in Kumamoto for five years with six members of his family, and he contributed greatly to the modernization of Kumamoto and Japan by, among other things, educating many talented people and developing a protestant band called Kumamoto Band.

The Janes' Residence, which is a stylish, colonial-design two-story wooden building, became the official residence of the Imperial Prince Arisugawanomiya Takahito, the commander of the government forces in the Satsuma Rebellion, which broke out in 1877, the year after Janes left Japan. As it was in this building that Tsunetami Sano, a *Genroin-gikan* (councilor of the Senate) from Saga prefecture, and others received the approval of the Imperial Prince to carry out the activities of the Hakuaisha organization, treating equally the victims of the government army and the Satsuma army, which had clashed at the Battle of Tabaruzaka, it is considered to be the birthplace of the subsequent Japanese Red Cross Society.

In response to the activities of the British nurse Florence Nightingale, who treated the wounded regardless of their side in the Crimean War of the 1850s, in 1864, Jean-Henri Dunant from Switzerland established the foundation that would lead to today's International Red Cross and Red Crescent movements. Sano's "Hakuaisha" activities took place 13 years after this, and since the Japanese government had joined the Geneva Convention in 1886, in the following year he changed its name to the Japanese Red Cross Society that became a member of the International Red Cross.

With regard to the protection of cultural properties in the event of emergencies, UNESCO established the Convention for the Protection of Cultural Property in the Event of Armed Conflict (the 1954 Hague Convention) in 1954 in order to prevent a recurrence of the looting and destruction of cultural heritage severely happened in during World War II. Following the intentional destruction of cultural heritage during the conflicts in the former Yugoslavia in the 1990s, the Convention was supplemented to have its Second Protocol, and under the UNESCO umbrella, international NGOs, including ICOMOS, the International Council of Museums (ICOM), the International Federation of Library Associations and Institutions (IFLA), and the International Council on Archives (ICA), formed the International Committee of Blue Shield, which was modeled on the International Red Cross, to work for the protecting cultural heritage threatened by natural

Photo 3.1.6.7 Members of the Janes Promotion and Education Society inspect the sections of the Janes Residence that have been dismantled, arranged, and stored.

Photo 3.1.6.8 The three warehouses to which the dismantled Janes House's building materials had been transported and are being preserved.

Photo 3.1.6.9 Members of the L. L. Janes Promotion and Education Society looking at the books and implements rescued from the collapsed Janes House.

Photo 3.1.6.10 The documents, books, and implements from within the collapsed Janes House that had suffered water damage and were rotting have been preserved, including being cleaned and freeze dried, in preparation for the day of the restoration exhibition.

and human-made disasters. It is encouraged that each country has a national Blue Shield committee, and professionals and practitioners in Japan have also started preparations to establish a Japan Blue Shield committee on the spirit of the 1954 Hague Convention to which Japan is the party. The challenge of the Blue Shield activities is to prevent the destruction of and rescue and give a first aid to cultural heritage against the disastrous situation in a comprehensive manner beyond the differences of the heritage categories.

In that sense, the rescue efforts of the Janes Promotion and Education Society, which covers both moveable and immoveable cultural heritage with the aim of handing over to the next generation the memory of one of the important person for modernizing Kumamoto is worth attracting international attention.

Acknowledgments

We would like to thank Koichi Nishijima and other members of the L. L. Janes Promotion and Education Society for providing the valuable photographs of the damage from the fore-shock earthquake and the main-shock earthquake

References

1) Kumamoto Industrial Heritage Study Group, Kumamoto Machinami Trust eds., Isoda Keishi: Kumamoto Western School Teacher Janes House, Kumamoto's Modernization Heritage (part 1), Genshobo, pp. 79-81, 2014

3.1.7 Yoshida Shokado Residence and Store

The history of Yoshida Shokado

Junseki Yoshida (first generation) was forced to fleeto Nagasaki following the so-called Siebold Incident (1828), and despite the good standing of coming from the family of the doctor to the feudal lord, he was unable to return to his hometown and began business in Kumamoto. He established a base in Kumamoto Castle town Shinsaikumachi (Shinmachi) and manufactured and sold "Shodokukeshigan," a medicine for digestive and heart problems, achieving great success. During the Meiji and Taisho Periods, he distributed the medicine nationwide and became extremely wealthy, and the Yoshida family became one of the most preeminent well-known families in Kumamoto. His residence was a typical mansion in Kumamoto Castle town, and it has been extended and altered repeatedly, each time it was designated as the accommodation for a member of the royal family or a government official visits, and today, 13 buildings and the garden still stand within a land area of 900 tsubo, approximately 0.3 km^2.

The pharmaceutical methods at the time the business was established have been passed down to the present, and because the method of manufacture has been a secret, the interior of the Yoshida Shokado has not been actively made open to the public. In addition, because the family traditions for the main business have been firmly maintained, while being located in the center of Kumamoto City, with high land prices, the appearance of the building at the time it was constructed over 140 years ago has been maintained in privacy.

The Structure of Yoshida Shokado

The site's south side consists of a circuit-style garden with a miniature artificial mountain, while the group of buildings consists of the two-story main building on the north side of the site (width, 8 span and a half, length, 8 span), and a connecting space in which a corridor connects the one-story sitting room, the tea room and other rooms on the east side. On the west side are the pharmaceutical manufacturing building and the warehouse, and there is a fence of a height of 3 meters surrounding this group of buildings. The appearance of the buildings and the site before the Seinan War (1877), or Satsuma Rebellion, is not clear, but since the majority of the city was burned down in the battles at that time, it is highly likely that they, too, were burned down. The existing main building was constructed in the following year (Meiji 11), and then, in Meiji 39, when it served as the accommodation for Prince Fushimi, the connecting part on the eastern side was constructed, which is basically its appearance today.

Photo 3.1.7.1 Yoshida Shokado: front (September 2017).

Photo 3.1.7.2 Yoshida Shokado: front (date of photo unknown, but probably in the Taisho Period).

The damage situation following the Kumamoto Earthquakes

All of the buildings, including the main building, were damaged, but none of them collapsed, and except for the "exterior bench" that was partially destroyed by mistake when a neighboring house was dismantled after the earthquakes, the site as a whole basically retains its former appearance. The main forms of damages include the destruction of the entire roof surface due to falling tiles, the fall of plaster walls, the inclination in the building from the deformation of the frame, the deformation of fixtures and fittings, and the collapse of parts previously damaged by ants. Subsequently, rain leaked in and mold appeared over a wide area; damage occurred to the household goods as well as to the house. At the time, looking at each building, the damages appears to be within a restorable range, but it is estimated that, when considering the group of 13 buildings as a whole, an enormous amount of money and energy will be required, and the owners was considering dismantling some parts and conserving others parts of the site.

The response immediately after the disaster

However, due to the strong wishes of the current owner for the site's survival, the voices of the local residents, who are familiar with the site, which has a symbolic presence in the area, and the support of the government, a movement toward its restoration has begun. That said, as the site has been closed to the public for a long time, there is little data on the buildings, and the work started from preparing actual measurement diagrams, with the cooperation of the university research team. In addition, researchers and culture-related government officials, who came from all over the country for the disaster area survey, have provided proposals and gathered information on the restoration and preservation methods. The large items, such as the folding screens and the lacquerware that were stored within the damaged warehouse, were taken away immediately after the disaster by a team from the prefectural art museum and elsewhere (cultural properties rescue team) for their preservation and to facilitate a smooth start to the repairs of the building. At the end of the earthquake year, a start was made on the work to correct the inclination to the main building, and restoration was being undertaken while paying attention not to lose the buildings' value as historic properties. In addition, to reinforce the earthquake resistance of the floor spaces with few load bearing walls, seismic walls were added using thick cedar boards. This was a result of reflection on the localized destruction, including to the beams running between the columns, in the places where the home was reinforced using structural plywood before the earthquakes.

Photo 3.1.7.3 The damage to the warehouse (south side).

Photo 3.1.7.4 Additional earthquake-resistant walls (left side of the wooden door).

The Yoshida Shokado repair policy

Since no major modifications have been made to the group of buildings and the garden, it is considered to have value as a cultural property. However, because it has not been open to the public, it has not received designations; in particular, it has not been designated as a cultural property. However, because the entire site was damaged, the situation was such that the owner alone could not pay for the repairs, thus some form of public support was also begun to be expected.

Therefore, the fundamental repair policy is to restore the property on the basis of the historical facts but without excessive focus on the restoration to avoid expensive repairs, carrying out the repairs with the aim of maintaining the site until it can be fully repaired (expected in the future). In the course of repairs, besides supervision by experts in restoring cultural properties, reference is being made to the specifications of the tiles and walls from the initial construction that have survived within the site. In addition, private records and photos from the Meiji Period to the pre-war periods were referred to. Moreover, samples were kept of the tiles and earthen walls that had to be removed, and photos and other records of them were taken. These are being kept as references for when the full repairs take place.

Yoshida Shokado will continue to produce pharmaceuticals as it has done in the past, but following the recent disaster, an investigation has begun into making one part of the site open to the public, with a view to the property's survival. At the same time, it is expected that there will be consideration given to passing it down to future generations in the form of a nationally and otherwise-designated cultural property.

Photo 3.1.7.5 Records of the original condition before removing the roof (main building south annex).

Photo 3.1.7.6 Restoration of the large building using the original tiles (main building).

Photo 3.1.7.7 The 15-tatami room awaiting restoration (sitting room).

Photo 3.1.7.8 The tea room and the garden.

3.1.8 Morimoto Store (Sliding-door picture framing materials store)

A large amount of components with aesthetic senses; such as beautiful tapestry weaves for mounting, high quality paper for *fusuma* sliding doors, finely engraved door handles for *fusuma* sliding doors and nail head covers, to create traditional Japanese formal sitting room spaces had miraculously survived in a form of business at this building. The building had a symbolic external appearance, with a *battari shogi* (the folding bench at the front of traditional townhouses) that gave it a strong individual identity, in conjunction with its business, and it was widely known and loved as a typical timber building representing the Kumamoto castle town. The front entrance was around 14m wide and consisted of a row of three buildings that had been built around 1886 (Meiji 19); while sandwiching the inner courtyard, they had a configuration of being separate buildings lined up over a depth of around 50m.

In the store section, which included the *battari shogi*, was designed to create an open space by having few columns, which caused localized deformation during the main shock of the earthquake. In addition, each of the buildings densely constructed within the site had oscillated during the earthquakes, and consequently damages were concentrated at the joints between them. In addition, the falling roof tiles and collapsed earth walls completely changed its appearance, which canceled out all the expense and efforts that the owner had spent to ensure the continuous of these buildings, the damages that were so overwhelming. However, at that point in time, there were only few concerns of collapse, and it was judged that they could be restored, technically speaking.

In order to save these buildings, their important inventory and household goods were removed, mainly through the efforts of a group of local young volunteers, and a survey of actual conditions by researchers from the University of Tokyo and elsewhere was conducted. There was also a movement to support the owner's efforts toward their survival. Despite these efforts, however, the buildings were dismantled in June 2017. The main reason given by the owner for the decision on dismantling was that the family business was a declining industry and there was little hope for its survival, so it was not expected to be able to find a successor. This situation is considered to be common to the management environment for many of historical house owners across Japan, and the problem becomes particularly and immediately apparent after an earthquake or other such disasters (even if it is technically possible to keep their houses), and the buildings are tend to disappear immediately after the events according to their managerial judgements. This is a problem that cannot be avoided for preservations of historical buildings; nevertheless it is difficult to find a right answer. However, if the buildings are located within a historic town or city, it would seem necessary to gather knowledge, human resources, and information—from both the public and private sectors—on the assumption that many privately owned buildings will suffer simultaneously and multiply on the occasions of disastrous events.

There have been many voices lamenting the loss of Morimoto's sliding-door picture framing materials store, and it was even reported in newspapers and on television. Attempts are being made to restore at least its façade, including the symbolic *battari shogi;* however, these attempts have not been successful yet. To this end, private art galleries and museums that for a long time have exhibited antique art of Kumamoto should provide spaces. Some designers, carpenters, stonemasons, and volunteers from the general public who shares the sense of crisis which has been caused by the chain of unfortunate events, they have been playing their respective roles nonetheless they have tried to preserve the disappearing image of former castle town.

Photo 3.1.8.1 The facade immediately after the disaster.

Photo 3.1.8.2 Dismantling work by volunteers for its relocation.

3.1.9 The Suzuki family home (the former Nakamura Pediatrics Hospital)

In the past, this hospital's red mansard roof stood out from the rows of homes with traditionally tiled roofs and could even be seen from a long distance away. It was visited by many patients and their families, and many street stalls appeared in front of its gates, creating a scene of thriving enterprise in the olden days. This wooden, two-story hospital building constructed in Taisho 3 was integrated with the residence of the owner. The former building was of a Western style and the latter building of a traditional Japanese style of architecture, and each was constructed with materials that were gathered over the course of several years. The architect, Masami Sato, worked as a teacher, naval officer, and engineer for Kumamoto City after graduating from the Kumamoto Prefectural College of Engineering.

Although the buildings escaped collapse in the main-shock earthquake, there were localized damages, such as the loss of pillars in the entrance hall. From a visual inspection, it is estimated that, on the basis of the partially collapsed outer walls, there was widespread rotting and ant damage to the wall bases and structural materials. In addition, the falling of plaster from the interior walls was extremely severe, and the owners had to spend a huge amount of time to clean it up that also created a psychological burden. Because of the high story height and vertically long windows, the plastered section that constituted the wall had a height of close to 3 meters, even when excluding the retaining wall section. At the time of the tremors, this section fell down like a falling iceberg, with the undercoating section sliding down and then crashing onto the floor. Since the remaining section also suddenly collapsed through some sort of momentum, it is not hard to imagine the owner's fear that shook owner's decision (intention) to preserve it .

As a result, because all of the structural material was a large-wall structure hidden behind a painted wall, unless all of the surfaces of the walls were dismantled, the framework would not be exposed (if they were dismantled, the original atmosphere would be lost), so it was anticipated that it would be difficult to make a start on such drastic repairs. This is considered to be a common potential problem of all so-called Western-style architecture, and it is different to *makabe* (true-wall) structures in which the pillars are exposed; it is necessary to use technical devices to overcome the difficulty of preserving these types of buildings. In fact, some firms did want to open businesses, such as restaurants, in this Western-style building, and to buy it, but this issue became an obstacle and new investment did not materialize. The high price of

the land had also accelerated the demolition of the building, which many local residents had felt a pride in and an affection for since the Taisho Period, including the garden that contained important stone artworks.

On the day before the Suzuki home (the former Nakamura Pediatrics Hospital) was dismantled using public funds, the people who would miss the building removed parts of it, such as the teak doors and their frames. With the cooperation of a local winery, the plan is to use them for a part of the interior of a winery that will open in the near future.

Photo 3.1.9.1 Before the disaster.

Photo 3.1.9.2 The interior after the disaster.

Photo 3.1.9.3 During the dismantling.

3.1.10 The Kimura family home

The Kimuras were a family of retainers during the era of Kato and subsequently became *gokenin* (low-ranking retainers) during the era of Shigekata Hosokawa. The main building is located in the center of the site, slightly on the north, and there are warehouses adjacent to the east of the building and behind it.

The main building is a wooden one-story home of construction, with a thatched roof. The flat planes of the east-west buildings protrude toward the north on the east side and to the south on the west side, creating a Z-shaped structure. On the west side, the protruding section consists of an eight-tatami sitting room, with an alcove, shelves, a *tsukeshoin* (a built-in table), and hammered *nageshi* (horizontal pieces of timber between the columns). From the traces, it is clear that the sitting room was an addition. On the north side, the eight-tatami sitting room has an anteroom and the same hammered *nageshi*. From the traces on the northern wall, it is apparent that there were formerly a floor and an alcove, and it seems that it was initially a sitting room. To the east of the anteroom are two six-tatami rooms. On further east side, the rooms continue,including six-tatami sitting rooms, and from here a large earth floor protrudes to the north side. The above-described rooms are accommodated in a temporary structure, attached to which is a small annex. Continuing on from this, at the anteroom, there is a small annex at the six-tatami two-span north-side room, at the west-side earth floor that protrudes

to the north (the kitchen), and at the north side. There is a toilet behind the anteroom connected by a corridor. The roof was originally a wheat-straw thatch but was subsequently changed to thatch mixed with rice straw, and in the repairs to the typhoon damage in 1991, principal rafters were utilized and the roof became a thatched-style galvanized-iron construction.

In the records passed down by the family, it is said that when raising the framework of the house the family members were supposed to be going on a boat trip but could not, because one of them was suffering from stomach ache, that consequently avoided the Shimabara Taihen tsunami of Kansei year 4 (1792). Thus, the construction period(year) of the home is considered to be Kansei year 4. The eight-tatami sitting room is an additional structure, and because square nails were used, it is considered to be from the late Edo Period. The author of the drawing on the sliding doors of the sitting room's storage space is written as "Unto," thus the drawing is possibly by Ryokei (who died in Ansei year 5), the sixth generation of the Yano family, the clan painter, and this would not contradict the estimated time of construction above. If so, the main part of the main building may have been constructed previously, possibly in Kansei year 4. The toilet and the hallway leading to it are clearly additions. However, because the use of square nails has been confirmed, it is clear that they were constructed before the early Meiji Period. There are records showing that, initially, the plan was for it be a tea room but that this was considered an unnecessary luxury and so it became a toilet instead.

The buildings suffered various kinds of damage in the recent earthquakes, including the collapse of earth walls and the displacement of roof tiles. Overall, the damage was kept down to partial destruction, but it was comparatively large in the small annexes and the toilet. T, The small annex (es) north to the earth floor collapsed, and the wall at the edge of the earth floor collapsed. In addition, the floor of the small annex on the north of the anteroom collapsed. The wall of the toilet and the floor of the corridor also collapsed. After these places, the damage was next greatest in the sitting room. The alcove's *otoshikake* (a bar placed across the upper part of the alcove) fell down, the wall collapsed, and the alcove's transom bar fell down. In the sitting room, the columns acquired an incline (in a southwest direction) of 1/30. In addition, the floor of the six-tatami room on the east side of the entrance collapsed.

There were other damages—for example, the roof frame and other sections show age-related deterioration, and the joints and fittings were slightly

Photo 3.1.10.1 The Kimura family home: Overall appearance (from the southeast side).

Photo 3.1.10.2 The Kimura family home: Overall appearance (from the southwest side).

Photo 3.1.10.3 The protruding earth floor section.

Photo 3.1.10.4 The collapsed small annex on the earth floor north side.

Photo 3.1.10.5 The sitting room: Collapsed interior earth wall.

Photo 3.1.10.6 The toilet: Collapsed earth wall.

Figure 3.1.10.7 Planar schematic diagram.

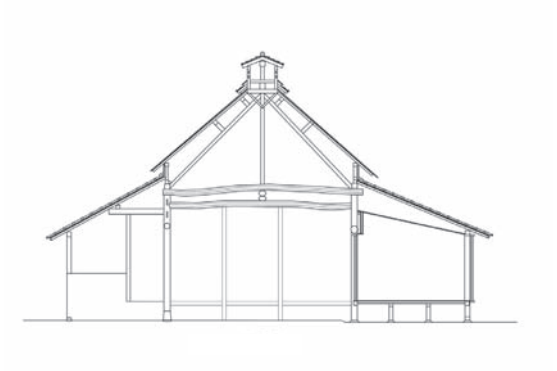


Figure 3.1.10.8 Cross-sectional schematic diagram (earth floor section).

loosened by the earthquake—but the damage was kept down to certain sections only. Therefore, if there are no repairs for the structure as a nationally designated important cultural property, it seems unlikely to cost much to protect the building through repairs that will not damage its value as a cultural property. A major issue will be how to preserve it over the long term so that it can be utilized.

3.2 Masonry structures

3.2.1 PS Orangerie (The former Daiichi Bank, Kumamoto Branch)

Built beside the Meiju Bridge on the Tsuboigawa River in Furumachi, PS Orangerie is a historic building that was built as the Daiichi Bank, Kumamoto Branch, in 1919 (Taisho 8) (See Photo 3.2.1.1). It is a nationally registered tangible cultural property (registered in 1998). As an example of liberal Taisho architecture that became a landmark in the former castle town, it is an important building, both historically and in terms of architectural design. Moreover, it is a structurally unique building, having a combined structure of brick masonry and reinforced concrete (RC). It suffered damage in the 2016 Kumamoto Earthquakes, including the appearance of cracks in the brick walls. An overview of the building and its damage situation is described below.

According to Fujigawa,[1)] the Daiichi Bank Kumamoto Branch was completed as a new building in 1919. It was designed by Yoshitoki Nishimura, who designed many banks along with other buildings, and it was constructed by the Shimizu-gumi (currently, the Shimizu Corporation). The architecture critic Takashi Hasegawa referred to those buildings that radiate the feel of freedom from their continuous light arches as “liberal Taisho architecture,” and this building is considered to be one of them. It is a landmark in the area for having given people an impression of modernization, in the townscape of lines of traditional wooden houses. The interior also has an open-ceiling space that is suitable for a bank sales floor.

Photo 3.2.1.1 PS Orangerie

Photo 3.2.1.2 The interior space

This building, which was built during the period in the early days of RC structures in Japan, was constructed by combining a unreinforced brick structure with an RC structure. The internal RC *ramen* (rigid frame) structure and the external brick wall structure constitute an integrated structure. The thickness of the lower brick wall is 47cm. The roof slab is made of RC, which endures the horizontal in-plane rigidity at the roof level.=In addition, there are RC bands above and below the windows. As it has an open-ceiling space, on the second-floor level, =which has openings rather than a complete floor, there is a catwalk made of RC, and this is considered to have a certain effect on keeping rigidity of the horizontal in-plane at this level. The foundation of the outer brick wall is brickwork, except for the brick wall on the north side facing the Tsuboigawa River has a foundation of wooden piles, and the RC frame has a footing foundation. Even in the recent earthquakes, no damage was seen to the foundation and the surrounding ground, such as the appearance of irregular settlement.

For 52 years up until 1971, the building was used as a branch of the Daichi Bank, and then, up until 1996, it was used as the building of the Kumamoto Chuo Shinkin Bank. After that, its owners changed,

and although at one point it was on the brink of being dismantled, a citizen group called the Kumamoto Machinami Trust was established, and the movement for its conservation was successful. In 1998, the building was acquired by PS Company, Ltd., which brings its history up to the present day. When the company acquired the building, PS spent around three years on renovation work; it uses the building as a sales office and a research facility. In this renovation work, internally, it introduced a steel framework that is independent of the building's main structure made of RC and brick. Photo 3.2.1.2 shows the interior space. In 2002, it received the BELCA Award, which is awarded to buildings whose lifespans have been lengthened through the use of excellent regeneration technologies.

A structural material survey of this building was conducted in 1997 by Professor Hisaaki Murhashi[3)] of Kumamoto Institute of Technology (currently, Sojo University), who conducted a building strength diagnosis. Then, in 1999, the Mitsui and Murakami research group from Kumamoto University surveyed the strength of the bricks in the underground inner wall[4)]. For the strength diagnosis, Professor Murahashi examined the seismic shear strength of the brick walls and the structural safety under normal loads of the RC cylindrical columns and the brick wall. In the examination of the brick wall's shear strength, he conducted structural calculations based on the Architectural Institute of Japan's masonry design standard (1992). At that time, the values indicated in this standard were used for the strength of the bricks. As a result of this examination, he concluded that the brick walls' shear strength was being sufficiently secured. With regard to the deformation in the out-of-plane direction, he noted that this was a confining effect by the use of RC bands, and as previously mentioned, the roof slab is an RC structure, so the roof's lateral stiffness was sufficient.

By contrast, in the investigation of the brick strength conducted by Professor Mitsui's research group, they took a ϕ290mm brick core test specimen from the underground wall (partition wall) and conducted tests in the laboratory on the shearing of the masonry joints and the compression of brick unit. As a result, although the variation was large, they reported that the shear strength (average) was 2.48kgf/cm^2 (0.248N/mm^2) and the brick compression strength (average) was 91 kgf/cm^2 (9.1N/mm^2). Furthermore, they reported that the specific weight of a single brick was, on average, 1.70. These strength values are lower than the strengths of common bricks and masonry joints used from the end of the Meiji Period to the middle of the Taisho Period. It is not known whether the same kind of bricks was used for the outer wall. In 2017, after the earthquakes, a survey project on the structure and materials was carried out for the preservation and restoration work. For this survey project, a survey of the cracks, a probe of the reinforcing bars, and a survey of the brick masonry and of the concrete's mechanical properties (using core sampling) were conducted.

Separate from this research survey, in mid-November 2016, the authors conducted the microtremor measurements of the building. The natural frequencies obtained from these microtremor measurements were found to be 4.2 Hz and 3.4 Hz for the translational primary natural frequencies in an east-west direction and south-north direction, respectively. In the microtremor measurements, it was found that the wall volume of the east-side brick wall was smaller because it had many openings compared to the west side, and the effects of eccentricity were recognized even in the microtremor records. It was also found in the microtremor records that the brick structure and the RC structure moved dynamically in an integrated manner.

Below, the damage to the main building is

described. There found no damage to the RC frame structure or to the internal steel frame. The damage to the brick wall was as described below. According to EMS 98 (levels 0 to 5, 6 stages), which is used for judging the damage level of masonry structures, the damage level was judged to be 1 (no damage or minor damage to the structure) as an emergency judgment, but a detailed investigation of the cracks is required for a more accurate judgment.

First, cracks appeared in the brick wall (inner side), with cracks appearing around and in the corners of the openings (See Photo 3.2.1.3). One of the characteristic movements of masonry structures during an earthquake has been found to be deformation in the form of expansion toward the outsides of the corners. In this building, too, cracks due to this out-of-plane bending deformation were observed at the corners. Moreover, cracks due to bending of the walls were seen. Shear cracks also appeared on the surfaces of the plaster-finish walls (although the width of these cracks were small) (See Photo 3.2.1.4). A more detailed investigation would be needed in order to ascertain whether these cracks only occurred in the finished plaster, whether they reach as far as the interior of the brick masonry, or whether they penetrate all the way through the walls.

Photo 3.2.1.3 Cracks appeared around the openings.

Photo 3.2.1.4 Shear cracks appeared in the walls.

With the cracks appearing in the brick wall in this way, in order to confirm whether the walls remained structurally stable, monitoring of the crack displacement (width) had been carried out. As crack displacement is affected by temperature, clarifying their relationship with temperature change was essential for the evaluation. On the basis of the above, in order to ascertain the movements of the crack displacements and to evaluate the soundness of the building, a crack displacement monitoring survey had been conducted to confirm the effects of the temperature fluctuations on the crack displacements (See Photo 3.2.1.5)

Figure 3.2.1.6 shows the records of the monitoring of the crack displacements and temperature (changes over time). The measurement point was on the inner surface of the brick wall at the southeast corner of the first floor. A displacement meter was installed in the inner wall in a horizontal direction across the masonry joint. Figure 3.2.1.6 is from the records of the meter installed at the “damaged parts” that had the cracks and at the “non-damaged parts” where no cracks were seen. Thermocouples were installed inside and outside.

From Figure 3.2.1.6, the structure was judged to be stable, because no significant changes were seen over the day, even though the crack displacement (width) repeatedly fluctuated over a one-day period due to temperature changes. It is useful to have

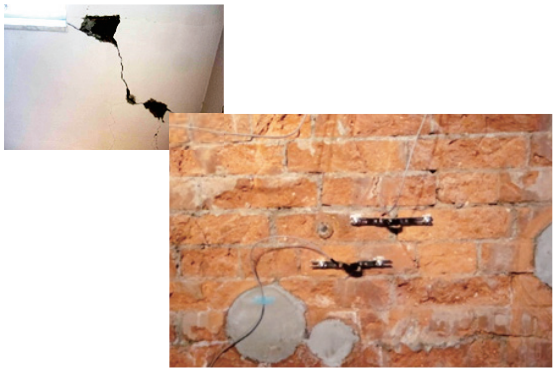
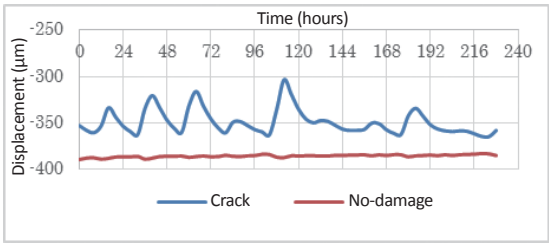


Photo 3.2.1.5 Monitoring the crack displacements in the brick walls.



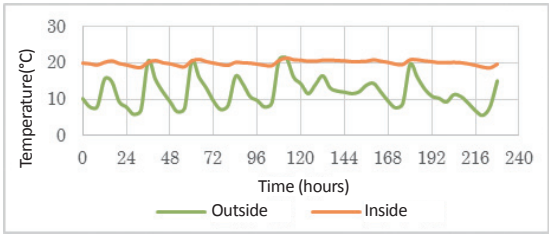


Figure 3.2.1.6 Monitoring the crack displacements and temperatures (upper: crack displacements μpp, lower: temperature in and outside the room).

long-term monitoring records of damaged masonry structures; furthermore, it is preferable to conduct long-term measurements.

In terms of the damage to the non-structural materials, as shown in Photo 3.2.1.7, one part of the plaster on the wood-lath ceiling in a second-floor office fell down. Falling wood-lath plaster becomes a danger to human life when it has a thickness of around 40mm, so urgent countermeasures were needed against the aftershocks that occurred intermittently after the earthquakes. In addition, the finish to the outer wall was cement and tile from the Taisho Period. From the survey of the damage, it was diagnosed that a considerable area of the cement and tile board had peeled off. As this is a cultural property, the method of repairing the cement and tiles that have become detached from the wall surface should also be an issue for the preservation and restoration work.

PS Orangerie, which is a nationally registered tangible cultural property, is important historically and culturally as a part of Kumamoto's modernization heritage. It is also a structurally unique building, because it has a combined structure with the main

Photo 3.2.1.7 The plaster on the wood-lath ceiling of a second-floor office fell down.

structure being non-reinforced bricks with RC, while an independent steel structure frame has been added inside. We hope that preservation and restoration work is carried out on the basis of a plan that is founded on a scientific approach to reinforce the structure.

Acknowledgments

We would like to thank PS Company, Ltd., Representative Directors Mr. Takehisa Hirayama, Mr. Sadahisa Hirayama, and Ms. Yoshiko Nakajima, for their cooperation in carrying out the field survey.

References

1) Kumamoto Industrial Heritage Study Group, Kumamoto Machinami Trust, eds.: Kumamoto's modernization heritage (part 1) Kazuhiro Fujikawa, pp. 31-33, Genshobo.
2) Former Daiichi Bank Kumamoto Branch Design Book.
3) Hisaaki Murahashi: former Daiichi Bank Kumamoto Branch structure strength diagnosis manual, 1997.
4) Kumamoto University Department of Civil and Environmental Engineering, Mitsui and Murakami Laboratory: former Daichi Bank Kumamoto branch building underground inner wall–an investigation of brick strength, 1999.

3.2.2 Historical Buildings in Kumamoto University

Outline

Kumamoto Earthquake brought serious damages to historical monuments in Kurokami campus of Kumamoto University. There are four historical buildings from the end of 19th century which were designated important national cultural properties. They were seriously damaged as described below, except the Fifth High School Main Gate (nicknamed 'Red Gate'), built of brick in 1889, which remained intact. Another small building, built of brick in 1908 and used as archive of Kumamoto Technical High School, was also intact except roof tiles. Two reinforced concrete buildings, Kumamoto Technical High School Main Building (now the Headquarter Building of Kumamoto Univ.) and its Library, built in 1925, were also intact due to its earthquake resistance wall structure.

The Fifth High School Main Building (The Fifth High School Museum of Kumamoto Univ.)

The Main Building of the School, built of brick in 1889 and ca.80 m long (E-W) with projecting wings and used for classrooms, was severely damaged. Some of its chimneys fell down from the roof by the first earthquake on 14th evening, the some others by the second stronger quake before dawn on 16th. The roofs are broken on the central part and on the west wing, and it caused rain leaking, which wetted the exhibits on the 2nd floor.

The cracks on the walls were observed in all over the place. The cracks on the classroom dividing walls at the corner of north long walls on the 2nd floor were very severe. Especially those of the central two rooms were serious with the width of ca. 10 cm and the length of ca. 2.5 m. Stripping of surface plaster on the walls and ceiling cornice was conspicuous.

Other severe damages were observed at the center of the arches in the corridor on the second floor, which connect the classroom dividing walls with the long walls on the south front. These arches support the front wall and prevent it from falling with its exterior buttresses. At the center of the arches, the surface plaster was fallen down and the bricks to form arches were exposed. Some of their bricks are fallen down as the time passed by and it is causing dangerous situation. The damage from the earthquake was more severe on the 2nd floor due to the height from the ground level.

Chemical Lab Building

The Lab Building, built of brick in 1889 and 42.5 m long from north to south, was used for chemical experiments and lectures. It was not damaged much because it is single storied low building with transversal walls. The fall and shift of several chimneys was conspicuous. Some minor cracks on the interior wall were observed.

Photo 3.2.2.1 A chimney which fell down on the roof.

Photo 3.2.2.2 A crack on the classroom wall.

Photo 3.2.2.3 Cracks and fall down of the surface plaster on the corridor arch. (The Fifth High School Main Building)

Photo 3.2.2.4 Fragments of a chimney on the ground. (The Fifth High School Chemical Lab.)

Photo 3.2.2.5 Crack on the top of corner walls.

Photo 3.2.2.6 Horizontal crack at the lower level of the wall. (Kumamoto Technical High School Machine Lab.)

Machine Laboratory of Kumamoto Technical Higher School (now Kumamoto University Engineering School Museum)

The rectangular building of the Machine Laboratory, 34.6 m long (E-W) and 14.6 m wide (N-S), was built of brick in 1831. It is now used as Engineering School Museum, housing old machines for machine experiments, student practice and other exhibits from the time of Technical High School.

It has high arched windows and entrances on its north, south and east sides. The central part of its interior is high void space with flanking mezzanines. Two rows of wooden pillars support the trussed roof. Its brick structure is weak against earthquakes

compared to the one with other brick buildings in the university, due to the structure with single exterior walls with more openings and its height of the walls.

Many cracks on the brick walls are observed from place to place; the top on the four corners of the walls, around the round window on the upper part of the east gable, etc. The top of most of the arched windows were also cracked. In addition, the horizontal continuous cracks on the walls were also observed at the level of lower window frames at the height of 1m above ground level. It suggests that strong horizontal shear force concentrated here.

The interior wall plaster was peeled and fell down from place to place. The wooden structure itself was not damaged, but the beam ends, which were inserted into or put on the exterior walls, damaged the surrounding parts.

3.3 Reinforced concrete stuructures

3.3.1 Honmyo-ji temple Nio-mon gate

Honmyo-ji was a temple built in 1585 by Kiyomasa Kato as the family temple of his father. It was relocated to within Kumamoto Castle after Kiyomasa had taken over Higo domain. After the death of Kiyomasa in 1611, it was moved to the current location at the northwest of Kumamoto Castle. The Nio-mon (Deva gate) is a large reinforced concrete(RC) gate built at the entrance to the Honmyo-ji grounds which has been constructed in 1920 (Taisho9). It is a rigid frame structure with a front width of 13.21m (3 spans), a depth of 6.36m (2 spans), and a height of approximately 14.8m. The roof is gabled RC structure in the *hirairi* style (a traditional Japanese architectural structure in which the building has its main entrance on the side that runs parallel to the roof's ridge), and the side ends frameworks below gables have infill walls with no openings (Photo 3.3.1.1). This Deva gate was listed as a National Registered Tangible Cultural Property in 2011.

Following the recent earthquakes, various kinds of damages to the Deva gate were confirmed, including [1] flexural cracks around the joints between columns and middle beams, [2] detached bracket arms, [3] damages around column bases, and [4] shear cracks on the walls below gables. The 12 columns that constitute the gate are connected at their upper and middle sections by beams, and because the weight and rigidity of upper sections above middle beams are extremely large, it was observed that flexural deformations of the lower sections were more prominent than at the upper sections. The flexural damages were also more pronounced in the gate's longitudinal direction than in the transversal direction, and in its transversal direction, the damages were greater at its two central column rows than at the side end column rows that were infilled with walls. Although the widths of wall cracks were narrow, there were concerns that the rigidity of the walls had been reduced.

Some damages are also found on the concrete ground slab around column bases. The slab at the back of Photo 3.3.1.3 would seem to have been partially removed to create enough space for vehicles to pass, because the extent of concrete ground slab is smaller than that of other columns, thus it is possible that this fact increased damages and subsidence around the column base.

In June 2017, Heritage Structure Engineering Design, Inc., conducted a condition surveys of the gate by using a 3D scanner and a drone that included; surveys of unevenness and inclination of the building structure; evaluations of cracks on its structural frames; concrete core sampling; rebar locating and sampling; surveys on cracked column-beam joints by chipping concrete; investigations by exposing existing foundations; and a subsurface investigation. It reported some of the results of these various surveys to the 1st Conservation Review Committee

Photo 3.3.1.1 Honmyo-ji Nio-mon: front.

Photo 3.3.1.2 Honmyo-ji Nio-mon: front.

Photo 3.3.1.3 Honmyo-ji Nio-mon: column bases and the surrounding area.

Photo 3.3.1.4 Honmyo-ji Nio-mon: damage to a column base.

Photo 3.3.1.5 Honmyo-ji Nio-mon: the state of the ground around the column base.

Photo 3.3.1.6 Honmyo-ji Nio-mon: shear cracks in the walls.

in July 2017. The noteworthy items in this report are that [1] the differential settlement of building is extensive, and the south side's column bases (left side of Photo 3.3.1.1) have sunk by around 120mm more than those on the north side, which is the main reason for the gate's incline (it is also one of the causes of the damage to the column-beam joints); [2] the columns and RC piles are directly connected,

and the damages that can be seen in Photo 3.3.1.4 are almost completely limited to the strips of stone footings and their adjacent areas; and [4] there are no ground beams or footings (Photo 3.3.1.5) as well as the extremely weak soil condition from 3m to 11m underground, so it is highly possible that this is the cause of the defects to piles penetrating this ground. Going forward, the results of other surveys are going to be reported, the seismic capacity of the building will also be evaluated, and seismic retrofitting will be assessed on the basis of these surveys and evaluations as scheduled. (Photos 3.3.1.1-3.3.1.4, 3.3.1.6 taken by the author, Photo 3.3.1.5 taken by Mariko Nishijima.)

References
1) Kumamoto Industrial Heritage Study Group and Kumamoto Machinami Trust, eds.: Kumamoto's modernization heritage (part 1), Genshobo, pp. 70-71, 2013.
2) Nishijima, Mariko: Study on Nioumon in Honmyouji Temple, the Architectural Institute of Japan Kyushu Chapter Architectural Research Meeting, No. 50, pp. 589-592, 2011.

3.3.2 Aso Volcanological Laboratory, Kyoto University (nationally Registered Tangible Cultural Property)

Introduction

This building was damaged in the main-shock earthquake of the Kumamoto Earthquakes during the early morning of Friday, April 16, 2016. On their homepage on April 18, it was announced that, "Entering into our buildings and site is difficult due to severe cracks and fissures (…) observations and other duties have been temporarily suspended, with the aim of quick recovery, including securing a temporary work space." By May 8, the majority of its functions had been recovered. On April 29, 2016, some functions had temporarily been transferred to Ozu Town, from April 12, 2017, onward, it was transferred to the former Sakanashi Elementary School in Ichinomiya Town, Aso City[1)], and the homepage of the Laboratory released photos and explanations as shown below.

Survey overview

Around two weeks after the Kumamoto Earthquakes of April 14 and 16, 2016, Professor Tsuneomi Kagiyama, the head of Aso Volcanological Laboratory, the institute for Geothermal Sciences, Graduate School of Science, Kyoto University, reported that "During the second major earthquake, a landslide has occurred on the mountain where the Aso Volcanological Laboratory is located (…) and fissures have appeared on its site. In addition, cracks have been found the building, and severe damages were also found in various places, including undulations of the floor on the ground floor (…) the situation indicates that there are no future prospects to the Aso Volcanological Laboratory main building as a cultural property." Previously, Fujihara had cooperated in registering the building as a Nationally Registered Tangible Cultural Property in 2011 and had evaluated it as follows (extract from the Kyoto University homepage): "The main building of the Laboratory was constructed in 1929 (Showa 4) as a building of the former Kyoto Imperial University Aso Volcanological Research Institute. The central wing has a six-storey tower-like external composition with tilted external walls. It also has balconies on three floors, while in the internal space; there are haunched beams, stairs decorated with trigonal pyramids and disc-shapes, chunky circular columns, and a fireplace with geometrical designs. In this way, its exterior and interior clearly shows the trends in architectural design of the early Showa Period, and it has become a landmark in the surrounding area." Identifying its designer had relied on the seal of Kyozo Nagese, who was the head of Kyoto Imperial University Maintenance Department, that have been left on the drawings which the Laboratory have stored, however, it was possible to determine that Saburo Okura, who worked under

Photo 3.3.2.1 This is an aerial photograph taken of the Aso Volcanological Laboratory and its surrounding area on October 24, 2016. In the far distance can be seen Mount Unzen on the Shimabara Peninsula. Below are the explanations of (1) to (6) in the photograph.

(1) From July to August 2016, one part of the access road to the Aso Volcanological Laboratory and the road within its site were temporarily repaired. This made it possible to access the Laboratory's buildings using an ordinary car.
(2) August 2016: Emergency measures were implemented to prevent water leaking into the buildings from the cracks.
(3) September to October 2016: A damage survey of the foundation was conducted.
(4) October 2016: To monitor for landslides, GPS reference points were set up at three locations, and measurements of ground displacement were initiated.
(5) The national government and the Kumamoto prefectural government planned construction works at places where landslides occurred on inclines at Takanodai.
(6) Repair work is in progress at the sites of collapse on National Highway 57, the JR Houhi Line, and the Aso Ohashi Bridge. However, it has not been determined when the repair work will be completed.

Nagase, was actually responsible for the design through investigations on the current situation of the damages[2]. After confirming the road condition to Minamiaso Village, where the aftershocks were continuing, surveys were conducted on Tuesday, June 7, 2017.

(1) The survey team (its local field team was led by Professor Tsuneomi Kagiyama and Assistant Professor Akihiko Yokoo) comprised Keiyo Fujihara, Graduate School of Design, Kyushu University, Professor, Doctor of Engineering; Kentaro Yamaguchi, Graduate School of Human-Environment Studies, Kyushu University, Associate Professor, Doctor of Engineering; Kentaro Morita, architect, qualified architect of the first class, Head of the Kentaro Morita Design Office, accredited as a Postearthquake Quick Inspector of Damaged Buildings; Koshin Matsuda, architect, qualified architect of the first class, Head of the Koshin Matsuda Design Office, accredited as a Postearthquake Quick Inspector of Damaged Buildings, and as a heritage manager certified by the Society of Architects and Engineering; Takashi Katsuki, architect, qualified architect of the first class, Chairman of Katsuki Construction; and Yoshinobu Arishima, qualified architect of the second class, Itsukushima Shinto shrine senior priest.

(2) Overview of the building

Location: Kumamoto Prefecture, Aso District, Minamiaso Village, Kawayo. Outlines of building: a reinforced-concrete structure, six-storeys (seven when including the penthouse) with a basement floor. Completed in 1928(Showa 3). Available for use from 1929 (Showa 4). Registered as a Nationally Registered Tangible Cultural Property in 2011.

(3) Methods of surveying damage conditions:[1] visual inspections on damage s; [2] surveys of internal damages of seismic elements and load-bearing elements of concrete, and decorative walls through a sounding test; [3] level surveys by measuring the unevenness of floors by setting a referral horizontal level on site by using a laser level.

Overview of the damage conditions

(1) It was felt that the damages on the four-storey part of the main wing, which was seven-storey high when including the penthouse, were generally small. In particular, it was found that the higher the floor levels, the less major damages were identified. Conversely, the most noteworthy damage at the main wing was that it had subsided straight down in relation to the rest of site. A laser level was used to prepare a virtual horizontal referral line on the surfaces of several room walls on the first floor and upper floors to check the levels of floors by

measuring the vertical distance from the referral horizontal line. By repeating this measuring method, no unevenness was identified at the main wing. Therefore, it was considered that the subsidence had occurred as a result of it sinking directly straight down into the ground. Some parts of the ground floor had appeared to be if they were embedded into the ground from the visual inspections conducted on its exterior, thus subsidence in a vertical direction was clearly apparent. In general, the amount of subsidence is speculated to be around 200mm to 260mm; however the actual measurement is unknown. The measurements have not yet been taken because the benchmarks are unconfirmed, and it is necessary to wait for more detailed measurements.

(2) Moreover, visual inspections were conducted from the four-storey part of the main wing to the two lower wings extended to north and east (both were two-storeys) that are arranged in L-shaped plan by centering the main wing. It resulted to discover several cracks on the concrete walls around openings.

(3) Surveys were conducted in the several rooms at the lower two wings (both were two-storeys) to check possibilities of differential settlement, as a result, there were slight signs of differential settlement to the both east and north wings. It was observed that each of the wings had relatively subsided on site through the visual inspections on their exteriors. However, the amounts of subsidence were likely to be smaller compared to the main wing. Inclines had internally appeared on floors around the joining parts where the main wing and two wings were connected.

(4) There were major damages in the form of flexural fractures to the joints between the main wing and the two lower wings (both were two- storeys). Continuing the visual inspections on their exteriors from the entrance porch projecting at the front of the building to the ground floor of east wing with some damages, it was found that there were cracks in the reinforced-concrete walls and exposed internal spaces that caught a glimpse from outside through cracks. In addition, the reinforcing bars within the walls had been fractured. The main wing which had vertically subsided straight down into the ground had drag the two lower wings (both were two storeys) connected in L-shape down, because the amounts of subsidence at the two wings were relatively smaller compared to the one of main wing, thus the force was considered as the main factor which triggered the inclines as well as the differential settlement of two wings. The visual inspections also confirmed the concentration of flexural fractions around the joints.

The locations of the flexural fractions that have been confirmed in (3) and (5) would have had expansion joints, if speaking in current practices, however, such method had not been established when the building was completed in 1928 (Showa 3). Thus, the main wing and two wings were constructed structurally rigid internally and externally with reinforced concrete, this could be the main factor of the severe damages around the joints between the main wing and two other wings.

(6) After the surveys, level drawings were prepared and then submitted to Kyoto University. When describing the details of actual surveys on drawings, the highest point of each zone was set as ±0 and each measurement was plotted as how much below from the ±0 point.

Cosideration

Due to the recent Kumamoto Earthquakes, a large-scale destructive landslip had occurred adjacent to the site of the building. The building was constructed on the tephra (pyroclasts), such as volcanic ash and pumice stone, that covers this area, and at the time when it was constructed in 1927-1928 (Showa 2 and 3); its foundation was constructed as spread footing,

although the detail of its construction procedure has been unknown. However, having different weights between seven-storey main wing with a penthouse and the two lower wings in L-shaped plan had caused the differences in the amounts of subsidence. It could be concluded that this caused the major flexural fractures around the joints of wings, at the same time; it also caused the differential settlement of two lower wings. Although many of the cracks appeared around the joints, the structure of wings themselves have not seriously been damaged with cracks or deformations, therefore, future restoration is not difficult in this respect.

Notes

1) On April 4, 2017, one year after the earthquakes, information was opened to media publications and Professor Takahiro Okura (volcano physics) reported the situation at the time of earthquakes. The majority of the main building of the Laboratory have been left in the same state, as if time had stopped after the main-shock earthquake, while in the surrounding area, the cherry blossom that was washed away by a landslip has bloomed again in this year. Activities aiming at a full recovery are finally beginning. Minamiaso Village was severely hit by the main-shock earthquake, with a seismic intensity of upper 6, and subsided by a maximum of 20cm. Even today, there are multiple fissures still remain in the garden, internal walls are partially collapsed, and the floor has been undulated. In the ground floor exhibition room, two large seismographs weighing more than 1 ton were damaged. (After the disaster) the observation work had temporarily been suspended; which is currently being practiced at temporary offices in the nearby Aso City and Ozu Town. Fortunately, a boring survey has confirmed the stability of subgrade, thus restoring the building is now under consideration.
2) After graduating from the University of Tokyo in 1906, Kyozo Nagase worked at the office of Kikutaro Shimoda and the Tatsuno Kataoka Architectural Design Office. From1909, he joined the Kyoto University Architectural Department under Jihei Yamamoto, and in 1919, he became the head of the Architectural Department. He retired in January 1929 (Showa 4). The Aso Volcanological Research Institute was possibly Nagase's last work from 1927 to1928 (Showa 2 and 3). Saburo Okura was influenced by Goichi Takeda as one of the first students at Kyoto University Architectural Department, and after he graduated, he was employed by the private-sector Hyozo So Architectural Design Office. He moved to the Kyoto University Architectural Department in 1928 (Showa 3) and designed the Aso Volcanological Research Institute. The styles of art deco and cubism that have been influenced by So are reflected not only in its external appearance but also in the internal spaces, and it is fulfilled with design techniques that are compatible with the existing Kyoto University Faculty of Economics main building, the Nada High School main building, and the Ikoma Watch Store.

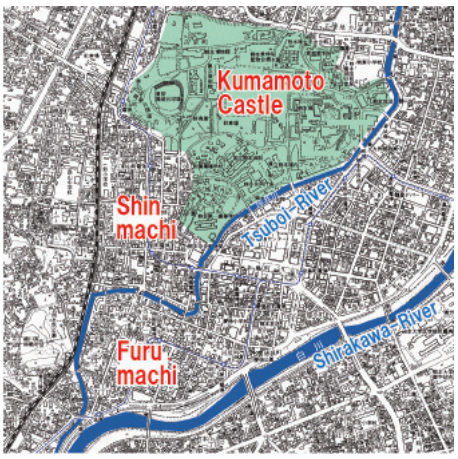
3.4 Traditional Townscape and Landscape Districts

3.4.1 The Shinmachi Furumachi District

The *machiwari* (town layout) of the castle town built by Kiyomasa Kato continues to exist today as a living space for contemporary life, despite having experienced many disasters and war damage. Kumamoto Castle and the castle town have the Tsuboigawa River as the inner moat and the Shirakawa River as the outer moat, changing the flow passage of the meandered Shirakawa River, which had experienced repeated floods. Over the passage of time, in the fires of the war of the Meiji 10 (1877) Satsuma Rebellion, almost all of Shinmachi-Furumachi was turned to ash. After the subsequent restoration from the war damage and alongside the conversion of land use from the Edo Period town of samurai and townspeople, it began to go down the path of "modernization," and the merchant houses were rebuilt using the same construction method of the modern style of *machiya* (townhouses). Moreover, facilities in response to the demands of society for modernization, including prefectural offices and other government facilities, courts, banks, schools, and hospitals, were constructed among the townhouses, accounting for most of the urban area. While preserving the *machiwari* of the urban area that had become scorched earth in the Satsuma Rebellion, buildings with new functions were built on the land with the former subdivisions. Because the moats of the Tsuboigawa and Shirakawa Rivers were natural rivers, rather than being filled in and converted to roads, both rivers became the edges of the urban area, and a modern city was formed within the area of the former castle town (Figure 3.4.1.1).

One feature of the Kumamoto castle town is that it is formed of multiple layers within a contemporary living space, having the cultural artifacts of the early modern Edo Period, the modern Meiji Period, and

Edo period



Modern age

Figure 3.4.1.1 The *machiwari* of Shinmachi-Furumachi.

subsequent years. The first layer is the historical remains that form the foundation of the castle town built by Kiyomasa (including the rivers, stone walls, and *machiwari*). The second layer is the historic heritage that was cultivated during the Edo Period or the Hosokawa clan period (samurai residences, townhouses, the associated crafts, and intangible cultural heritage such as festivals, entertainment, and food). The third layer is the modernization heritage from the Meiji, Taisho, and Showa Periods, including historic sites relating to the Satsuma Rebellion and sites related to the renowned literally figures Ogai and Soseki.

Figure 3.4.1.2 to the right describes the features of the townscape of Tojin Town:

①Aligning streets to Mt. Kinpozan in the west

②In the vicinity of Tsuboigawa River (town ward north), the Mei-hachi Bridge and Mei-ju Bridge, stone bridges built in Meiji 8 and Meiji 10 respectably.

③A chessboard-type sequence of consecutive town wards, of one town ward, one shrine (Furumachi)
Alleys that form the entrances to the temple.

④The view to Kumamoto Castle
The greenery of Fujisakidai from the Mei-hachi Bridge

⑤The series of townhouses

⑥The modern architecture facade

⑨The rebuilt, human-scale, small- and medium-sized commercial buildings (including hospitals and clinics)

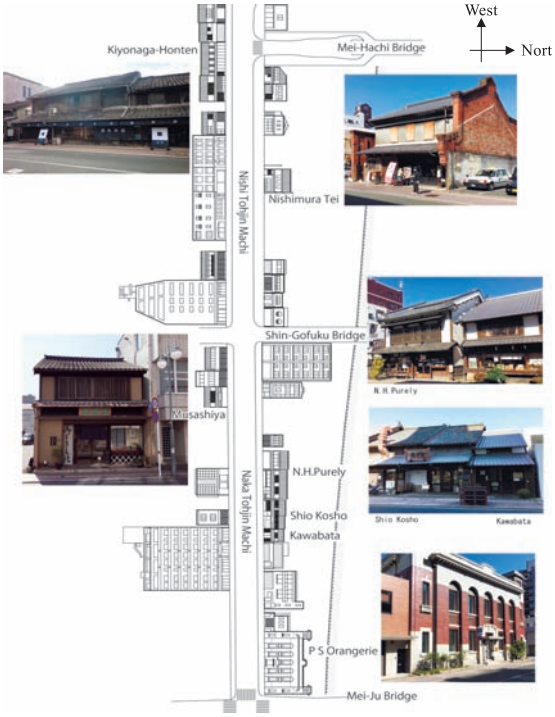


Figure 3.4.1.2 The townscape and appearance of Tojin Town.

⑩ Medium- to high-rise apartment buildings
⑪ Open air parking lots

Most common features are shared also with other roads in the Shinmachi-Furumachi district, but the shapes of the Shinmachi's town wards are different, and the site is divided in half by a configuration of long, south-north town wards.

Currently, out of Kumamoto City's total of 19 townscape-constituting properties and important landscape element buildings, 11 buildings are located in the Shinmachi-Furumachi district. Including the three buildings that are within this group, it has four buildings that are registered national tangible cultural properties (Figure 3.4.1.3).

From the research results of the emergency-risk judgments conducted three months after the earthquakes to confirm the conditions of the 203 townhouses, 91 had a red judgment (45%), 85 had a yellow judgment (42%), and 27 had a green judgment (13%), meaning that nearly 90% had a red or yellow judgment, and many of the townhouses were damaged. Kumamoto City had established a subsidy system for the repairs and maintenance of the surviving townhouses with the objective of creating a historic townscape that gives a sense of the atmosphere of a castle town in 2012. ,By 2014, 22 buildings had been completed their repairs. In contrast, we found that the conditions of these 19 townhouses (out of 22) during the emergency-risk judgments, 2 had a red judgment (10%), 11 had a yellow judgment (58%), and 6 had a green judgment (32%), so around 70% had either a red or yellow judgment; it was noted that their damage rate tended to be smaller. In has also noted that, the townhouses repaired independently without using the subsidies, such as to repair their structural frameworks, walls, foundations, and roofs, escaped major earthquake damage. In the recent earthquakes, the importance of maintaining the sound conditions of historic buildings on a regular basis through repairs was once again confirmed.

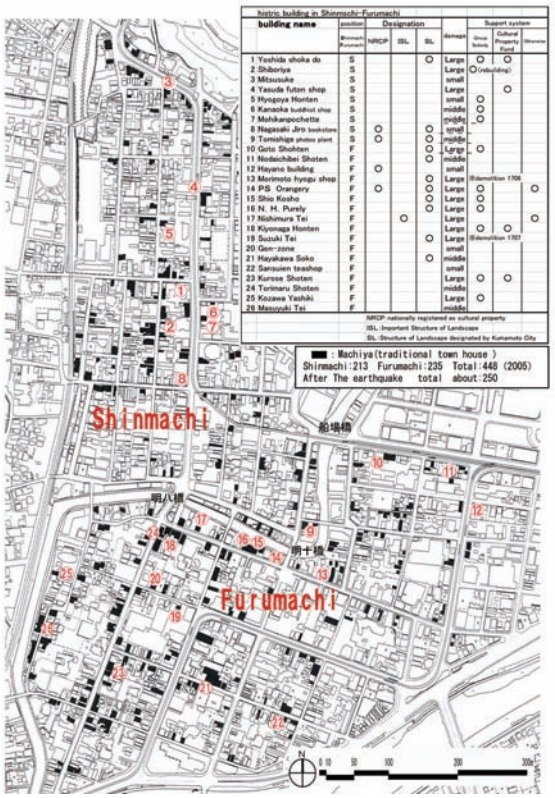


Figure 3.4.1.3 The Shinmachi-Furumachi historic buildings.

Photo 3.4.1.4 A townscape-formation building being dismantled (July 2017).

Despite the arduous "life-saving" efforts made in the year after the earthquakes, two townscape-constituting properties had to be dismantled one after the other in June and July 2017 (Photo 3.4.1.4). Going forward, in order to maintain the historic landscape over the long term, it is hoped that:

1) the maintenance and management of individual building shall not be neglected during non-emergency periods;
2) there is the systemization of emergency measures (from the dismantling) that can be initiated during times of emergency, such as a disaster; and
3) a townscape infrastructure is established, including the utilization of open spaces made after dismantling by turning them into disaster-prevention plazas.

3.4.2 The Kawashiri District

The damage to the surrounding area of Mashiki Town was great; it was announced that the epicenter of the earthquake was to the west of Mashiki Town Hall and Mashiki Town Park. The tremors occurred with the frequency of the so-called 1.2-second killer pulse, which is particularly damaging to wooden structures constructed using traditional methods. The instrumental seismic intensity was 6.7, which is 20% to 30% greater than the Takatori wave recorded in the Great Hanshin Earthquake. It was an extraordinarily large earthquake. The collapse rate of the wooden buildings in the vicinity of Mashiki Town Hall exceeded 50%.

Several months have passed since the true epicenter was changed to Kashima, 5km west of Mashiki Town, but because the fault lines are linearly continuous, although it was an epicentral earthquake, it was not the case that the damage was great only directly above the epicenter.

Several months later, the officials announced that the true epicenter was Kashima, 5km west of Mashiki Town, but that does not mean that the damage was concentrated only above the epicenter even though it was an epicentral earthquake. Especially, the fault lines are linearly continuous.

Even at some distance from the epicenter, earthquake damage will be great if the ground frequency matches the building frequency. The Kawashiri District is located 8km west from the epicenter in Kashima, and it is a delta into which five rivers flow. The bedrock is located 30m below ground, and the surface amplification factor is 2.2, which means that when an earthquake occurs, the vibrations are easily amplified to the ground.

The Kawashiri District prospered during the Edo Period as a port to accumulate the annual rice tax. It has many pre-war buildings, most of which were damaged in the earthquakes, but it is too simple to jump to the conclusion that the damage was great because they were old buildings. The damage was considerable because the seismic wave frequency of the killer pulse and the frequency of the old buildings matched. This can only be put down to "bad luck." Ironically, buildings with a short natural period such as of (concrete) blocks remained sound. In many cases, people often rebuild their buildings thinking they became "old" once they become more than 50 years old, when most of the traditional, wooden buildings are roughly 100 years or older since their construction. Even if a building is damaged, it is far cheaper to repair that building than to construct the same quality building anew.

- In the damage survey, the representative historic buildings were surveyed by cultural asset doctors. Among these buildings, there were 19 shrines and temples, all of which had been damaged. If we count these buildings separately into priests' quarters and main temples, we can say that there were 30 damaged buildings, of which three have been dismantled. A subsidy system for historic structures has been newly set up, but it seems that religious facilities are not eligible for these

subsidies even if they are registered as an element for landscape or cultural property, so it would appear that there is nothing that can be done for them.

- The group subsidy system has proven to be a blessing for the commercial facilities. In the Kawashiri District, the various businesses, such as local shops, a brewing company, and a confectionary manufacturer, formed a group and are applying for subsidies. Within them, the Zuiyo sake brewery, which was founded at the end of the Edo Period, has a group of 40 buildings of reinforced concrete , steel, and wooden structure, as well as earthen wall warehouses, all of which were damaged. Among them, six buildings had to be dismantled due to a shortage of construction workers and for the sake of managing the factory. Another seven buildings suffered severe damage and were either half or completely destroyed, but they are scheduled to be repaired. The earthen wall warehouse with large wall surfaces appears to have suffered major damage looking from the outside, but from the inside, the structure can be confirmed and can be repaired. In old days, it seems that the people used to have sacrifice the earthen walls at the time of major earthquakes to secure the structure itself. They must have foreseen what to be restored. As they were built by hand, it seems natural that they can also be repaired by hand. There are many buildings that were dismantled as a result of a judgment that they were completely destroyed. If a new category of " but repairable" is added to the "completely destroyed" category, then this may have saved nearly 40,000 buildings.
- The Imamura family home, which was constructed at the end of the Edo Period, is registered as a national cultural property. The second floor is small and long, running from east to west, which appears to be why its building frequency did not synchronize with the seismic frequency. As far as we can say, it did not suffer earthquake damage. (Photo: the Imamura family home)
- All five of the Kumamoto city–designated landscape-formation buildings and important buildings were damaged. Four of them were judged to be completely destroyed, but they are scheduled to be fully restored. It seems that this will take more than three years, however, due to a shortage of workers. (Photos: the Zuiyo head office, the Zuiyo Masudai Warehouse, the Zuiyo Resource Center, an office, the Yoshimura family home, the Zuiyo Memorial Warehouse [no designation]).
- The Kawashiri Public Assembly Hall, which was constructed in the early Showa Period, was scheduled to become a city-registered cultural property, and the seismic reinforcement had been completed, but the earthquakes occurred just before construction was to start. In contrast to the Imamura family home, it is long in the south-to-north direction, but short from east to west. It has very few walls and an extremely flexible structure, but it is believed that its frequency was too long and therefore did not synchronize with the earthquakes and was able to withstand them. Although there was damage to the *shoji* (paper sliding doors) and the earth walls, there was little damage to the structure itself, and the plan is to repair it at the additional construction cost of only a small amount. (Photo: the Kawashiri Public Assembly Hall)
- The nationally designated Hosokawa clan rice granary is undergoing construction work, and as the earthquakes occurred before the roof and walls were installed, the building was light and suffered hardly any damage. The restoration work will be completed in November, as planned. (Photo: the Hosokawa rice granary)
- The damage to the old buildings within the town

Photo 3.4.2.1 The Imamura family home (nationally designated undamaged)

Photo 3.4.2.2 The Zuiyo office building (city designated)

Photo 3.4.2.3 The Zuiyo Masudai Warehouse (city designated)

Photo 3.4.2.4 Warehouse in the town

Photo 3.4.2.5 The Zuiyo Resource Center (city designated)

Photo 3.4.2.6 An office (city designated)

was great. In one square kilometer, there are over 60 dismantled buildings, old and new. There remained a privately owned warehouse. There is no relief system. There is the “Town Development Subsidies Project,” but a structure is not eligible for this unless it faces the road. Repairs are possible at a very small cost, but a flexible response is required. (Photos: a warehouse in the town, a map of the dismantled structures)

Photo 3.4.2.7 The Yoshimura family home (city designated)

Photo 3.4.2.8 The Zuiyo Memorial Warehouse

Photo 3.4.2.9 The Kawashiri Public Assembly Hall

Photo 3.4.2.10 The Hosokawa Domain rice granary (nationally designated)

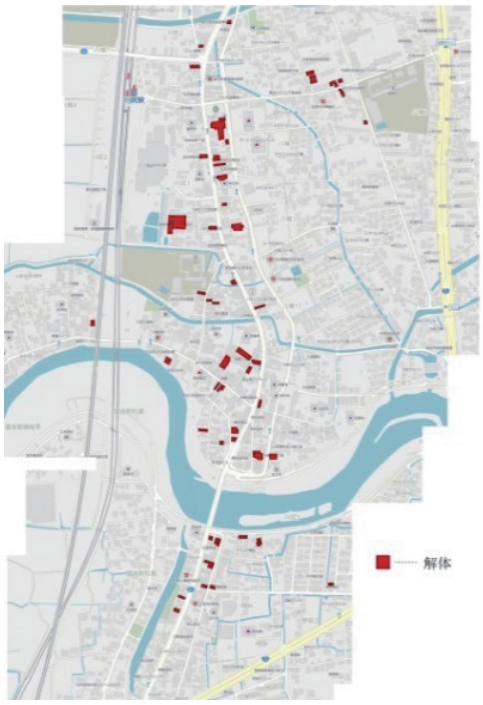


Photo 3.4.2.11 Dismantling in the Kawashiri District (60 buildings)

3.4.3 Ogawa District

Ogawa Town, Uki City, is located in the center of Kumamoto Prefecture. It prospered as a post town on the Satsuma road during the Hosokawa era. It was once a port town close to the coast, but today it is far away due to the land reclamation. It was the center of the regional economy for trade with Nagasaki, including as a trading center for Amakusa seafoods and tea, but today it lacks the bustle of former times. Most of the townhouses altered their first-floor facades due to the removal of the eaves following the widening of the road in the Showa 40s (around the 60s and 70s), but the several *Igura* style townhouses have survived and were still telling the story of the town in its former days.

The damage situation of the traditional townhouses

The Ogawa Town commercial district is located on top of the Hinagu fault, and it experienced a series of earthquakes, including two of seismic intensity of more than 6: on April 14, the fore-shock earthquake of a seismic intensity of lower 6; on April 15, aftershocks of seismic intensity of upper 6; and on April 16, the main-shock earthquake of a seismic intensity of upper 6. Students and former students entered Ogawa Town immediately after the earthquakes to carry out a survey of the Shin Koujiya registered tangible cultural property. Many townhouses from the end of the Edo Period to the Meiji Period remain in the Kanmachi and Nakamachi parts of the town, where this building is located. At Shin Koujiya, the tiles of the annex building (T11, 1922) had fallen and rain had leaked in, the building had acquired an incline, and the plaster wall had collapsed. The ceiling of the connecting building collapsed, but the Meiji 16 main building suffered hardly any damage. Tiles also fell from the Shioya (M39, 1906) salt merchant room, and rain leaked in all the way to the first floor. At the Wakasaki hardware store in the main building (from Manen year 2, 1861) and the warehouse (from Genji year 1, 1864), the courtyard fence collapsed, and the plaster wall that formed the building's outer wall had collapsed in numerous places. These splendid townhouses, built during the Edo and Meiji Periods, were found to have broken and collapsed ground tiles and plaster walls, but, surprisingly, the structures of the columns and the beams suffered hardly any damage. This once again gives us a sense of the strength of traditional construction methods.

Support

Some of the residents who lived in the townhouses ended up living in their cars because of their strong fears about the safety of these old wooden buildings, and some had decided to dismantle their splendid townhouses even though they had suffered hardly any damage. Therefore, around a month after the earthquakes, a consultation meeting was held, and the residents were informed about the strength of the traditional construction methods and told that their properties could be restored. Around two months after the earthquakes, a meeting was held to explain the group subsidies that are provided by the Small and Medium Enterprise Agency, and the residents started to submit applications for the townhouses with attached stores that were eligible for the restoration subsidies.

Architects also participated. With regard to the restoration method, starting from measuring, a substantial amount of time was required up to the stage of preparing the estimates, and this work is currently ongoing. In February 2017, the Kumamoto Prefecture Cultural Affairs Section announced restoration subsidies for a maximum of two thirds of the properties, even for the undesignated cultural properties so that the homes and other buildings that were not eligible for the group subsidies also became possible.

Photo 3.4.3.1 The location of Ogawa Town.

Photo 3.4.3.2 The Ogawa Town commercial district

Photo 3.4.3.3 Architects inspected each townhouse and provided advice on repairs.

Photo 3.4.3.4 Advice from the University's structural expert.

Photo 3.4.3.5 Introducing a restoration case study in Kuroshima, Wajima City.

Dismantling using public funds

Up to the present time, approximately 25 townhouses and other buildings have been dismantled in the Ogawa Town commercial district. Among them there were two townhouses considered to be from the Edo Period for which we asked for restoring their houses, but this wish was not realized. If the announcement about the subsidies for undesignated cultural properties had been made sooner, maybe these townhouses would have survived. In addition, all of the empty houses will be dismantled.

A shortage of skilled workers

A year and a half has passed since the earthquakes, but it has not been possible to find the plasterers, tile craftsmen, and carpenters who are able to restore the structures using traditional construction methods, and the restoration of the majority of the townhouses will take place sometime from now. In addition, there are few architects working on the restoration, which requires a lot of time and effort compared to dismantling and constructing a new building.

Thanks to the visits of many people and establishment of the Karukaya-no-kai organizaton that foresees the future of the town

The town was blessed with numerous visits and advices received from many people, including Mr. Hasegawa from Niigata, cultural properties conservators, university teachers and architects from many regions, and Mr. Koyanagi, who was involved in the restoration of the traditional townhouses in Kuroshima, Wajima City, Ishikawa Prefecture, after the Noto Peninsula Ocean Earthquake. One year after the earthquake, the townhouses were in a terrible condition, and it was not a situation in which it was possible to think about the town as whole. In June of this year, however, civic minded volunteers from the town's commercial district launched the Karukaya no Kai organization, and discussions on the future of the town have begun.

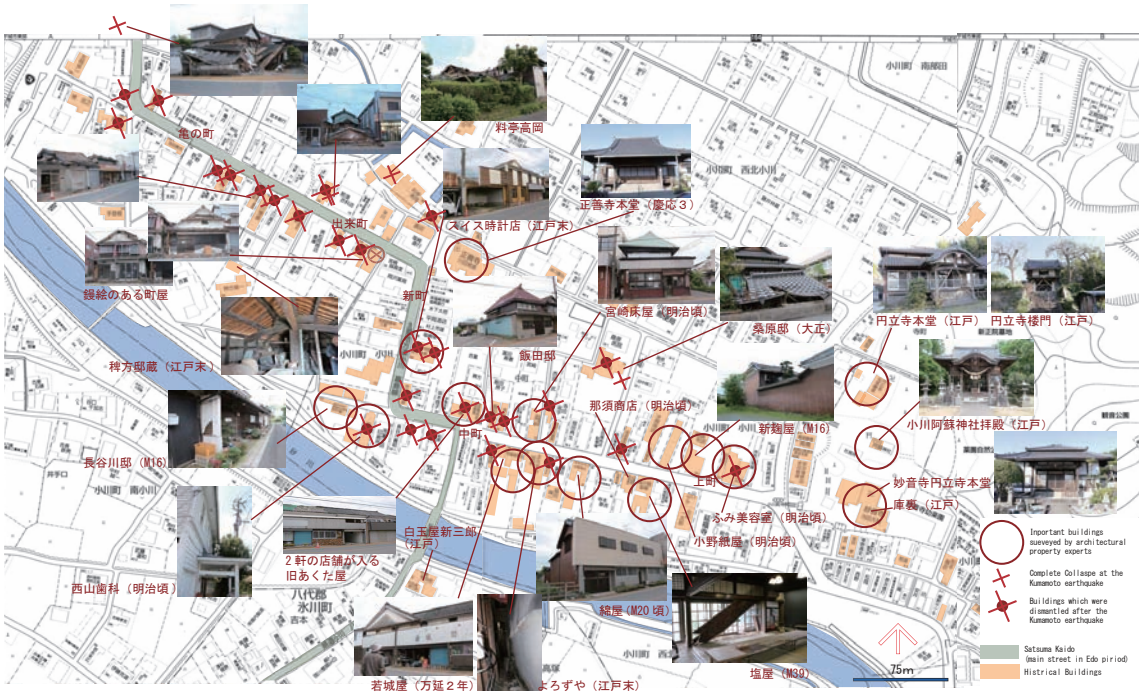


Photo 3.4.3.6 The damage situations at the traditional townhouses in Ogawa Town's commercial district (August 2017).

3.5 Missionary-related schools and others Western-style modern architectures

Maude House (Nationally Registered Tangible Cultural Property)

Completed in 1927, a timber, two-storey building at 1 Chome 14-1, Kuwamizu, Chuo Ward.

The home of the missionary Maude Powlas, who established the "Jiai-en" Social Service Community. There were no major problems with the main structure, its external walls and roof were not damaged, however, few cracks were identified on its internal walls, while the chimney duct in the attic had broken and fallen off through the ceiling into the room below. In addition, planters attached under external windows had fallen off at several places. As Jiai-en is an iconic building and the design office that was involved in previous preservation and renovation works is nearby, it is believed that careful restoration works will be conducted to the building.

The Riddell-Wright Memorial Hall (Nationally Registered Tangible Cultural Property)

Completed in 1919. The first floor was added in 1935. A timber two-storey building at 5-23-1 Kurokami, Chuo Ward, Kumamoto City.

A research facility for Hansen's disease (leprosy) established by two female, Ms Riddell and MsWright. It is two-storey building with a long, east-west rectangular shape. The building suffered from various kinds of damages caused by the earthquakes, as the ground at the south elevation was shifted forward by around 10cm. Along with this ground shift, cracks had appeared onto its foundation, columns became misaligned, and some parts of internal walls were peeled off. A large-scale construction works is required, including jacking up the building to replace it to its original position. It had been used as an exhibition hall, however it is currently closed.

Photos 3.5.1 Maude House

Photos 3.5.2 The Riddell-Wright Memorial Hall

Kyushu Gakuin Lutheran High School Chapel (Nationally Registered Tangible Cultural Property)

Completed in 1924. Made of reinforced concrete. At 5 Chome 2−1, Oe, Chuo Ward, Kumamoto City.

A Romanesque chapel built in memory of Mr. Brown, the founder of the school. The architect was William Vories, an American missionary responsible for numerous architectural works in Japan. Although there was no damage to its exterior, there were cracks running horizontally along its internal walls at some parts where the side aisles connect to the nave. In addition, one part of the internal wall had fell off.

Kyushu Jogakuin High School main building (nationally registered tangible cultural properties)

Completed in 1926. A three-storey, reinforced concrete building at 3 Chome 12-16 Kurokami, Chuo Ward, Kumamoto City.

The main building of a missionary school designed by Vogel, an American architect. There were cracks

Photos 3.5.4 Kyushu Jogakuin High School main building

Photos 3.5.3 Kyushu Gakuin Lutheran High School Chapel

Photos 3.5.5 A meeting hall for Bible study

in some parts of its exterior. Some of its roofing slate tiles had also fallen off and been scattered. Inside of the building, plaster ceiling had partially come off. A lot of damages could be seen on its decorative arched beams in the main hall of the chapel. Repair works have been completed and the building is now used as when it was before.

Completed in 1931. A reinforced concrete, three-storey building at 2 Chome 27−23 Kurokami, Chuo Ward, Kumamoto City.

A meeting hall for Bible study that was built with donations, from the North American YMCA, volunteers from the former No.5 Senior High School and such. Cracks were observed in the internal wall of its penthouse, other than that, no other major damages were found.

3.6 Stone constructions

3.6.1 Stone arch bridges

There are more than 300 stone bridges in various places in the prefecture. As a result of the field surveys conducted after the Kumamoto Earthquake, it was possible to identify 19 bridges that had suffered damage, based on the protrusions from and collapses of the stone walls, the gaps between the arch stones and the cracks in the stone materials, the cracks in and collapses of road surfaces, the balustrades that had fallen or become cracked, and the conditions of the filling materials. To identify the damage caused by the earthquakes, it proved useful to use the existing chart of stone bridges, which summarizes in the form of a list of figures and photographs. Comparing with the basic information about the stone bridges, the conditions before the earthquakes, the extent of the damage was assumed due to the earthquakes. The main stone bridges that had suffered major damage were the Tsujun Bridge (Yamato Town), Futamata Fukura-watashi Bridge (Misato Town), Senbabashi Bridge (Uto City), Yasemeganebashi Bridge (Mifune Town), Yasumi-shimoduru Bridge (Uki City), and Zenigame Bridge (Minamiaso Village).

After the fore-shock earthquake (5 upper), the Tsujun Bridge, which is a nationally designated important cultural property, suffered numerous leaks, and several cracks appeared in the earth covering the upper part of the bridge. This damage was then exacerbated by the main-shock earthquake (6 lower), and protrusions of curbstones in the upper part of the stone bridge were confirmed in three places. In addition, it was confirmed that the plasterwork on the upper surface of the bridge had been pushed up and that cracks had appeared in the junctions of the water pipes; it is also possible that the plasterwork was damaged at many points on the water pipes and that there were leakages from the arch stones (Photo 3.6.1.1).

The Futamata Bridge, which has been designated a town cultural property, consists of two stone bridges (Futamata Fukura-watashi and Futamata-watashi) that form a characteristic L-shape. Due to the earthquake, with a seismic intensity of 6 lower, and the aftershocks, the stone wall, road surface, and balustrades in the upstream and downstream parts of the right bank collapsed at one part of the bridge. In addition, due to the vertical and horizontal shaking of the structure during the earthquakes,

Photo 3.6.1.1 At the Tsujun Bridge, water leaked from the arch stones (Photo by Yamato town)

Photo 3.6.1.2 The collapsed stone wall at Futamata Fukura-watashi

Photo 3.6.1.3 The bridge post collapsed at the Senba Bridge

other damage occurred, including sectional damage to the arch stones; continuous fissures, cracks, and deformation in the shapes of the arches; and protrusions from the stone walls in the upstream and downstream areas on the right bank (Photo 3.6.1.2). Due to the resultant entry of rainwater from the surface of the bridge, the filling material seeped out of the collapsed parts of the stone walls on the upstream side, and in conjunction with this, there were major protrusions from the stone walls or, in other words, deformation of the original shape of the outer surface, which is thought to have triggered the collapse.

A single-arch bridge built in 1863 on the Senba-gawa River, Uto City, the Senba Bridge is a city-designated cultural property. As shown in Photo 3.6.1.3, the damage to this bridge due to the earthquake occurred more on the upstream side than on the downstream side. The damage included cross-sectional deficit and continuous cracks in the arch stones. In addition, on the road surface, the balustrades and the bundling pillars collapsed, the wheel guard and road surface stone materials suffered deformation, and some of the balustrades fell into the river.

The Yasemegane Bridge is a stone bridge built on the Yase-gawa River in 1855. It is part of the former Hyuga Highway and has been designated a Kumamoto Prefecture cultural property. In the recent earthquakes, the stone wall on the front side of the arch base on the upstream side collapsed. As shown in Photo 3.6.1.4., the minor collapse of the stone wall that occurred in the fore-shock earthquake was widened by the main-shock earthquake, and the railings collapsed in some places. With regard to the possible cause of the collapse of the stone wall, it was found that the collapsed section had previously been repaired when it collapsed 28 years ago in 1988, and the filling material that could be seen following the recent collapse was material that was used in the repair work. As the original internal filling material was red clay, it was understood to be significantly related to the repair method.

A Uki City–designated cultural property, the

Photo 3.6.1.4 The stone wall on the upstream side collapsed at the Yasemegane Bridge (Photo by Mifune town)

Yasumi-shimoduru Bridge is a single-arch stone bridge, constructed on the Hamado-gawa River in 1848. It was found that in the recent earthquakes, the stone wall in the vicinity of the arch foundation on the right bank had collapsed extensively (Photo 3.6.1.5). In addition, in the balustrades section on the surface of the bridge, all of the balustrades had collapsed and fallen down, and when looking from below at the central part of the arch stones and the vicinity of the foundation, large gaps have appeared as a result of the earthquakes, not only in a direction perpendicular to the bridge axis but also in the same direction as the bridge axis. This stone bridge was completely flooded in the heavy rain and flooding of June.

The Zenigame Bridge is a stone bridge built in 1918 on the Kawayokuro-kawa River, Minamiaso Village, and mortar was affixed to the stone materials that were used for the arch stones and the stone walls. As shown in Photo 3.6.1.6, the four stone walls collapsed due to the fore-shock earthquake of a seismic intensity of 5 lower, the main-shock earthquake of a seismic intensity of 6 upper, and the many aftershocks. This was the only stone bridge where the four stone walls collapsed; this sort of damage was not seen at the other stone bridges, where the stone walls were not affixed using mortar. However, no large gaps appeared in the arch stone sections, although integrated cracks were visible at the joint parts of the mortar, which in turn caused major cracks in the arch stones themselves.

Photo 3.6.1.5 The stone wall collapsed at the Yasumi-shimoduru Bridge (Photo by Uki city)

Photo 3.6.1.6 The stone wall on the upstream and downstream sides collapsed at the Zenigame Bridge

3.6.2 The thirteen-storied pagoda (nationally designated Important Cultural Property)

The thirteen-storied pagoda, which is designated as an Important Cultural Property, is a stone pagoda built in 1230 (the second year of the Kanki Period). It was located in Myodo-ji Temple in Yunomae Town,

Photo 3.6.2.1 The thirteen-storied pagoda after the disaster

Kuma District, Kumamoto Prefecture, together with a seven-storied and a nine-storied stone pagoda. Myodo-ji Temple was founded in the Meiji Period, but these three pagodas were built earlier, at the time of the previous Joshin-ji Temple and were damaged and looted when the Meiji Period temple fall into decay. In 1911 (Meiji 44), Tomonori Yone gathered the remnants of the thirteen-storied pagoda and rebuilt it at his own residence in Yatsushiro City. Currently, it has been rebuilt as an eleven-storied pagoda and has the feature of *Oni* or goblin faces at the end of the corner rafters, which is a feature not seen in the seven-storied or nine-storied stone pagodas that were built in the same period.

In Yatsushiro City, there was a fore-shock earthquake with a seismic intensity of 5-minus on April 14th, followed by the main-shock earthquake on April 16th with an intensity of 6-minus. As a result of these earthquakes, the top four stories and the roof of the pagoda rotated and some of the stone materials were damaged. Afterwards, the stone materials that suffered heavy damage at the fifth story and above were quickly dismantled and stored, and that made it possible to avoid collapse or other major damage during the after-shocks. There were center holes in the stone materials used for the pagodas and in the roof, so it is highly possible that there was something like a center pillar at the time of the original construction, but this pillar was not installed when it was relocated in the present site. Moreover, lead boards have been used at the upper end of the pagoda to adjust the unevenness in the stone materials.

The stone materials that suffered severe damage were on the fifth story, which split into two large sections (Photo 3.6.2.4), and on the seventh story,

Photo 3.6.2.2 The upper part of the twisted thirteen-storied pagoda

Photo 3.6.2.3 The dismantling of the upper part (April 19th, 2016)

Photo 3.6.2.4 The damaged fifth story of the pagoda

Photo 3.6.2.5. The ninth story roof with fragmented eave-ends

which roof was fragmented at the eave-ends. They are being reinforced using stainless steel dowel pins and epoxy resin combined together and, in order to improve earthquake-resistance, stainless steel core post is to be installed during reassembly.

3.7 Historic Sites

3.7.1 Kumamoto Castle's dry stone walls and structures

The Kumamoto Castle site is a "flatland-mountain castle" erected on the tip and around a hillock extending towards the South. In Tensho 16 (1588), Kiyomasa Kato became the *daimyo* of the Northern half of Higo Province (from Keicho 6, feudal lord of the whole country, except for the Kuma and Amakusa Counties). From Keicho 4 (1599), he carried out the construction works to build a high dry stone wall, mainly around the high ground known as Mt. Chausuyama, and by around Keichō 12 (1607) he completed the *Honmaru*, principle compound in a castle complex. Subsequently, the Hosokawa clan was transferred to this castle, and it conducted partial refurbishments and repairs up to the end of the Tokugawa Shogunate. The castle became an army garrison at the beginning of the Meiji Period, and during the Satsuma Rebellion, which was Japan's last civil war, many parts of it were burned down, including the castle keep, turrets, and palace. However, other structures, such as the castle gate and turrets, including the Udo Turret, survived, and in particular the dry stone walls and the moat have retained so well their original features that the site has been designated a Special Historic Site, recognizing its extremely high value as a model example of an early-modern castle.

During the 2016 Kumamoto Earthquakes, in the fore-shock earthquake of the night of April 14th, the dry stone wall collapsed in six places and extensive ground damage was ascertained, including

Figure 3.7.1.1 A map of the places where the Kumamoto Castle's dry stone wall was damaged in the 2016 Kumamoto Earthquakes

protrusions of the stone wall, collapses of the upper parts of the stone wall, and cracks in the ground. Moreover, ten structures designated as Important Cultural Properties and seven reconstructed buildings were damaged, including the loss of roof tiles and plaster on the exterior walls that had fallen off. Then, 28 hours later, during the main-shock earthquake in the night of April 16th, the stone wall collapsed in 517 sections, the damage area accounting for 30% of the total stone wall area (973 sections); within the damage-affected sections, the wall had collapsed in 229 sections (in 50 places). In addition, all the 13 buildings designated as Important Cultural Properties were damaged; of these, two buildings had completely collapsed and three had partially collapsed. Moreover, all the 20 reconstructed buildings were damaged, while the fences of five of them had collapsed. Below is an overview of the main damage and the current situation.

The castle main keep (Tenshu)

The castle main keep is composed of two main keeps, a large one and a small one, and was rebuilt in Showa 35 (1960) using reinforced concrete.

Photo 3.7.1.2 The damaged castle main keep

Supported by a deep caisson pile foundation, which extends for 47m underground, the castle main keep escaped collapse, but the dry stone wall underneath was damaged. In particular, the cellar's inner stone wall, which was partially burned in the fire of Meiji 10 and then damaged again and repaired in the earthquake of Meiji 22, fell down and collapsed completely. The outer dry stone wall, which surrounds the large castle keep with its impressive curves and is well known as a "Kiyomasa-style dry stone wall," did not suffer major damage, but the small castle keep's stone wall on the Northern and Eastern sides was badly damaged.

The castle main keep building was not seriously damaged apart from the sixth floor, which is the top floor, and it is being restored with the seismic reinforcement measures that were already under consideration before the earthquakes. As far as the interior is considered, a new exhibition is being planned. As for the dry stone wall foundation, at the large castle keep the restoration work is mainly needed only for the cellar inner wall, but given that the small castle main keep suffered major damage, both the outer stone wall and cellar inner wall are expected to require large-scale reassembling works.

The Sukiyamaru Gate site

This hook-shaped entrance with two bends between Heizaemonmaru and Sukiyamaru castle compounds was used as the usual passageway during the feudal government period.

In the fore-shock earthquake, the stone wall facing the passageway collapsed, while in the main-shock earthquake the extent of this collapsed section widened, and stones fell into and blocked almost filling in the passageway. An inspection of the upper surfaces of the stone rampart on the West side revealed that there was a crack in the earth at its center, starting from which the East-section stone wall had collapsed. On the West side, gaps had appeared immediately behind the masonry and the bottom stone materials of the top surface had sunk into these gaps causing protrusions in the upper part of the stone wall.

Equivalent damage occurred to both sides of this passageway in the earthquake of Meiji 22, after which they had been restored using the technologies of that period, such as reworking the stones as *kenchi-ishi* narrowing them at one end, or omitting the filling material *aizume-ishi* to occlude the voids in between the main stones of the stone wall, and the easier and faster construction method of piling stones *otoshizumi*, which consists of inserting them into the uneven face of the wall, after having roughly beaten and broken them. During these restoration works, mixing earth and sand in the back-filling was

Photo 3.7.1.3 The damaged Sukiyamaru Gate site (from the South)

Photo 3.7.1.4 Emergency measures taken at the Sukiyamaru Gate site (from the West)

Photo 3.7.1.5 The damaged Iidamaru Five-storied turret

Photo 3.7.1.6 The damaged the West Turret Gate site

particularly conspicuous and at the stone rampart on the Heizaemonmaru side, the works were completed leaving the upper part lower of around 1.5m. Through the collecting work of the collapsed stone materials, it was possible to confirm that the lower stones had fallen into the base of the stone wall, and on top of them, the "chestnut stones", small cobblestones used as backfill or to fill small gaps, as well as the upper stones had fallen from above and covered them.

The base of the Iidamaru Five-storied Turret

The current corner turret, added at the end of the Keichō Period to the castle compound corners initially built, but dismantled just before the Satsuma Rebellion, was reconstructed in 2005. The standard *sangizumi* method, an ashlar construction consisting in piling up roughly worked, rectangle shaped stones to create even horizontal rows, was used, but in the earthquake of Meiji 22, the upper part largely collapsed and was restored by the army.

During the recent earthquakes, at the sections in the Southern, Eastern, and Western sides that were restored by the army, during the fore-shock earthquake a 6m x 6m section of the upper part of the Southern side collapsed, and then during the main-shock earthquake, the extent of this collapsed section was further widened, while the Eastern side also largely collapsed. Consequently, six cornerstones of the South-east corner remained in a column-like shape and were in a dangerous condition. However, following emergency works to prevent the collapse, a steel supporting platform has now been installed while the damaged sections are being restored.

The West Turret Gate site

This entrance was located at one corner of the "100 bays *ken* turret" on the line with the West side of the Iidamaru castle compound's stone wall. During the recent earthquakes, both stone ramparts, which form the foundation of this turret gate, collapsed from their bases. Both stone ramparts formed the entrance, and were 3m in height and 5m wide, with a steep around 77 degrees slope in

both the passageway side and the stone wall side. The corners were constructed using the *jubakozumi* multiple-layered box method and the construction stones were roughly broken and piled up using the *nunokuzushizumi* method, ashlar construction at least for one line of joints. Within the collapsed stone ramparts, no mixture of earth and sand was visible and the backfill "chestnut stones" were composed of round gravel, cobblestones uniform in size, more or less as large as softballs. Due to the subsidence of the ground during the earthquakes tremors, the cobblestones of the upper surfaces of the stone ramparts had descended by around 10cm.

The Higashi Juhachiken Turret

This turret serves as the entrance of the East turrets of Tochikunomaru castle compound in the Eastern part of the Honmaru, main castle compound. Constructed on top of a stone wall of a height of 19m, it is a long (a width of 4 bays *ken* in the direction in which transverse beams run and a length of 18 bays *ken* in the direction of the purlins), it is a one-storied turret designated as Important Cultural Property. Both the dry stone wall and the turret itself were built around Keicho 12, and the gradient at the base of the stone wall is around 53 degrees, with the entire stone wall forming a beautiful curve.

It has been ascertained that during the fore-shock earthquake, fine cracks occurred to the surface of the West side of the turret, while in the main-shock earthquake, the East side stone wall, which formed part of the turret's foundation, largely collapsed, and as a result of this, the upper parts of the stone wall on the West and South sides also collapsed. In the Southern half of the turret base, the stone ramparts are entirely filled with cobblestones, circular gravel ranging in size from that of a fist to that of a head; they had been tightly packed in, so that any soil or other substances was hardly added. More than 1,800 construction stones were collected, and here the

Photo 3.7.1.7 The Higashi Juhachiken Turret before the damage

Photo 3.7.1.8 The Higashi Juhachiken Turret after the damage

scale of the collapse was greater than anywhere else. The cracks on the curved surfaces were increased in number and made wider by the main-shock earthquake.

The turret's wooden materials and roof tiles that fell off in the collapse were extensively damaged, but all were collected and after the cleaning work and the work to remove the nails

have been completed, are now being stored in the warehouse that was constructed within the castle grounds in preparation for the rebuilding of the turret.

The Miyauchi stone wall

In this dry stone wall with a height of 9m and length of 16m, located at the Western end of the

Ninomaru castle compound, the protrusion of the lower part had become so conspicuous that in 2003 repair works were carried out, assigning numbers to the stones while temporarily dismantling them, to re-pile them up again. In these recent earthquakes, the damaged parts corresponded almost exactly to those previously repaired, and it was possible to determine the original positions of the collapsed stones.

The stones in the lowermost four levels of the collapsed area fell to lay face down directly beneath the stone wall, and were covered by the backfill cobblestones. Then, on top of these, the upper construction stones fell and spread in a semi-circular shape, but retaining the vertical relationship between them. In other words, this situation suggests that the collapse occurred in an instant, with the lowest part of the collapsed section collapsing first, followed by the backfill cobblestones, which flow out, while the upper part of the stone wall slid off retaining the vertical relationship that existed prior to the collapse, thus fell at once.

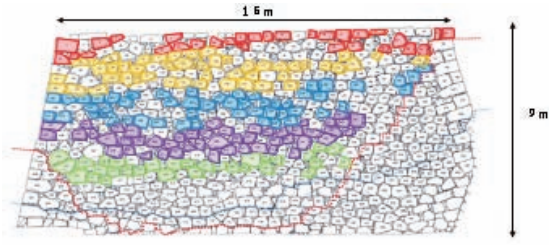


Figure 3.7.1.9 An elevation diagram of the Miyauchi dry stone wall

Figure 3.7.1.10 The collapsed Miyauchi dry stone wall

Summary

The damage to the Kumamoto Castle Site in the 2016 Kumamoto Earthquakes constitutes some of the worst damage inflicted by a natural disaster on a designated Cultural Property in modern times.

It was inevitable that the essential features of the Kumamoto Castle site as Special Historic Site, which are described as "a *Honmaru* main castle compound encircled by a high dry stone wall built using traditional construction methods," would suffer damage due to the tremors of strong earthquakes registering a maximum seismic intensity of 7. Moreover, it has attracted the public attention as a major example of earthquake-related damage where, designated Important Cultural Properties such as turrets and fences that were built on the stone, as well as castle buildings previously restored to maintain the castle as a Historic Site, collapsed or provoked the damage.

Clarifying the effects of the earthquakes on the castle's dry stone walls and the mechanisms causing them to collapse is an urgent issue for the restoration and for taking measures to protect against earthquakes, and this work is progressing with the support of civil engineering–related societies. However, this work is complicated by the fact that each dry stone wall has its own individual characteristics, such as the characteristics of the ground it was built on, its masonry technologies, its history of disaster-related damage and of repair works. Therefore, clarifying the mechanisms will not be easy. Restoration methods adopted will not impair the value of the site as a Cultural Property, but also securing the safety of the site is another big issue to be solved. In addition, there is also the issue of passing down the intangible, traditional masonry techniques that are indispensable to maintain the essential value of the castle's dry stone walls in the future, and also the issue of training the engineers to use these techniques. The damage to the Kumamoto

Castle site has also cast a light on and revealed the existence of a variety of present-day issues relating to Cultural-Property dry stone walls.

3.7.2 Kofun mound tombs

In the 2016 Kumamoto Earthquakes, damage occurred to many *kofun* (mound tombs), including those in Fukuoka and Oita, but mainly in the municipalities in Kumamoto Prefecture near the epicenter and the fault zone. This damage included fissures in the mounds, destruction of the stone chambers, as well as damage to the protection facilities. In the data of Kumamoto Prefecture, there are 41 *kofun*, but this figure includes only those designated as Cultural Properties, and in fact it would increase significantly when including those that have not been designated or those that are designated but whose state of conservation has not yet been fully ascertained.

A distinctive feature of the damage in the recent earthquakes was the damage to the "decorative *kofun*", which are those *kofun* with interiors decorated with line patterns, reliefs, and painting in the stone coffins and stone chambers. Nationwide, around 660 decorative *kofun* have been ascertained, and 30% of these are concentrated in Kumamoto Prefecture. For those painted with pigments, many aspects such as temperature and humidity control, and measures against mold are difficult to handle.

The Idera Kofun in Kashima Town was one of the first nationally designated Historic Sites in 1921. The main section is a "higo-type", a lateral-hole stone chamber made of volcanic-tuff rock. It is a decorative kofun with *chokkomon* (lines and arcs) patterns painted on the *sekisho*, the flat side of the stones facing the interior of the pit. It is located in the Futagawa River fault zone, close to the epicenter of the main-shock earthquake in which seismic intensity of upper 6 was recorded. As a result, many fissures appeared on the mound, and the stone chamber too suffered major damage, such as the stone materials cracking and falling, including the back wall's *sekisho*. However, since the metal door that had been installed at the entrance of the stone chamber could not be opened due to deformation, it was not possible to enter inside, so instead a hole was opened and photos were taken by attaching a camera to a pole and inserting it through the hole. Both the mound and the stone chamber are in danger of collapse and restoration works are expected to be very difficult (photo).

The Eianji Higashi *Kofun* in Tamana City is a decorative kofun with multiple, lateral-hole stone chambers where triangular and circular patterns in red pigment, as well as boats and horses are depicted. It became a nationally designated Historic

Photos 3.7.2.1 The Idera Kofun: Fissure in the mound and damaged stone chamber (courtesy of Kashima Town Board of Education).

Photos 3.7.2.2 The Eianji Higashi Kofun: The damaged mound and stone chamber (courtesy of Tamana City Board of Education).

Site in 1992, and maintenance works were carried out from 1999 to 2005, re-piling up the collapsed sections of all the stone chambers and installing in front of it a protective visitors room. Even though it was comparatively far from the epicenter, seismic intensity of upper 5 was still measured in its vicinity. Regarding its condition, it suffered various kinds of damage, including cracking in the stones in the front chamber section that had been re-piled up and the collapse of surfaces with decorations; moreover, other stone materials had also cracked and fallen, and there had been an inflow of earth and sand. It will be necessary to proceed carefully with the restoration work so as to not damage the painted decorations (photo).

The Tsukahara Kofun Group in Kumamoto City is a memorable site because it was scheduled to be destroyed for the construction of the Cross Kyushu Expressway, but as the result of a movement for its conservation, the construction method was changed and the site was saved. It became a nationally designated Historic Site in 1976, and it is maintained as a *kofun* park that includes also the adjacent land. Within this *kofun* group, the main section of the Ishinomuro Kofun suffered major damage, including the collapse of the side wall of the lateral-opening type stone coffin made of volcanic-tuff rock, and the fall down of the stone ceiling. As the *kofun* is inside a preservation facility, it seems that to restore it the dismantling of this facility will be necessary (photo). Moreover, other *kofun* in the group, such as

Photos 3.7.2.3 The damage in the Ishinomuro Kofun stone chamber and an aerial photo of the Tsukahara Kofun Group (courtesy of Kumamoto City).

Sandanzuka Kofun, Kunugizuka Kofun, and Biwazuka Kofun, suffered damage, including cracks in and collapses of the mounds.

Other than the above, even looking only at those *kofun* that are nationally designated Historic Sites, the damage included the collapse of the restored mound at the Kamao Kofun in Kumamoto City; at Oonoiwaya Kofun in Hikawa Town, the cracking and falling of stone materials into the stone chamber, which is in the largest class, with a ceiling height of 6.5m; and the falling of stone materials at the Obusan Kofun in Yamaga City.

References
The 20th Kyushu Large Keyhole-shaped Kofun Study Group Executive Committee, *The current state of and issues with the kofun damaged in the 2016 Kumamoto earthquakes*, June 17th, 2016.

3.8 Movable Cultural Properties

It is common knowledge that there are Cultural Properties designated as having high value through the Cultural Properties Protection Law, as well as undesignated Cultural Properties. For national and local government designated Cultural Properties, the Administration verifies the damage, and in the case of national and prefectural designations, public subsidies are available for the properties' preservation and restoration. This is not the case for the undesignated properties, however. If a homeowner's residence is damaged, it may suffer water damage and be stained, lose its storage space, and ultimately have to be disposed of. In fact, most movable cultural properties owned by private individuals, such as old documents, are undesignated, and rescuing them has become an urgent task. Why is rescuing these undesignated cultural properties an important issue? Let's consider as an example the old documents owned by private individuals.

An extremely large amount of documents was created in Japan's early-modern history (the Edo Period) and the way they were created reflects the stratified hierarchy of the social structure of that time. In the case of Kumamoto, which was once the territory of a *daimyo* feudal lord, this hierarchy would be roughly understood as follows: ① *daimyo* family documents (historical materials produced by the domain administrative headquarters), ② *daimyo* ministerial documents, ③ retainer family documents ④ *soshoya* (local administration) documents, ④ *sonshoya* (village administration) documents, and ⑤ farmer and townspeople (local residents) family documents.

These early-modern history documents were continuously created and accumulated in the families pertaining to each one of the classes forming the early-modern times' social structure, or at the key sites of the government organizations, which functioned in a multilayered manner. Each group of documents was stored by the organization that created it. In the case of Kumamoto, there are approximately 58,000 of type ① documents, the "Eisei Bunko Hosokawa Family Documents Collection", owned by the Eisei-Bunko Public Interest Incorporated Foundation and Museum ,and entrusted to the Kumamoto University Library. In terms of type ② documents, Kumamoto University Library and Yatsushiro Municipal Museum are responsible for the management of several tens of thousands of documents related to the Matsui Family, the former Kumamoto clan chief *daimyo* minister. Like the Kumamoto documents, other groups of documents related to *daimyo* families in early-modern history are in most cases managed by public institutions. The documents of the Hosokawa family and the Matsui family were managed as rare documents within earthquake-resistant structures, so they escaped damage. However, the majority of the type③ to ⑤ documents are, even today, owned by private individuals, usually the descendants of the

persons who created them, and they are being kept in the homes of these people or in warehouses.

There is a tendency to think that undesignated documents owned by private individuals have little "value," but this is a great mistake. For example, the group of *sonshoya* (village administration) documents from the Kamimashiki District that were rescued at the end of April, immediately after the Kumamoto Earthquakes, was found to contain specific and detailed plans on the development of the wasteland in the village, as well as documents requesting money from the *soshoya* for wages for the workmen who were required for this work. In the Kumamoto clan's territory, a total of more than 50 people were appointed in each region as the *soshoya*, who was the person responsible for the local administration (also called *daishoya* official), and these jurisdictional districts were called *tenaga*. At the *tenaga* and *soshoya* level, policy drafts for agricultural infrastructure, infrastructure maintenance, and disaster rehabilitation were formulated upon receiving a request from a village, and therefore there were frequent submission of documents from the *soshoya* to the upper relevant department of the Kumamoto domain administrative headquarters. Then, these drafts were examined by the domain administrative headquarters and eventually become clan policies to be were implemented at the *tenaga* level.

The main local policies of the Kumamoto clan, which included agricultural infrastructure improvements, the construction of roads and stone bridges, and disaster rehabilitation, were shaped and realized, surprisingly, through a bottom-up type of policy creation system that was premised on the local administrations. The type ③ *soshoya* documents and type ④ *sonshoya* documents include detailed records of an autonomous policy drafting process. In other words, if the contents of the group of documents owned by private individuals is not taken into consideration, it is not possible to correctly understand the type ① *daimyo* clan's policy historical materials and type ② *daimyo* ministerial documents. By paying attention to the relationship between these groups of documents at each level, it becomes possible for the first time to understand the overall situation in the Edo Period society.

Thus, the documents owned by private individuals not only provide testimonies on local histories, but are also related to a major issue for the study of history, namely, that of understanding Japan's early-modern society from its very basis. This is why the activities to rescue cultural properties following the Kumamoto earthquakes targeted also the groups of documents held by private individuals, as well as the fine arts and crafts, tools, weapons and any other item that were kept together with them.

Next is a detailed description of the deployment of the activities to rescue the undesignated movable cultural properties immediately after the earthquakes.

Organized activities are essential for rescuing disaster-affected cultural properties. This is understood from the experience of the Great Hanshin-Awaji Earthquake of 1995, and there was an awareness that should a major disaster also occur in Kumamoto, it would be necessary to establish a system to rescue the cultural properties. However, the plans for this existed only within the minds of the respective researchers and curators, and there had been absolutely no specific preparations for it.

Despite that, on April 23rd, the Kumamoto Disaster Historical Materials Rescue Network (Representative: Tsuguharu Inaba) was formed by staff of Kumamoto's universities and curators of Kumamoto's museums, and began activities to rescue undesignated cultural properties. Afterwards, on July 13th, calling on the support of the Agency for Cultural Affairs and the National Institutes for Cultural Heritage, the Cultural Properties Rescue Project was initiated and its

rescue-measures facility headquarters were located within Kyushu National Museum. Since the launch of the project, the Kumamoto Disaster Historical Materials Rescue Network has been conducting activities within it. From fy2017, Kumamoto Prefecture took over the project and is continuing to carry out the rescue activities.

Because one feature of the Kumamoto Earthquakes was that the large after-shocks continued for a long time, it was not easy to ascertain the damage at the cultural properties, and so, unavoidably, it took around three months from the time of the earthquakes until the rescue activities based on a public framework could begin. The volunteer rescue activities that were carried out by local people during this period are worthy of praise.

As of the end of August 2017, the results of these activities can be summarized as follows: 43 disaster-affected movable cultural properties have been targeted by the rescue activities, of which 38 have already been rescued. The exact number of rescued materials is still unknown, but it is thought to exceed 15,000 items in total, including items such as old documents, fine arts and crafts, weapons and Buddha statues.

4. Emergency response and support system

4.1 The "Cultural Properties Doctors' Dispatch Project"

Objectives of the Project

The Agency for Cultural Affairs is carrying out the "Project to Support the Rehabilitation of Cultural Properties (Architectures) Damaged in the Kumamoto Earthquakes", known as "Cultural Properties Doctors' Dispatch Project". This Project, through a collaboration between the public and private sectors, is meant to provide support to survey the disaster-affected historic buildings, including those undesignated as Cultural Properties, and to provide technical advice for their rehabilitation. The targets of the surveys are historic buildings other than state-designated National Treasures or Important Cultural Properties, while the areas to be surveyed are those in Kumamoto and Oita Prefectures where the damage was particularly heavy and seismic intensity above a certain level was measured.

The "Cultural Properties Doctors' Dispatch Project" was launched following the Great East Japan Earthquake of March 2011. Previously, damage to the cultural properties caused by disasters was reported by the municipality in which the property was located to the Agency for Cultural Affairs via the related prefectural Boards of Education, focusing mainly on nationally designated Cultural Properties. However, the damage caused by the Great East Japan Earthquake was spread over such a wide area and so severe, that it was estimated to be difficult to rapidly ascertain at the administrative level the overall damage to the cultural properties. Therefore, a new scheme was launched to dispatch to the afflicted areas both university researchers of architectural history as well as experts on historic buildings from the private sector to conduct surveys of the damages and actual conditions of the historic buildings. In concrete terms, a public and private sectors cooperation was effectively carried out through the request of cooperation made by the Agency for Cultural Affairs to the relevant architectural organizations, such as the Architectural Institute of Japan, the Japan Institute of Architects, and the Japan Federation of Architects & Building Engineers Associations, so that the members from these organizations could collaborate in conducting systematic surveys to ascertain the damage at an early stage and providing technical support for the properties' rehabilitation.

The set-up of the Project and its framework

Like the Great East Japan Earthquake, the Kumamoto Earthquakes too caused major damage, and therefore the support from the private-sector experts to conduct damage surveys and to provide technical support was estimated to be absolutely necessary . On April 20th, which was the sixth day after the first earthquake, the Agency for Cultural Affairs arranged a meeting with the relevant parties from the above-mentioned groups and requested their cooperation. A Restoration Support Committee was established, composed of members from each of these groups, and the "Kumamoto Earthquakes Cultural Properties Doctors' Dispatch Project " was launched with the Japan Federation of Architects & Building Engineers Associations functioning as the Secretariat (Figure 1). On May 19th, the Agency for Cultural Affairs formulated the project's implementation guidelines and on June 1st, made a consignment agreement with the Japan Federation of Architects & Building Engineers Associations and the project started.

Within the context of this "Cultural Properties Doctors' Dispatch Project", special mention deserves

the active role played by the experts (called "heritage managers" by the Associations) provided and trained by the Architectural Associations in each prefecture in historic buildings survey and in restoration techniques. Particularly in this region, the Kyushu region, the Heritage Managers from the Architectural Associations in each prefecture had a cooperation system to conduct trainings that simulated the rescue of historic buildings at the time of a large-scale disaster. Therefore, the measures already practiced in these simulation trainings could be directly implemented in the aftermath of these Kumamoto earthquakes.

In addition, the targets of the surveys were buildings with historic value, regardless of whether they were officially designated as Cultural Properties or not. In fact, the Architectural Institute of Japan is compiling a database (called the "Historic Architectures General Catalog Database") of the historic buildings in each area, based on the various survey reports, and had also already concluded with the Japan Federation of Architects & Building Engineers Associations and the Japan Institute of Architects an agreement for the joint use of this database, envisaging its effective utilization in the event of a disaster. So, after these recent Kumamoto earthquakes this database has been utilized for the first time.

Overview of the surveys

The surveys are divided into a Primary Survey to acquire an overview of the damage from the property's external appearance, and a Secondary Survey that examines the site in more detail, including the interiors.

First, the "Historic Architectures General Catalog Database" was used to decide the buildings to be surveyed and the survey teams were then allocated to them. In the Primary Surveys, priority was given to properties with an official status, such as nationally registered, prefecture and municipality designated and to Structures of Landscape Importance, while for undesignated buildings, the surveys have been conducted prioritizing those located in a historic district. In the Secondary Surveys, the targets were, among the properties for which a Primary Survey was conducted, those for which the owners and other relevant parties have requested more detailed survey, which were conducted including the drawing of plans necessary to provide technical support. The surveys began in Kumamoto Prefecture on June 25th, and then in Oita Prefecture on September 12th. The surveys in fy2016 continued intermittently until March 2017. As a result, Primary Surveys were conducted at 1,350 sites in Kumamoto Prefecture and 350 sites in Oita Prefecture. When combined with the Secondary Surveys, damage surveys of historic buildings during fy2016 were conducted for around 2,300 sites in total; the report on these surveys has been published.

During the implementation of this project, in February 2017, Kumamoto Prefecture decided to provide restoration support for historic buildings, including undesignated ones, by utilizing the "Disaster-affected Cultural Properties and related Properties Rehabilitation and Restoration Fund". This decision, i.e. making eligible for support from this "Rehabilitation and Restoration Fund" the rehabilitation costs of Registered Cultural Properties as well as of undesignated historic buildings that previously were not eligible for national subsidies, was an epochal one. The support was targeted at the properties for which a Secondary Survey was conducted within the framework of the "Cultural Properties Doctors' Dispatch Project". Moreover, this process has built up the sequence of steps to be followed when the need to restore damaged buildings occurs: striking of the earthquake → damage survey and technical support from the dispatched experts → restoration through the

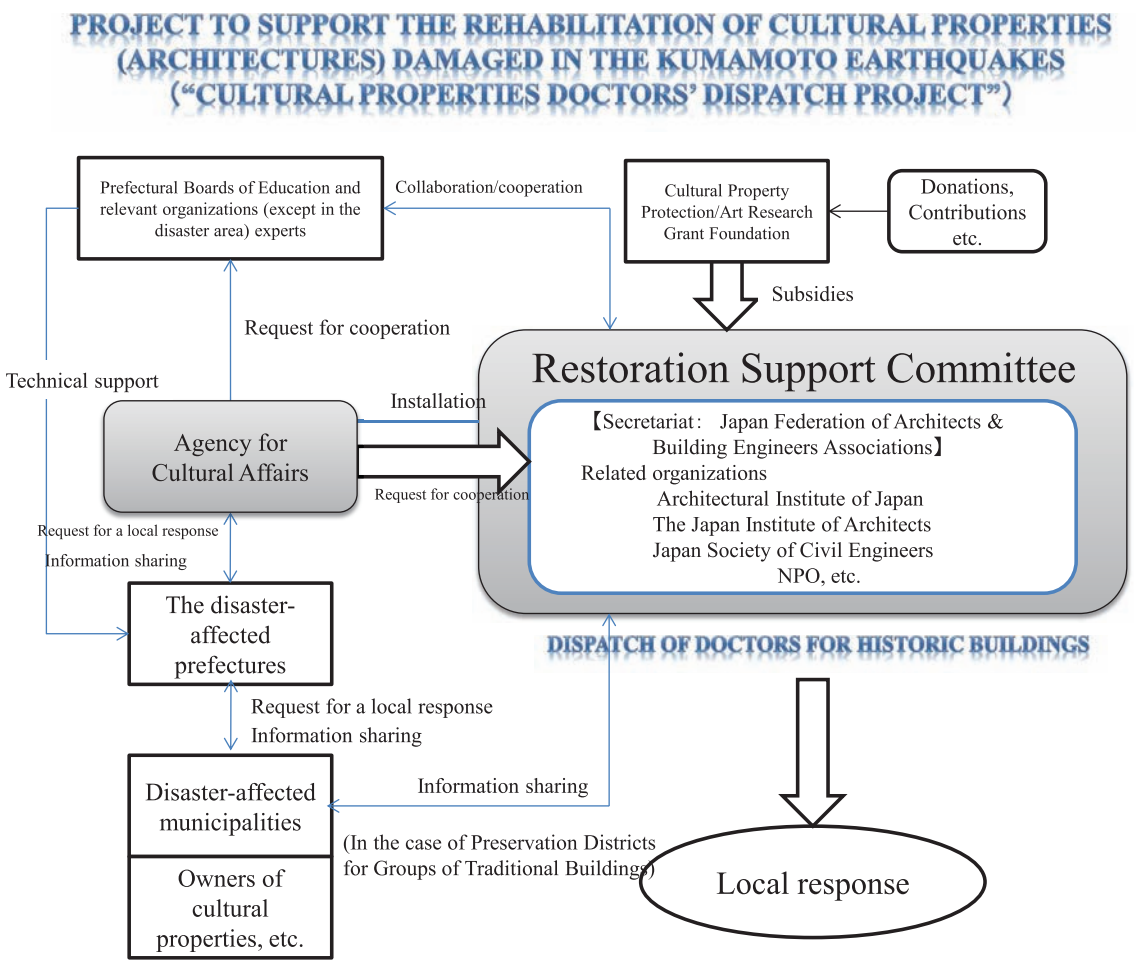


Figure 4.1.1 The project scheme.

"Restoration Fund". From now on, it is expected that this sequence will be widely used as a project scheme to support historic buildings damaged in a disaster.

In fy2017, the "Cultural Properties Doctors' Dispatch Project" continues to be implemented as a consignment project of the Agency for Cultural Affairs. At its center is the provision of technical advice to the owners, including the rehabilitation methods and calculation of the rehabilitation costs. It is hoped that the "Cultural Properties Doctors' Dispatch Project" will result in the rescue of as many as possible damaged historic buildings.

4.2 The Cultural Properties Rescue System

The Project to Promote the Cultural Heritage Disaster Risk Mitigation Network

The Cultural Properties Rescue Project is intended to conserve with urgency disaster-affected movable cultural properties and related properties, and to prevent them from being disposed of, lost, or stolen. It is a rescue project that was initiated after the Great Hanshin-Awaji Earthquake of January 1995, and it is led by the national government (the Agency for Cultural Affairs), which cooperates with various institutions, such as museums and art galleries,

relevant groups, experts, and other related parties, on a wide range of cultural properties.

In the March 2011 Great East Japan Earthquake aftermath too, the Agency for Cultural Affairs initiated the "Project to Rescue Cultural Properties and related Properties damaged by the Great East Japan Earthquake" (known as the "Cultural Properties Rescue Project"), and with the National Institutes for Cultural Heritage serving as the Secretariat, in the two years up to the end of fy2012, it has conducted temporary rescue and emergency measures for many cultural properties regardless of whether or not they are officially designated or registered, and not only for artistic artifacts but also for a wide range of other properties, including artworks, natural history–related materials, official documents and archives, and books.

Because of the Fukushima Daiichi Nuclear Power Plant accident, there were areas into which entry was prohibited, including the at that time Warning Zones within Fukushima Prefecture, and therefore many cultural properties were left as they were without the necessary preservation measures. Consequently, with the National Institutes for Cultural Heritage as the main agency, "The Project to Rescue the Disaster-affected Cultural Properties in Fukushima Prefecture" (the "Fukushima Cultural Properties Rescue Project") was implemented, and support provided within Fukushima Prefecture.

At the National Institutes for Cultural Heritage, on the basis of this experience of rescuing cultural properties and other such activities, it was recognized that, henceforth, one urgent task was to build a system to carry out damage prevention for cultural properties in the event of a major disaster, such as the Nankai megathrust earthquakes and earthquakes centered directly under the capital that are expected to occur in the future, and for rescue activities for cultural properties damaged in such disasters. Therefore, in July 2014 the "Headquarters to Promote the Cultural Heritage Disaster Risk Mitigation Network" was established with the aim of constructing a network with the goal of preventing damage to cultural properties and related properties during times of emergency. At the same time, with the support of the Agency for Cultural Affairs, the "Project to Promote the Cultural Heritage Disaster Risk Mitigation Network" was launched, composed of related organizations and groups, and today it continues to conduct its activities.

Efforts following the Kumamoto Earthquakes

The rescue activities immediately after the Kumamoto Earthquakes, which were a series of earthquakes in April 2016 centered on Kumamoto Prefecture and Oita Prefecture, were conducted independently by the "Kumamoto Disaster Historical Materials Rescue Network," which was established by staff from the universities and curators from the museums within Kumamoto Prefecture, as well as by organizations that included the Kumamoto Prefectural Museum of Art, the Kumamoto City Museum, and the Kumamoto Prefecture Museums Network Center (a facility that supports museums and fine arts museums within Kumamoto Prefecture). For example, in the case of the Kumamoto Prefectural Museum of Art, on April 18th, immediately after the main-shock earthquake, the staff removed from the temples within the city the Buddha statues nationally designated as Important Cultural Properties, and then, on April 27th, removed the works of the artist Fujita Tsuguharu that were being kept at the Elementary School Attached to the Faculty of Education, Kumamoto University.

Following a call from the Agency for Cultural Affairs, the "Cultural Properties Rescue Project" began from July of the same year, and the groups that were already conducting activities joined this project. As with previous cultural properties rescue projects, the sequence of steps to be followed started with the

request from an owner whose property has been damaged, followed by a judgment to decide whether rescue is necessary, and if so, the cultural property was transported to a safe place and emergency measures were conducted, such as removing mold and dust, drying, and fumigation, and the property was temporarily stored until it could be returned to the owner.

As far as the experts required for this work are concerned, requests were made to the museums, research facilities, and other such facilities in Kyushu and Yamaguchi Prefectures. In fy2016, rescues through the "Cultural Properties Rescue Project" were carried out on 28 occasions; around 14,400 materials were rescued, and a total of 996 personnel were dispatched. This project will continue in 2017 and beyond.

In preparation for an earthquake that would strike Kumamoto, by 1998 the Kumamoto Prefecture Board of Education had already surveyed and compiled a list of municipality designated and undesignated cultural properties, with the aim of ascertaining the candidates to future Cultural Properties designation. However, in addition to the extensive damage, the aftershocks occurred over a long period, so it was hard to conduct activities for these properties, and the fact that it took three months from the time the earthquakes occurred until the rescue project got implemented is a point to reflect on. In addition, even though 20 years have elapsed from when above-mentioned survey was conducted, the list was not been updated, and there were cases where the ownership of the cultural properties was not known due to a change of owners, as well as cases where cultural properties that were not on the list were rescued.

Meanwhile, organizations like the "Kumamoto Disaster Historical Materials Rescue Network" and the Kumamoto Prefectural Museum of Art, which began activities immediately after the earthquakes, have been conducting work based on information from the owners of the cultural properties with whom they have been interacting through daily research and exhibition activities. Moreover, in mid-May, the Kumamoto Prefecture Board of Education asked local historians to investigate the locations of and the damage to the 3,000 cultural properties that were on the list. However, it took two weeks until the results of this investigation were known and the Kumamoto Prefecture reflected that, "there is a sense that the administration lagged behind."

Another reason it took so long for the "Cultural Properties Rescue Project" to start was the difficulty in securing the facilities where to provide emergency measures for the cultural properties, as well as places to store them. Because priority was given to the evacuation sites for local residents, it was difficult to find storage places, which is the same problem that occurred after the Great East Japan Earthquake. (Currently, the emergency measures are being conducted at the Museum Network Center [in Uki City], and the properties are being stored in school buildings and other buildings with spare space in Mashiki Town and Yatsushiro City. There is also an exhibit of disaster-affected cultural properties at the Museum Network Center.) Furthermore, because the dismantling of collapsed buildings through Public Funds had not progressed, there were many cases of newly found movable cultural properties that needed to be rescued as the dismantling work progressed, and it has been noted that the rescue project has been prolonged as a result of this. Currently, a cultural properties rescue system has been established on the initiative of Kumamoto Prefecture, and the properties are being stored and treated with a view to designate them as Cultural Properties or to return them to the owners.

There are many decorative kofun (mound tombs) in Kumamoto Prefecture, which feature stone chambers and *endo* passages that have been decorated

with colored pigment, line patterns, and other decorations. In the Kumamoto Earthquakes, many of them suffered damage, including falling, cracking, or collapse of their stone materials. In response to this, the Agency for Cultural Affairs established an Investigation Committee and has conducted a survey of site conditions jointly with the Kumamoto Prefecture and with the cooperation of the relevant municipalities. Currently, a detailed academic survey is being conducted, mainly by the Nara National Research Institute for Cultural Properties, and the repair of these decorative kofun is being planned.

4.3 Support activities by private-sector intermediate support organizations

The Kumamoto Machinami Trust's activities

The Kumamoto Machinami Trust (hereafter, KMT) was founded in 1997 following the successful efforts to preserve the former Dai-ichi Bank building (built in 1919), which was about to be demolished. Since then, the KMT has conducted activities for making known to the general public and preserve Modern Architecture. Moreover, since around 10 years ago, it has conducted surveys of the *machiya* (traditional townhouses) in the Shinmachi-Furumachi District and has engaged in many activities for the reuse and regeneration of the townhouses.

Due to the two strong earthquakes of April 14th and 16th, 2016, the Shinmachi-Furumachi District's townhouses and modern architectures suffered severe damage. The KMT had to face the situation of having to conduct several projects at once close together with the district inhabitants. On April 20th, four days after the earthquakes, the six members met, with pale, anxious faces at the regular April meeting, which had already been scheduled prior to the earthquakes. Writing down on the whiteboard the damage, as far as each of them was aware of, on the historic buildings focusing on Shinmachi-Furumachi, they were overcome by vague thoughts about the need for special activities, which would differ from that implemented during normal times.

As early as the end of April, up to during the consecutive holidays in May, the Japan ICOMOS National Committee survey team conducted surveys of the damaged cultural assets within each region of Kumamoto Prefecture, releasing an emergency appeal statement on May 12th. The KMT, in addition to taking part to the survey of the Shinmachi-Furumachi District, also conducted coordinated activities sharing the concept of "Saving undesignated buildings," which was included within the emergency appeal statement. On the basis of a resolution taken at its General Assembly in June, the KMT rented for three months from July to the end of September, a townhouse café, which wasn't in use anymore because damaged, and opened a field office where core members were permanently stationed, shifting on a daily basis. In this way, the KMT acquired a good reputation among local residents not just for the specific tasks it has been carrying out, including the restoration of the townhouses and consultations on group subsidies, university surveys, and the introduction of volunteer groups, but also for the sense of security it provided to the residents through this permanent stationing of its members within the community. However, at the same time the relevant parties gradually started to become frustrated because the conditions of the damaged buildings had deteriorated even further due to the impact of the typhoons six months after the earthquake disaster and yet there was still no prospect of the establishment of a specific restoration fund.

It was in these challenging circumstances that the "Liaison Committee for Owners and Others related to Disaster-affected Cultural Heritage Sites" was established. Following preparatory meetings,

Photo 4.3.1 A consultation meeting on the damaged buildings and structures, May 2016

Photo 4.3.2 The KMT founding general meeting, March 2017

it held a founding general meeting on November 12th and resolved to appeal to the Administration for a "Support System for Undesignated Cultural Assets." The KMT was responsible for establishing the above-mentioned "Liaison Committee" and has been responsible also as its administrative office since it was established up to the present day. One of the successes of this "Liaison Committee" is the establishment of "Disaster-affected Cultural Properties and related Properties Rehabilitation and Restoration Fund" as a Kumamoto Prefecture system to provide financing from the Cultural Properties Fund. Its implementation started in March 2017, one year after the earthquake. Nevertheless, two important cultural heritage sites that were badly damaged could not bear the excessive burden of uncovered expenses and had to be dismantled, successively, in June and July.

The KMT decided it was necessary to be converted into a corporation in order to be able to handle private-sector funds that would enable it to respond to the emergency situation of a major earthquake and to implement projects to regenerate the townhouses. Therefore, preparation started at the end of 2016 and, following a founding general meeting in March 2017, it acquired certification on May 23rd and became an NPO corporation. Currently (as of September 2017), with the support of the World Monuments Fund (WMF), it is examining how to participate in the projects to regenerate individual townhouses.

"Kumamoto Shinmachi-Furumachi Restoration Project" activities

The "Kumamoto Shinmachi-Furumachi Restoration Project" founding core members are volunteers who distributed boiled rice in a local elementary school that became an evacuation shelter following the fore-shock earthquake on April 14th. Its fundamental approach is that "the motto of the *machizukuri*, the community-based town development, which is 'having pride in the castle-town', is also essential for the town restoration process," and is continuously conducting activities focused on the local community, including independently collecting donations, removing debris, and distributing vinyl sheets. The members are mainly around 40 years of age, and the organization is characterized by its youthful activities, including holding a Reconstruction Aid Concert by Lisa Ono in February 2017 at the townhouses in Furumachi. A second live performance in support of the restoration activities is planned in November 2017. But it is also working on a project to revitalize the area by reusing the damaged townhouses as guesthouses.

Other groups

The Townhouses Study Group, Kumamoto

University, and the Prefectural University of Kumamoto are also working on the community-based urban restoration.

The Shinmachi-Furumachi Townhouses Study Group was established in 2007 as a group that conducts research on townhouses and holds events, such as tours of townhouses and flea markets. As its members are often also members of the above-mentioned Kumamoto Machinami Trust and Shinmachi-Furumachi Restoration Project, its activities tend to be shared with those of these groups.

Kumamoto University is working on town management activities, centered on the activities of the Kumamoto City Center Revitalization Committee for the Sakuramachi-Tori cho District (downtown), which is a role it shares with the Shinmachi-Furumachi District's KMT. The Prefectural University of Kumamoto is conducting fieldwork in the Shinmachi-Furumachi District, including the publication of an information magazine by students and advice from experts on architectural structures.

4.4 Rehabilitation Support System by the administration and other entities

Group Subsidies

"Group Subsidies" is a system to subsidize by the state or prefectural government a maximum of three quarters of the rehabilitation costs of the facilities and equipment of small and medium-sized enterprises affected by earthquakes. It was created following the Great East Japan Earthquake and has also been used for the 2016 Kumamoto Earthquakes. It is an extremely rare example in Japan of a system of state subsidies for private properties. To avail of these subsidies, it is first necessary to form some sort of group, based on, for example, the same industry, the same area, or the same supply chain, and then grounds for the subsidies are required, such as evidence that the rehabilitation of that group will contribute to the creation of a virtuous circle in its local economy. If the group receives certification, it moves to the second stage of the application procedure, for subsidies for individual businesses.

In the Kumamoto Earthquakes, the first public tender for applications took place from June 20th to August 26th, 2016. In the Shinmachi-Furumachi District, three groups applied in the "commercial district" category. The process followed by one of these groups, the "Jokamachi Tachiyoridokoro" (Castle-Town Drop-in Place) group, is described below.

Local merchants took the initiative to apply for support to the Kumamoto Machinami Trust (hereafter KMT), and following the call of a KMT member consultant, the kick-off meeting was held on July 5th at the KMT Restoration Office. The application documents were finalized at the seventh meeting on August 17th, and then, on August 24th a group of 10 companies submitted the application for certification. Following the review of the application, on September 29th the group representative received the certification document from the Governor of Kumamoto Prefecture. However, this certification recognized the group's Restoration Project Plan only, and included the proviso that the details of the rehabilitation and maintenance of the facilities and equipment of each of the businesses, as well as the subsidy amounts, had not been approved yet. Therefore, subsequently the 10 business owners each carried out the application procedure individually, and their subsidy amounts have been determined, sequentially. As of September 2017, five of the businesses have been notified of the decision that their subsidy application has been approved. One application was withdrawn, so the remaining four are currently within the application procedure or the preparation process.

In the "Jokamachi Tachiyoridokoro" group,

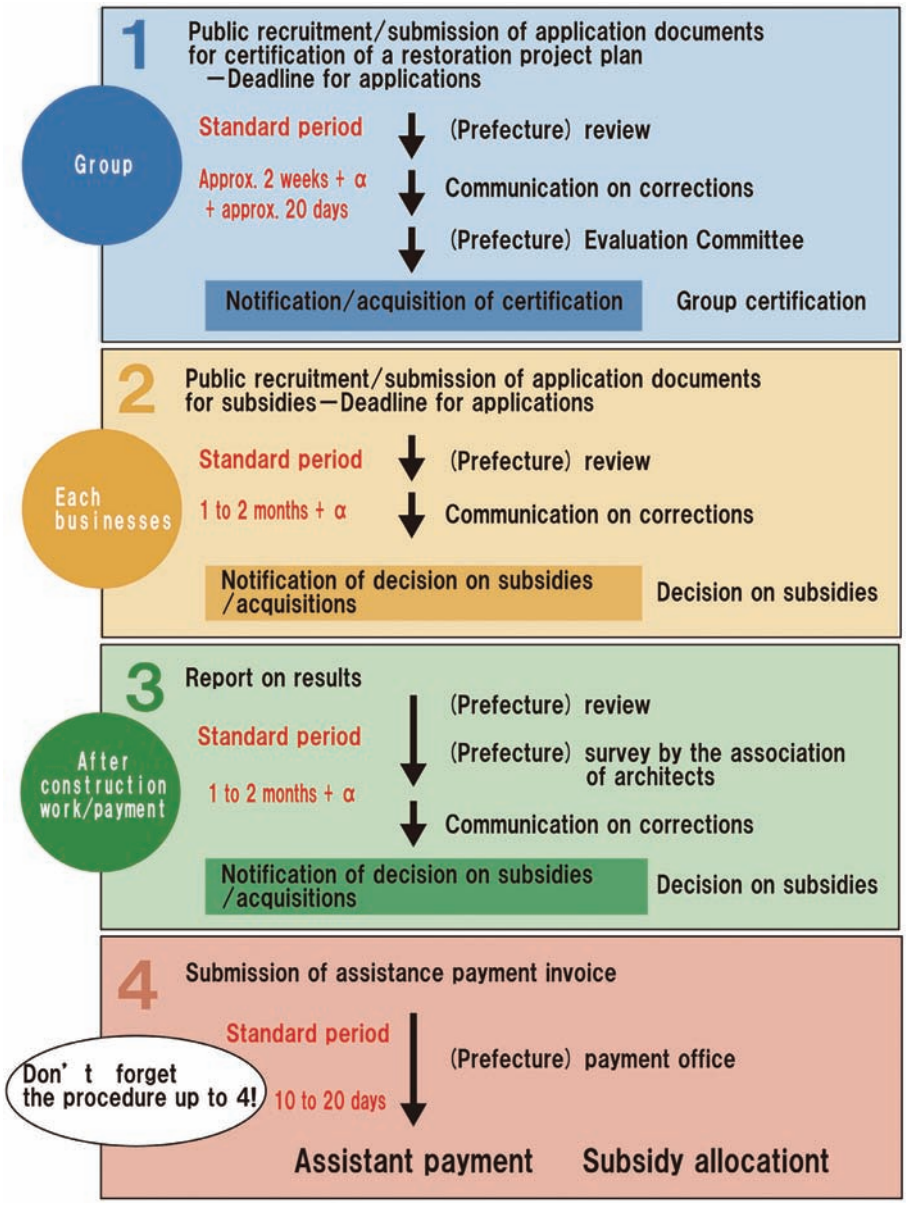


Figure 4.4.1 The "Group Subsidies" application process (from the Kumamoto Prefecture homepage).

no business establishment has completed its rehabilitation works yet and therefore no business has progressed to the subsidies stage so far. However, among the businesses within the Shinmachi-Furumachi District, there is one that has applied as part of another group (not in the "commercial district" category) and which rehabilitation works have progressed to a certain extent to be able to reopen its business in August 2017 (Photo 4.4.2). There are also businesses that are applying for Group Subsidies and conducting rehabilitation works while remaining open for business.

The fourth tender for applications for Group Subsidies began on September 1st, 2017. Subsidy decisions for Kumamoto Prefecture as a whole have been made for 2,685 business establishments, and in total, subsidies of 67.09 billion yen have been determined (from a newspaper report on September 1st).

Photos 4.4.2 The rehabilitation works progress (June 2017) and the reopened store (August 2017).

Subsidies for the Rehabilitation and Restoration of Cultural Properties and related Properties

As explained in Section 4.3, the financial resources for the "Subsidies for the Rehabilitation and Reconstruction of Cultural Properties and related Properties" is the Cultural Properties Fund, which is funded by donations collected from the private sector with the aim of rehabilitating and restoring Kumamoto Castle and Aso-jinja Shrine. Given that this system was designed to assign partial allocations for "undesignated cultural properties," the management of it is passive at the current stage. One approach that is being considered for future universal application is a scheme to rescue undesignated cultural properties that will become Registered Cultural Properties upon being recognized as special cases at the time of a disaster. In order to aim for a more active management, however, it would be preferable to systematize this process, putting it within the district designation system for the conservation and utilization of the historic environment.

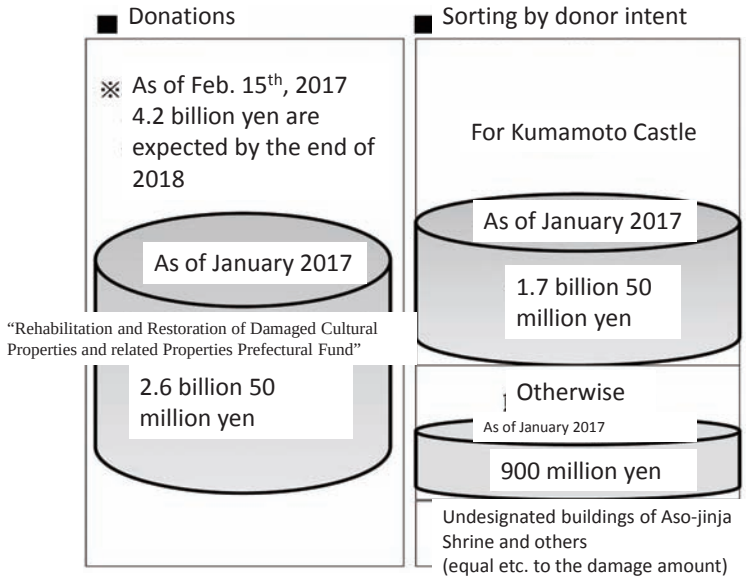


Figure 4.4.3 Activities implemented through the "Subsidies for the Rehabilitation and Restoration of Cultural Properties and related Properties" which damaged in the 2016 Kumamoto Earthquake (Kumamoto Prefecture Cultural Affairs Section).

4.5 World Monuments Fund support

World Monuments Fund support to restoration efforts in the aftermath of the Kumamoto Earthquake

After the 2016 Kumamoto Earthquake, surveys of disaster-affected cultural heritage sites were undertaken during the May holidays following the seismic incident. It was found that damage to the structures of numerous cultural heritage sites was as great as the damage caused by the tsunami of the Great East Japan Earthquake in 2011. Moreover, this damage occurred over a wide area that necessitated cooperation between public and private sectors, as well as international support. Integrated approaches and collaboration would be essential for successful recovery and restoration efforts.

The damage-affected buildings ranged from famous heritage sites to lesser-known sites. For example, the damage to the Kumamoto Castle and Aso-jinja Shrine was widely reported. The damaged main hall of the shrine in the mountains, however, is considered to have been constructed in the late Edo Period and is hardly recognized by people outside of the region. Most importantly, many damaged but less known monuments, which have been preserved and passed down by local people as a familiar and unchanging presence, formed the foundation of their local community.

Disaster recovery for cultural heritage sites ranges from emergency rapid response measures to full restoration. Decisions about what is restored and the extent of reconstruction are driven by the level of protection afforded to certain sites, national legislation about post-disaster needs, and locally-driven interests that can range from economic factors to religious concerns and issues of cultural identity.

In the Kumamoto Earthquake disaster areas, these emergency rapid-response measures were required to prevent unnecessary demolitions and loss. The importance of this initial process to save as many disaster-affected cultural heritage structures as possible is a lesson that was learned in the Great East Japan Earthquake. Historic structures that suffered damage include buildings that may hold high cultural significance but may not be designated as official cultural heritage sites. Understanding the feelings of local stakeholders and property owners is essential for determining how best to support community rebuilding efforts and minimize imprudent demolition. The question of how to respond quickly and determine what is needed is still being asked today, more than a year and half after the disaster.

Disaster Recovery is a Core Component of WMF's Work

A galvanizing moment in WMF's history is its engagement in 1966 in recovery efforts in response to the devastating floods in Venice. The lessons of collaboration, investment in documentation and research, and preventive conservation measures have informed WMF's work. Since 1966, WMF has supported communities all over the world in response to natural disasters from devastation after Hurricane Katrina in the United States to flooding in Ayutthaya, Thailand, the earthquake in Haiti in 2010, and sadly on numerous other occasions including the Great East Japan Earthquake and the 2015 earthquake in Nepal. Just as this article is being written, forceful hurricanes have caused severe damage in the Caribbean and Gulf Coast of the United States and two earthquakes damaged significant areas in Mexico.

WMF's Restoration Support in Kumamoto

Following the on-site field study in May, WMF visited afflicted sites in Kumamoto in early November 2016 with The Freeman Foundation, WMF's philanthropic partner. Visits included Kumamoto Castle Town, or Shinmachi-Furumachi, to understand

Photo 4.5.1 Meeting at the castle town

Photo 4.5.2 Aug. 3, 2017 announcement

the priorities and conservation needs. (Photo 4.5.1)

On August 3, 2017, WMF announced its partnership with the Kumamoto Machinami Trust (KMT) in supporting local community efforts in Kumamoto Castle Town/ Shinmachi-Furumachi, Japan, to restore selected iconic structures damaged by the Kumamoto Earthquake of April 2016. (Photos 4.5.2)

WMF's support, made possible by a generous grant from The Freeman Foundation, will assist the KMT in its restoration efforts to restore the Historic Castle Townscape of Kumamoto/ Shinmachi-Furumachi. The KMT identified five priority historic buildings for this project that are symbolic structures preserving the characters of the castle town. The KMT will also address documentation, community outreach, and preservation efforts in the town. The restoration program supported by WMF will be completed in March 2019. A couple of thoughts behind the program are:

(1) **Cultural heritage with historic and social values are at risk**: About 350 historic buildings essential to the town's historic streetscape sustained damage in the 2016 earthquake. Some were demolished in the aftermath of the disaster, leaving many of the approximately 300 structures that remained at major risk of demolition. Conservation of the townscape is equally to do with the life and culture of the community and residents as it is about preserving the historic buildings.

(2) **Recovering iconic cultural heritage and its historic context**: Kumamoto Castle Town dates back over 400 years to the well-known Kumamoto Castle's construction. In 1877, during

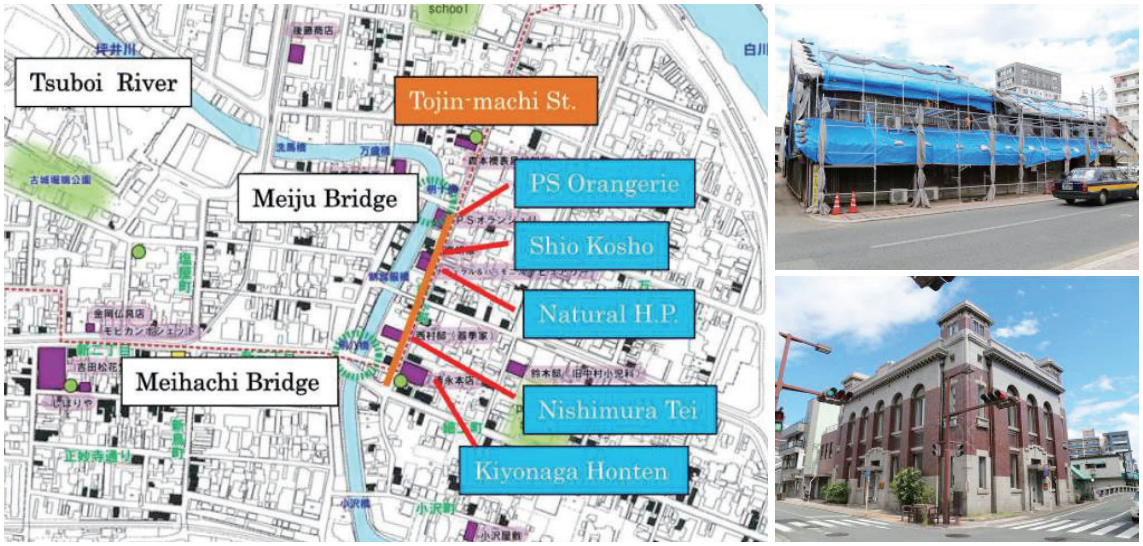


Photo 4.5.3 Five historic buildings including modern architecture in the report

the last civil war in Japan, most of the town's Edo Period structures were destroyed by fire. In the wake of the destruction, the rebuilding efforts at the end of the 19th century led to the inclusion of traditional wooden townhouses called *machiya* and new buildings, which today are part of the essential character of the castle town.

(3) **An anticipated role in saving cultural properties outside of the established framework for conservation and repair - e.g., Registered Cultural Properties and Structures of Landscape, as in the case of Shinmachi-Furumachi**: Losing cultural heritage in disaster recovery because of the lack of an established framework to save them is a frequent global issue. In the case of the Kumamoto Earthquake, there are still many heritage sites at risk of demolition inside and outside Kumamoto, and the call for support needs to be accelerated and must reach a broader audience. It is hoped that the partnership with the KMT will contribute to efforts to document heritage sites and minimize loss due to unnecessary demolition.

Community engagement is essential to ensure the sustainable preservation of cultural heritage. Today, as we witness community activities, starting with local stewardship, in the castle town of Shinmachi-Furumachi, including public and private sectors, we are certain the collaboration with the KMT and other stakeholders toward this shared goal can be a beacon for further action for the benefit of the community.

5 Past support activity and the future prospects

Support activities by Japan ICOMOS for the conservation of cultural properties affected by the Kumamoto Earthquakes

The field survey

The Japan ICOMOS National Committee dispatched a survey team to the local area on May 3rd, 4th, and 5th (and part of May 6th) jointly with the Architectural Institute of Japan and the World Monuments Fund (WMF). After the fore-shock earthquake and the main-shock earthquake of April 14th and 16th, as member of the Japan ICOMOS National Committee the writer (who is from Nishihara Village, Kumamoto Prefecture) entered the site on the following day, contacted the ICOMOS members living in Kumamoto and together ascertained that the historic buildings and related sites had suffered major damage. In fact, in terms of the period when the cultural properties damage survey team should enter the site, on the one hand the survey should start after people living in the disaster area have received full-fledged life support and have been able to catch their breath, but on the other hand if the survey starts too late, it would not be possible to give timely and appropriate advice to the owners of the damaged cultural properties.

For that reason, a joint survey team was formed, including members of Japan ICOMOS and the Architectural Institute of Japan, and the field survey was carried out. The members from Japan ICOMOS and the Architectural Institute of Japan were Vice President Yuga Kariya, Executive Committee members Kanefusa Masuda (ICORP), Toshikazu Hanazato (ISCCARSAH) and Toru Ajisaka (ISC20C), and Secretary Kazuyuki Yano, in addition, ICOMOS members Kyushu University's Kentaro Yamaguchi, Fukuoka University's Mineo Takayama, Kumamoto University's Ryuichi Ito and Juko Ito, and Tokyo City University's Takeshi Sasaki. From the WMF, Mitsuhiko Inagaki and two other persons, as ICOMOS member residing in Kumamoto City Kazuhiro Fujikawa (Director of the Kumamoto Machinami Trust), moreover four experts in cultural properties restoration from the Japan Cultural Heritage Consultancy, and one local architect also cooperated, bringing the total to 19 people.

On May 3rd, the team inspected the Eto family home, an Important Cultural Property in Ozu Town; the settlements of Futada District which is on the Nishihara Village's fault and damage was particularly severe, as well as the undesignated Kataoka family home, located in the same place; the Yano family home (*Hontaku* and *shintaku*), a Registered Tangible Cultural Property in Kadode District; and the undesignated Hachiosha Shrine in Miyayama District. On May 4th, the team inspected Kumamoto Castle in Kumamoto City; PS Orangerie (former Daiichi Bank, Kumamoto Branch), a Registered Tangible Cultural Property in the Shinmachi-Furumachi neighborhood; the Suzuki family home (formerly the Nakamura Pediatrics Hospital), which is a Landscape Important Property of Kumamoto City; and the Honmyo-ji temple Nio-mon Gate, a Registered Tangible Cultural Property. On May 5th, they inspected the prefecture designated The Janes' Residence in Kumamoto City and Yasemegane-bashi Bridge in Mifune Town, Suizen-ji temple Joju-en Japanese gardens, and the Mashiki Town settlement. On May 6th, they inspected the Kumamoto University Goko Memorial Hall and other sites.

Among the inspected sites, at Kumamoto Castle they found major damage, including the collapse of many dry stone walls, turrets and other buildings. That gave the feeling that from now on, it will be necessary to conduct preservation and repair works to ensure the safety of the site and to plan long-term

projects addressing the difficult issue of tourism. It also seemed necessary to establish a system for the repair works that is different from that used up to the present time.

Preservation and repair works of nationally designated properties are likely to be completed even though it takes time. However, in this case there was widespread damage to various properties, including Registered Tangible Cultural Properties and important though undesignated historic properties, and if there is not a mechanism in place to subsidize the repair works in the event of such disasters, it is likely that many important historic properties will end up being dismantled and disposed of. Shinmachi-Furumachi District in Kumamoto City was reduced to scorched earth in the Satsuma Rebellion, but the subsequently restored old townscape has partially survived and there are places that still retain the atmosphere of a castle- town. Nevertheless, emergency condition examination was carried out and red stickers (indicating that they are dangerous) have been attached to many of the townhouses, and it can be said that their survival is in danger. In this sense, even though the castle would remain, the castle-town appears to be at a critical point and on the brink of disappearing.

Publication of the report and emergency appeal

On the basis of the results of the surveys, the Japan ICOMOS field survey team submitted the Kumamoto Earthquakes Disaster Emergency Report (in English) to the ICOMOS headquarters, and information has been disseminated globally. On May 12th, "The emergency appeal for the conservation of cultural properties and other structures damaged in the Kumamoto Earthquakes" (in Japanese and English) was compiled and sent to the relevant organizations. The content of the emergency appeal included "The establishment of a Cultural Heritage Restoration Fund, which would include donations also from the private sector," "The establishment of a system of organic cooperation between the public and private sectors and the promotion of rehabilitation measures within community-based historic town development policies," "The creation of a strategy to promote the registration of undesignated structures nationwide," and the "Promotion of the training and certification of groups of specialists such as heritage managers involved in the registration and preservation of cultural properties." This emergency appeal statement was distributed when the Architectural Institute of Japan's Emergency Report Meeting was held at the Tokyo Institute of Technology. Moreover, the team compiled and published on June 11th *The 2016 Kumamoto Earthquakes Japan ICOMOS National Committee Report—the Damage to the Cultural Properties and their Restoration Prospects*.

On July 30th, at Kumamoto Gakuen University, the "Kumamoto Earthquakes Disaster-affected Historic Buildings Preservation Forum" was held by Japan ICOMOS. The forum was attended by 180 people, including the owners of the historic buildings, government officials responsible for cultural properties and landscapes and related sites, heritage managers, experts in repairs of cultural properties, researchers and students from universities and other institutions, locally elected Diet members, City Council members, members of the general public, and the media. At the forum, Yuga Kariya, the Japan ICOMOS Committee Vice President, provided an overview of the disaster, after which Councilor Hiromichi Murakami of the Hyogo Prefecture Board of Education gave a lecture titled "From the Experience of the Great Hanshin-Awaji Earthquake," and then a presentation was given on the support for historic buildings, including undesignated ones. This was followed by a presentation of Kazuhiro Fujikawa, Kumamoto Machinami Trust Director, on the local actions taken in Shinmachi-Furumachi District after the earthquakes, after which Professor Juko Ito of

Kumamoto University introduced the content of the proposal made at the "Interim Report Meeting" of the Cultural Properties Doctors.

The support movement

In July, "The Committee to Support the Restoration of Kumamoto Castle, Aso-jinja Shrine, and Other Disaster-affected Cultural Properties" was launched and began fund raising to support the disaster-affected cultural properties. This movement led to the calls by Japan ICOMOS to Kumamoto Prefecture, Kumamoto City, and the other relevant local governments for the preservation of their undesignated historic buildings. Meanwhile, supported by the Agency for Cultural Affairs, Cultural Properties Doctors have been conducting primary surveys and their Report Meeting on September 22nd at Kumamoto University was attended by Professor Osamu Goto of Kogakuin University and others. The secondary surveys have been under way since October. The "2016 Kumamoto Earthquakes Disaster-affected Cultural Properties and Related Properties Restoration Fund" was established by Kumamoto Prefecture and possible support mechanisms started to be examined.

On November 2nd and 3rd, executives from the WMF and the Freeman Foundation visited Nishihara Village, Mashiki Town, and Shinmachi-Furumachi District in Kumamoto City, and both groups started looking at the possibilities for support.

In November, the "Liaison Committee for Owners and Others related to Disaster-affected Cultural Heritage Sites" was formed by, among others, the owners of the damaged cultural buildings in Kumamoto City, and it was decided to make requests to the Administration. Concerning the historic buildings that Japan ICOMOS thought should be preserved, it has been providing advice and coordination with the relevant offices to the owners and other concerned parties.

On entering 2017, the dismantling works through Public Funds began, and the situation in which the old dwellings that were damaged and had become vacant are going to disappear was imminent. Therefore, in February 2017, "A request for emergency support for disaster-affected cultural properties" was submitted, among others, to Diet members elected from the Kumamoto area requesting their cooperation for the "Support for the rehabilitation of cultural properties from the Restoration Fund" as well as for the "Establishment of a legislation enabling support for damaged Registered Cultural Properties and other properties in major disaster-designated areas."

On February 9th, 2017, Alex Kerr, a researcher in Oriental culture and a member of ICOMOS, was invited to Kumamoto, and a gathering was held, jointly hosted by the Japan ICOMOS National Committee and the Liaison Committee for Owners and Others related to Disaster-affected Cultural Heritage Sites. It was attended by 70 people, including the properties owners, individuals from the government and universities, and experts in cultural properties. Mr. Kerr delivered a lecture on case studies of reuse of historic buildings and preservation of historic landscapes. After the lecture, there was an active exchange of opinions on the difficult situations the owners are facing and prospects for the future.

On February 15th, the Kumamoto Prefecture Cultural Affairs Section announced that it would utilize the "Disaster-affected Cultural Properties and related Properties Rehabilitation and Restoration Fund" to subsidize up to two thirds of the costs for private-owned undesignated townhouses and samurai residences and related structures (Registered Cultural Properties or those for which there is already consent to become Registered Cultural Properties) , as well as a maximum of 50% for those recognized as having value as historic buildings. At the same time, with the support of the Agency for Cultural Affairs,

the Cultural Properties Doctors conducted the primary surveys, and their Interim Report Meeting, held on September 22nd at Kumamoto University, was attended by Professor Osamu Goto of Kogakuin University and others. The secondary surveys began in October, but it seems that it will take some time for all of the disaster-affected historic buildings to be covered.

The Cultural Properties Restoration Fund aims at supporting 150 cultural properties, but at this point, it is still unclear to what extent the support will spread to buildings other than Kumamoto Castle and Aso-jinja Shrine.

On November 2nd and 3rd, the WMF and the Freeman Foundation inspected various sites, including Kumamoto Prefecture's Nishihara Village, Mashiki Town, and Kumamoto City's Shinmachi-Furumachi District, searching for possible ways to support the townhouses and other properties. In addition, the International Interior Design Association (IIDA) JAPAN donated funds raised from a charity concert to the activities of Japan ICOMOS to support the cultural heritage damaged in the Kumamoto Earthquakes.

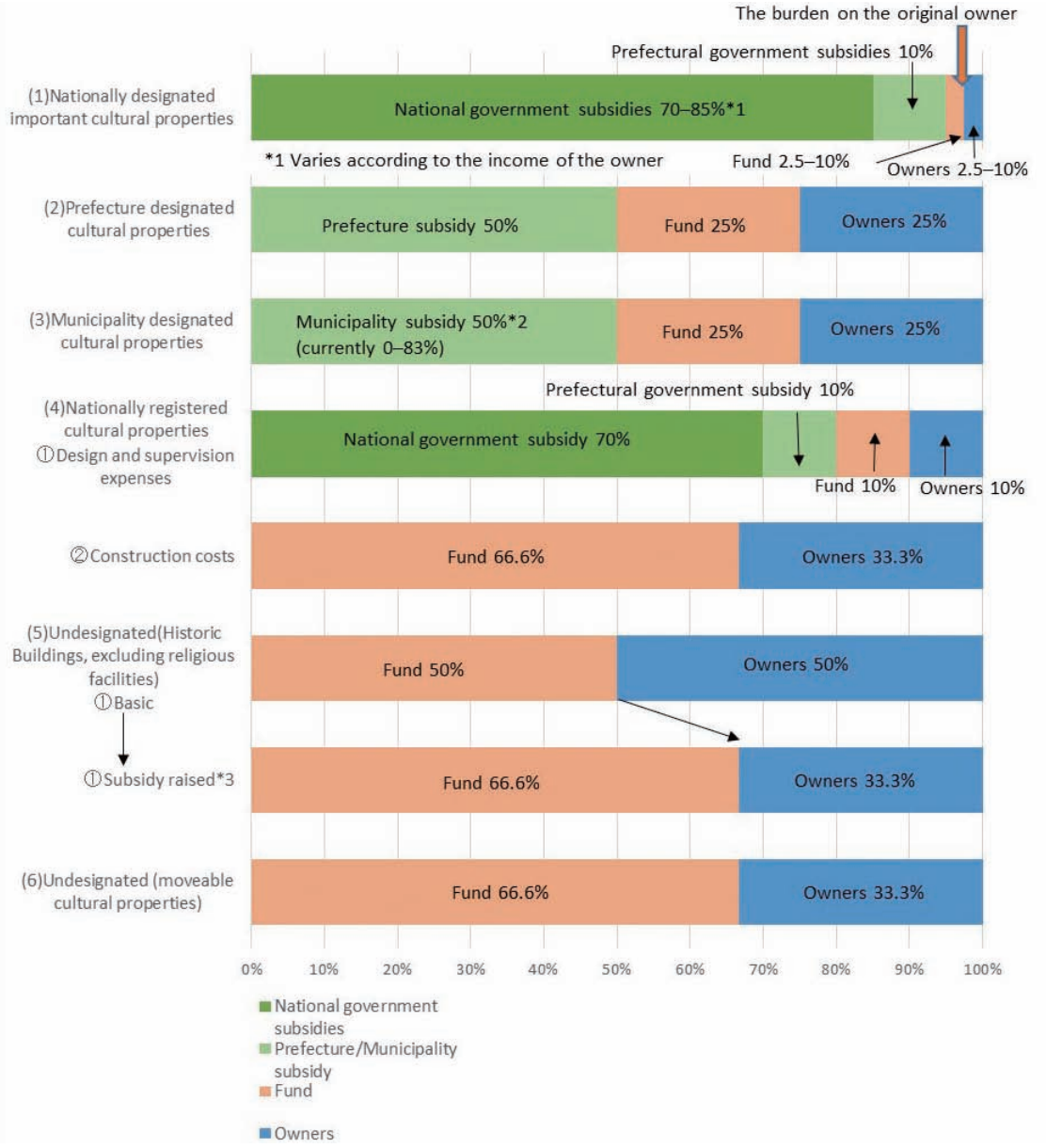
The start of the restoration of cultural properties

In 2017, one year after the Kumamoto Earthquakes, there is the feeling that the situation locally has returned to somewhat normal, however the full-fledged rehabilitation and restoration work will take place from now on.

The restoration works for the cultural properties damaged in the Kumamoto Earthquakes began at nationally designated Important Cultural Properties, such as the Eto Family Residence and the Aso-jinja Shrine, or Special Historic Sites such as Kumamoto Castle. Besides such designated properties, the restoration of Registered Cultural Properties and undesignated cultural properties started quickly through the "Group Subsidies System" administrated by the Small and Medium Enterprises Agency, but regarding the cultural properties, also the "Disaster-affected Cultural Properties and related Properties Rehabilitation and Restoration Fund" has finally begun operating officially. It has been decided that, concerning the design supervision of the Registered Tangible Cultural Properties, when combining the state and prefectural funds, 90%; in the case of Registered Cultural Properties or those for which there is already consent to become Registered Cultural Properties, two thirds; for those properties recognized as having value as historic buildings, one half, support will be provided for the work expenses. In addition, for the shrine buildings in each village, up to a maximum of one half of 20 million yen support will be provided from the Restoration Fund as community facilities.

While it can be said that a measure of success was achieved through the requests from organizations such as Japan ICOMOS, the Architectural Institute of Japan, and the Japan Federation of Architects & Building Engineers Associations, still there are cases where rehabilitation costs are more than 50 million yen and the financial burden placed on the individual owner reaches up to tens of millions of yen. Therefore, in such cases, there are owners who feel they have no choice but to dismantle their building through Public Funds. In fact, within the context of an aging population, having to pay upward of 10 million yen is inevitably a harsh reality for many owners. At the end of May in Kumamoto City, "Morimoto picture framing materials store", which was said to be the machiya townhouse which most retained the original building type features unchanged, and "the Suzuki Residence," a Western-style building, were dismantled with Public Funds. It can be said that the race against time to try to preserve such buildings has started.

Table 5.1 The financial resources for the system to subsidize the recovery of damaged cultural properties (private owners)



*2 Currently, municipality subsidies can also be seen in a system of "No subsidies" and "Subsidy rate of less than 50%" by municipalities, so together with promoting the conversion to a system with a subsidy rate of 50% or more, the plan is to subsidize from the reconstruction fund, which is separate from the amount that corresponds to the actual burden for the municipalities that is not covered by the special allocation tax (municipal subsidies of 20%).

*3 In cases where consent has been obtained from the owners for the property to become a registered tangible cultural property

In (1) to (4), in the event that the municipalities have their own system of subsidies for owners, the burden borne by the owners, excluding this subsidy amount, will be reduced from the fund.

Created on the basis of materials from the Kumamoto Prefecture 3rd Committee to Allocate Funds for the Restoration of Damaged Cultural Properties (August 31, 2017).

This is true also for the restoration of shrines and other such buildings, such as Nishihara Village's "Hachiosha Shrine," which requires 50 million yen for its restoration; it was necessary to consider that the support of 10 million yen from the Restoration Fund might not be that useful to the shrine parishioners. Therefore, if the designation of the shrine as a village designated Cultural Property in order to obtain a different type of support would not be considered, then there would have been no choice but to dismantle the shrine that features excellent Edo Period designs. For this reason, with the cultural property designation as a condition, it was possible to obtain two thirds of the funding from the "2016 Kumamoto Earthquakes Disaster-affected Cultural Properties and other Properties Rehabilitation and Restoration Fund."

What is felt to be important in the current support for the restoration of cultural properties is the significant role to be played by the private-sector platform as an intermediate support structure between the Administration and the owners. Volunteer-based groups are needed that would cooperate with the Administration and provide various forms of advice to the owners. The "Kumamoto Machinami Trust", which for many years has conducted community-centred town development activities in Kumamoto City, has become an NPO corporation, and from now on will provide support for disaster-affected cultural properties. Its Chief Director, Juko Ito, and its Director, Kazuhiro Fujikawa, are both ICOMOS members and it is providing painstaking support for the preservation of historic buildings that must be preserved at the present time, with the goal of achieving national designations in the future, or to preserve the historic urbanscape, or for sightseeing.

Photo 5.2 The Morimoto Store before the disaster

It is plausible to think that while owners temporarily take on the burden of preservation costs, as they grow old, they choose the option of dismantling through Public Funds because they do not want to put this burden on the next generation. Going forward, it will be necessary to conduct activities to prevent such dismantling by actively aiming for a preservation with a wider vision to reuse the buildings in various ways, such as for accommodation facilities and restaurants.

On August 3rd, Kumamoto City WMF decided on its Kumamoto Earthquake Support, and the letter notifying this was sent from WMF Japan Office Representative Inagaki to Juko Ito, the Chief Director of the "Kumamoto Machinami Trust," the NPO corporation that will be the recipient of this support.

In addition, the Nippon Foundation decided to fund the activities of Japan ICOMOS to support the restoration of cultural properties damaged in the Kumamoto Earthquakes (8.15 million yen) and various activities are planned, including technical support for repairs with a high degree of technical difficulty, cooperation to register and designate unregistered and undesignated properties, cooperation for local government designated cultural properties, holding of symposia, cooperation for the Kumamoto City planning of a community-based historic city development, and the publication of an English-language report on the Kumamoto Earthquakes (scheduled to be distributed at the

December ICOMOS General meeting).

On September 24th, a symposium hosted by Japan ICOMOS and co-hosted by Kumamoto City, with the support of the Agency for Cultural Affairs and the Ministry of Land, Infrastructure, Transport and Tourism and others, titled "A community-based town development valuing history—the rehabilitation after the Kumamoto Earthquakes" was held, and it was decided to proceed with the support for the rehabilitation and restoration of the disaster-affected cultural properties within the "Maintenance and Improvement of Historic Scenery Act", which is a joint legislation of the Agency for Cultural Affairs; the Ministry of Land, Infrastructure, Transport and Tourism; and the Ministry of Agriculture, Forestry and Fisheries. The attendees of this symposium included University of Tokyo Professor Yukio Nishimura (Japan ICOMOS President), Professor Osamu Goto of Kogakuin University (ICOMOS member), and Professor Toshiaki Funabiki of Miyagi University (ICOMOS member), while a lecture was given by the Mayor of Kumamoto City Kazufumi Onishi, and Kazuyuki Yano (Japan ICOMOS Secretary) served as the moderator.

Prospects for the future

Going forward, there is the need to build a system (including creating funds and building an organic, collaborative system between the public and private sectors) that could work in times of emergency such as a disasters to rescue those historic buildings that can be preserved. In addition, it is expected that conducting long-term restoration support helps to maintain the dignity of urban and regional areas and leads to regional revitalization through cultural tourism. In the case of the recent Kumamoto Earthquakes, it would seem necessary to act taking this as an opportunity to practice Build Back Better (BBB) based on history and culture.

Collaborations are planned between the Agency for Cultural Affairs and the Ministry of Land, Infrastructure, Transport and Tourism; to be further joined by Kumamoto City; Kumamoto Prefecture; each municipality; and also the Japan Federation of Architects & Building Engineers Associations, which is responsible for the "Cultural Properties Doctors' Dispatch Project"; the Architectural Institute of Japan; and other organizations.

Photos 5.3 Symposium

INTERNATIONAL COUNCIL ON MONUMENTS AND SITES
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28 April 2016

A flash report on the Kumamoto Earthquakes

The series of massive earthquakes started rattling wide parts of Kumamoto and Oita Prefectures on 14 April 2016 and have killed 49 people, wounded about 1,100 people, and left 1 person unaccounted for, as of 26 April. As for damages to residential buildings, 1,553 of them have reportedly been destroyed, 1,460 buildings are half-destroyed and, 2457 buildings are partially damaged. Some 5,000 other buildings are damaged, but its extent is unknown yet. Aftershocks are still continuing to strike to this day and many people are still spending their days and nights in temporary shelters. I would like to express my sincere gratitude to many of the ICOMOS colleagues who have kindly extended us messages of sympathy.

The 2016 Kumamoto Earthquakes were caused by two plates slipping against each other along with Futagawa Fault and Hinagu Fault which run across the central part of the island of Kyushu. The events have taken place at spots inland as shallow as 10km underground. They are typical epicentral earthquakes. The main tremor recorded magnitude-7.3, causing a huge shake with maximum JMA (Japan Meteorological Agency) Seismic Intensity 7. There have been more than 1000 aftershocks as of 28 April, including one triggering another Seismic Intensity 7, and five with Seismic Intensity 6.

As far as material damage to cultural heritage in Kumamoto Prefecture is concerned, 107 items of cultural properties - among which 46 are nationally designated and 59 are locally designated – are affected, along with a number of old houses. The numbers are believed to increase, as the whole picture of the after-earthquake situation becomes clear.

Among the damaged cultural properties, Kumamoto Castle, which is one of the most well-known castles from the early modern period, has suffered a significant damage; sections of its stonewalls have crumbled and some constructions such as *yagura* keep collapsed. Other severely damaged cultural heritage include a gate of Aso Shrine, an Important Cultural Property, and the municipally-designated cultural property Janes Residence (former teacher's residence of Kumamoto Yogakko school), which was the first Western-style building constructed in Kumamoto in 1871. Moreover, other Important Cultural Properties such as the Eto Residence, as well as many nationally-registered tangible cultural properties including the Yano Residences, where my family owns and I used to live as a child, are suffering serious damages.

Meanwhile, a historical Japanese garden called Suizenji Jojuen, nationally-designated as a place of Scenic Beauty, is famous for its designed ponds with abundant spring water; however the water has stopped coming out since the shocks.

Japan ICOMOS is sending a team of experts from 3 to 5 May to conduct a survey of the damages, which will be reported to the ICOMOS International in due course.

Secretary-General, Japan ICOMOS
Kazuyuki Yano


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