

Disaster prevention of historic buildings and townscapes

— Consideration of earthquake resistance measures in particular —

My profile

KARIYA Yuga, 苅谷勇雅 : Professor Emeritus of Oyama National College of Technology, Doctor of Engineering, Registered architect.

- Born in 1948, Graduated from Kyoto University, Department of Architecture, and completed the doctoral course of its Graduate School.
- After having worked for Kyoto City Government as a conservation architect and city planner from 1976, he has been involved in the preservation of cultural property buildings as a Chief Senior Specialist in the Building Division of the Agency for Cultural Affairs in Japanese Government since 1995, and has served as Director of the Building Division, and Councilor of Cultural Properties in the Agency since 2003.
- In 2009, he was appointed President of Oyama National College of Technology, from which he retired in 2014. Currently, he serves as a member and chairman of several municipalities' historical town planning councils and councils for the preservation of groups of traditional buildings. He is also a part-time lecturer at Mukogawa Women's University Graduate School.
- Books: Kyoto- Modernization of the Old Capital and Conservation of its Urban Landscape, Japanese Townscape of Historic Cities and Villages” I , II ,(joint works), and others.

Disaster prevention of historic buildings and townscapes

— Consideration of earthquake resistance measures in particular —

KARIYA Yuga

Although natural disasters such as earthquakes are not necessarily frequent in Cairo, the historical center of the city has a dense and narrow urban structure.

Many historical buildings with fragile structures such as stone and brick structures are distributed there.

In order to protect the lives and property of citizens, preserve cultural properties, and revitalize the area in this historical city center, it is necessary to pay sufficient attention to disaster prevention, especially earthquake countermeasures.

In this occasion, I would like to introduce examples of earthquake damages to historic buildings in Japan.

Then I would like to explain Japan's experience in implementing rehabilitation projects for damaged historic buildings.

I would also like to show the examples of various earthquake-resistant measures in advance, as well as the progress of the preservation system in tandem with these efforts.

Disaster prevention of historic buildings and townscapes

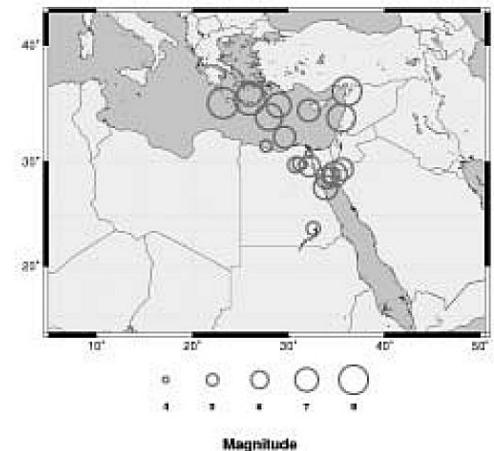
- In order to protect the lives, livelihoods, and properties of the people of Cairo and to revitalize the historical areas, it will be necessary to repair and improve many historical and other existing buildings, but in the process, it is also important to improve their disaster resistance.
- Unlike Japan, earthquakes and other disasters are not so frequent in Egypt. However, it is essentially important to promote awareness and preparedness for disasters in the city context where historic stone and brick buildings, RC buildings whose strength has not necessarily been confirmed, and unauthorized additions to existing buildings are densely built along narrow streets.
- Here, I would like to provide information on the status of disaster prevention, especially earthquake resistance measures, for historical buildings in Japan.

Earthquakes in Cairo and Japanese Cooperation

- ◇ Oct. 18, 1754, Great earthquake in Cairo, estimated to be M.6.6.
About 2/3 of the buildings in Cairo collapsed. At least 40,000 people died.
- ◇ 1900s Several earthquakes of M5.8 to M6.8 occurred around Cairo
- ◇ October 12, 1992, Earthquake in southwest Cairo -Estimated magnitude 5.9; 541 deaths and more than 100,000 affected; 8,000 houses damaged.
The earthquake was the first major earthquake to hit Cairo in 140 years.
→ Since people are not used to earthquakes, a sort of panic ensued, leading to more deaths.
- ◇ Oct. 19, 2021, Earthquake around Cairo.

Although seismic activities in Egypt may not be so active, even a small earthquake could cause extensive damage because of the fragile urban infrastructure and buildings.

Since 1960, the Research Institute of the Japanese Ministry of Construction has accepted trainees from Egypt for seismic research, and since 1987, through JICA, Japan has been cooperating in the development of seismology in Egypt. This includes the establishment of a permanent seismic observation network and the training of experts.



図一 1 エジプトにおける被害地震の分布図。紀元前2200年から2005年まで

Distribution of Damaged Earthquakes in Egypt. From 2200 BC to 2005.

Major Natural Disasters in Japan in Recent Years (1995-2022)

1. Major Earthquakes

(1) January 1995 Great Hanshin-Awaji Earthquake

M7.3, maximum tremor 6, 6,434 deaths, 640,000 houses damaged, 116 Important Cultural properties and 1 Important Preservation District of Traditional buildings were damaged.

(2) March 2011 Great East Japan Earthquake

M9.0, maximum tremor 7, 15,899 deaths, 2,529 unknown, 297,800 houses damaged, Huge Tsunami and Atomic Power Plant accidents, 143 Important Cultural Properties, 6 Important Preservation Districts of Traditional Buildings, and 438 Registered Cultural properties were damaged.

(3) April 2016 Kumamoto earthquake

M7.3, maximum tremor 7, 273 deaths, 43,300 houses damaged, 39 Important Cultural Properties, 3 Important Preservation Districts of Traditional Buildings, and 74 Registered Cultural Properties were damaged.

(4) February 2021 and March 2022 Fukushima-Oki earthquakes

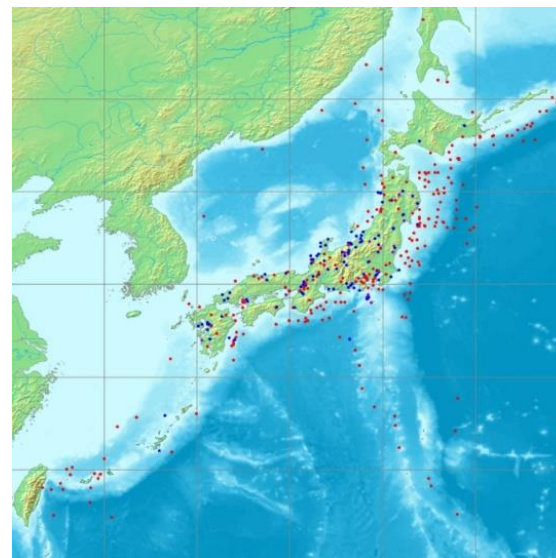
M7.3 maximum tremor 6 weak, 3 deaths, 20,000 houses damaged and M.7.4, maximum tremor 6, 3 deaths, 50,000 houses damaged.

2. Other Natural Disasters

Frequent Big Typhoons/Heavy rains/Land slides/
Volcanic eruptions and others.

Epicenters of major earthquakes in Japan in the past.

Red: M7 or higher, Blue: fatalities, Purple: maximum intensity 6 or higher.



Damage to Important Preservation Districts for Groups of Traditional Buildings by the Great East Japan Earthquake

Kakunodate (Akita Pref.)



Kanegasaki (Iwate pref.)



Oouchi (Fukushima Pref.)



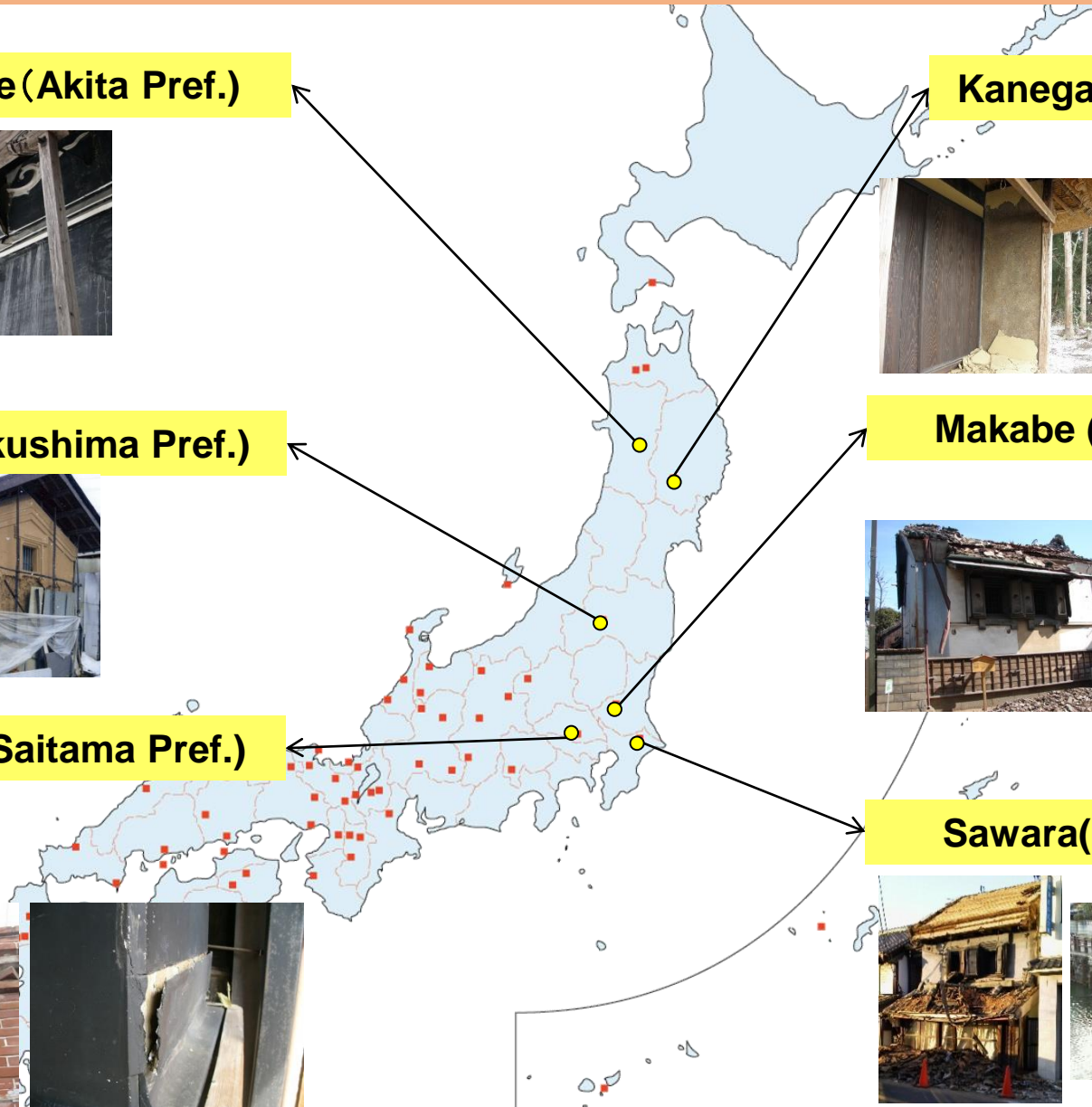
Makabe (Ibaraki Pref.)



Kawagoe (Saitama Pref.)



Sawara (Chiba Pref.)

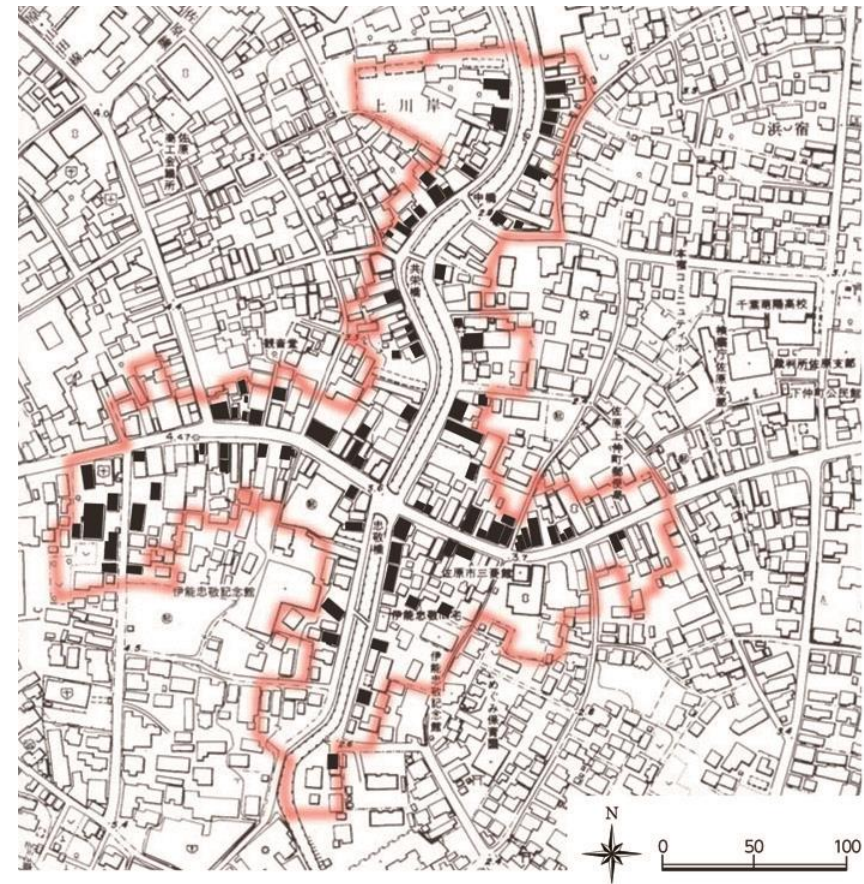


Damage to Important Preservation Districts for Groups of Traditional Buildings by the Great East Japan Earthquake

Sawara District (Chiba pref.)

2011/3/11

Immediately after the Tohoku Great Earthquake



- Red line: Extent of the Preservation District.
- Black: traditional buildings

Damage to Important Preservation Districts for Groups of Traditional Buildings by the Great East Japan Earthquake

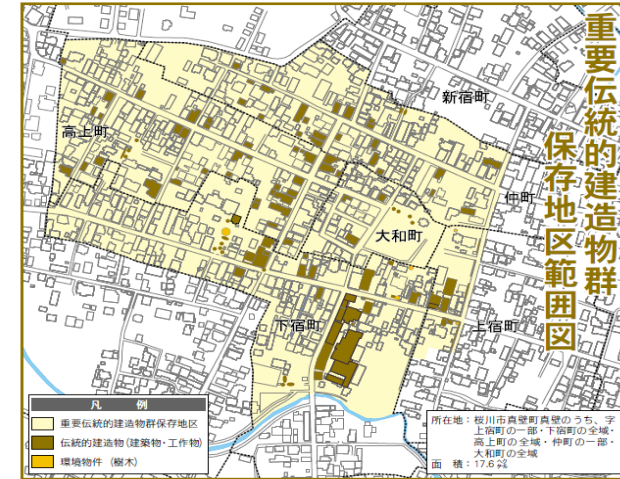
Sawara District (Chiba pref.) —present condition



Damage to Important Preservation Districts for Groups of Traditional Buildings by the Great East Japan Earthquake

Makabe District (Ibaraki pref.)

特定建築物の被害分布



- Extent of the Preservation District.
- traditional buildings



Distribution of the damaged traditional buildings

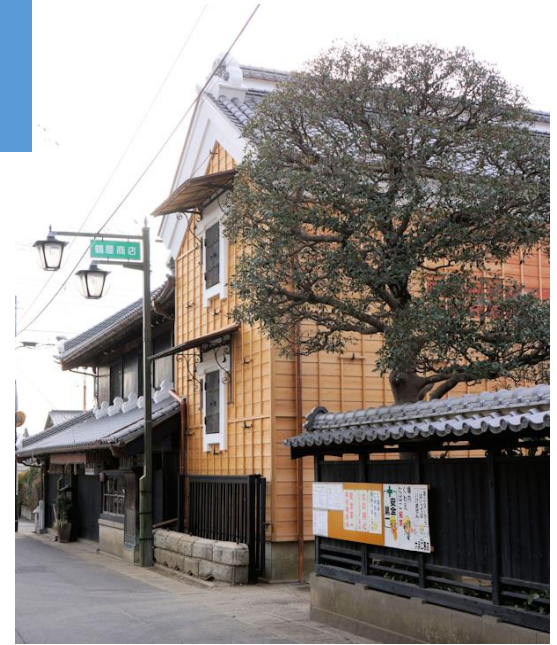
Damage to Important Preservation Districts for Groups of Traditional Buildings by the Great East Japan Earthquake

Makabe District (Ibaraki pref.)



Damage to Important Preservation Districts for Groups of Traditional Buildings by the Great East Japan Earthquake

Makabe District (Ibaraki pref.) → Recovery from the earthquake



Damage to Important Preservation Districts for Groups of Traditional Buildings by the Great East Japan Earthquake

Makabe District (Ibaraki pref.) → Recovery from the earthquake

Difference of Subsidy rates from the city government for the projects between Normal repairment and Earthquake recovery in the Makabe preservation district

For the projects of traditional buildings

○ Normal repairment project

Up to 8 million yen per case within 80% of the project cost
(around 1,150,000 EGP)

● Earthquake recovery project

No upper limit within 90% of recovery cost

+ 75% of personal expense is subsidized by the prefecture.

→ (2.5% of personal expenses in real terms)

Damages of Kumamoto Earthquake, April 2016

Kumamoto old castle site



A watch tower-not so much damaged (original, 1601)

Collapsed castle tower (reconstruction, 1960)



Collapsed castle stone wall



Collapse of an old residence (Eto family house), built in 1830



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)



Damages of Kumamoto Earthquake, April 2016



Map of Japan

Left : before, Right : after

The Kumamoto Earthquake
Japan ICOMOS Report 2017 p.12

Damages of Historic Area in Kumamoto City

Damaged town houses



Former bank building, 1919



16



Stone bridge, 1875

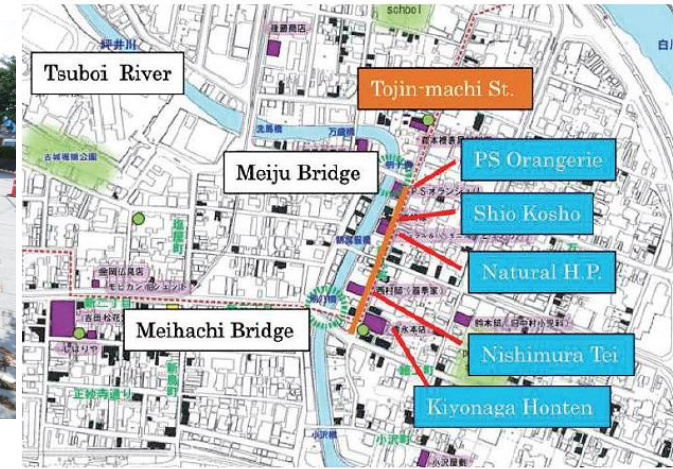
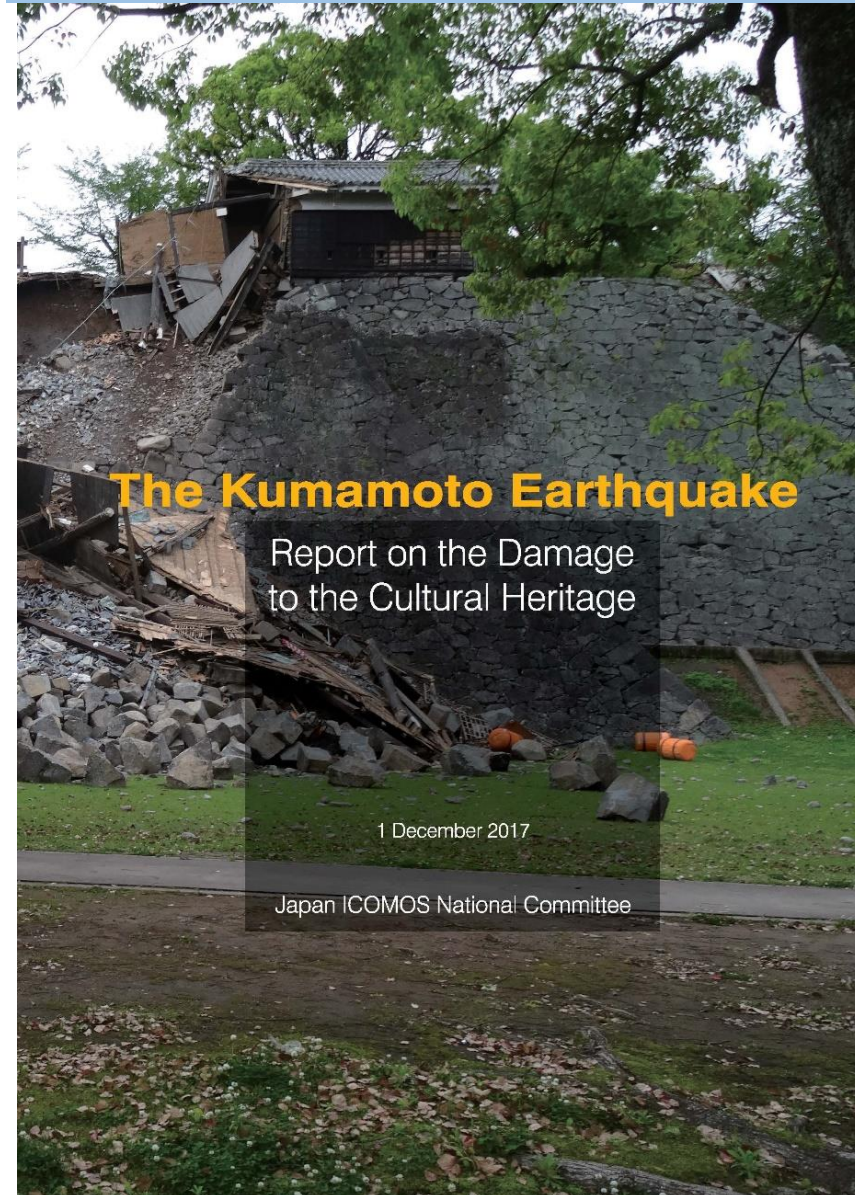


Photo 4.5.3 Five historic buildings including modern architecture in the report

An Urgent Appeal for Protection of the
Cultural Properties damaged by
the Kumamoto Earthquakes
ICOMOS Japan , 12 May 2016

1. Creating cultural heritage rehabilitation funds comprising donations from private funds.
2. Constructing an organic public-private cooperation system.
3. Promoting rehabilitation measures in the framework of historic 3 community renovation policies.
4. Building nation-wide strategies for promoting registration of historic buildings.
5. Promoting training of technical experts, and their certification, so that they can engage in cultural property registration and preservation as part-time conservation architects.

The Kumamoto Earthquake
ICOMOS Japan Report 2017



2016年熊本地震 日本イコモス報告書

文化財の被害状況と復旧・復興への提言

The 2016 Kumamoto Earthquake

Report on Damages to the cultural properties
and

Recommendation for their restoration and rehabilitation



Symposium aimed at Recovery from the earthquake organized by Icomos Japan in Kumamoto City, Sep. 2017



Restoration support for historic buildings damaged by the Kumamoto earthquake

Type of assistance Program	Outline	国指定		地方指定	国登録		未指定				
		熊本 城 他	その他		(設計)	(工事)	全般	店舗 (居住部 分除く)	新町・ 古町・ 川尻 地区	社寺 集会場 等	
Government Subsidy	建造物保存修理事業、史跡等総合活用整備事業、重要文化財等防災施設整備事業	○	○			○					
Municipal Subsidy	県文化財保存整備費補助金、市町村補助	○	○	○		○					
Kumamoto Cultural Property Restoration Assistance Fund	民間からの寄附金を財源とする熊本文化財復興支援金の内、用途を限定して寄附されたもの	○									
Subsidy for Restoration and Reconstruction of Cultural Properties Affected by the Kumamoto Earthquake	文化財基金＋復興基金を財源			○	○	○	○				
Subsidy for restoration and improvement of group facilities for small and medium-sized enterprises in Kumamoto Prefecture (group subsidy)	中小企業の施設・設備の復旧支援。グループを組み、そのグループの復旧が地域経済の好循環に資する根拠が求められる。							○			
Kumamoto City Townscape Restoration and Preservation Support Project	新町・古町地区、川尻地区において、熊本地震により被災した町屋などの伝統的様式建造物(昭和25年以前に伝統工法で建てられた木造の建造物)の復旧に要する費用を補助(補助率:対象工事に要した額の1/2、補助金限度額:上限1500万円)									○	
Project to support reconstruction of local community facilities, etc.	被災した地域・集落における地域コミュニティの場として長年利用されてきた施設等の再建を支援(補助率:1/2、補助上限:1000万円)コミュニティで維持管理しているものが対象で、法人施設は対象外。										○
Private Fund								○	○	○	
Disaster Victim Life Reconstruction Support Grant		一般住宅も含めて全ての住宅に適用(112.5~200万円)									
Emergency repair system for damaged houses	仮設住宅を使用しない世帯が対象。	一般住宅も含めて全ての住宅に適用(57.6万円)									

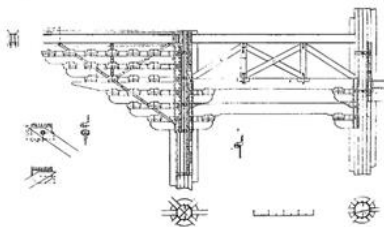
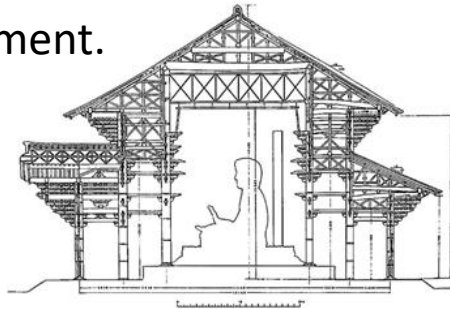
Examples of structural reinforcement of cultural property buildings

Todaiji Great Buddha Hall, 1709, National Treasure

The latter half of 19 c.



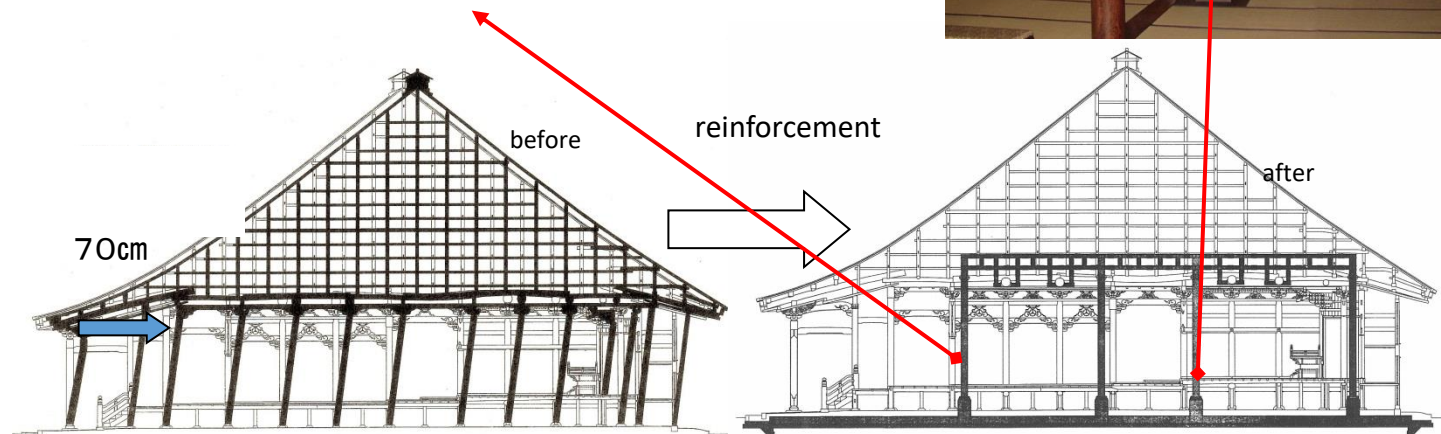
Cross section of after repairs, 1903-1913.
Steel frame and wooden trusses for structural reinforcement.



Examples of structural reinforcement of cultural property buildings

Main hall of Joko-ji temple, latter half of 17 c, Important cultural heritage

Seismic reinforcement with an additional steel frame



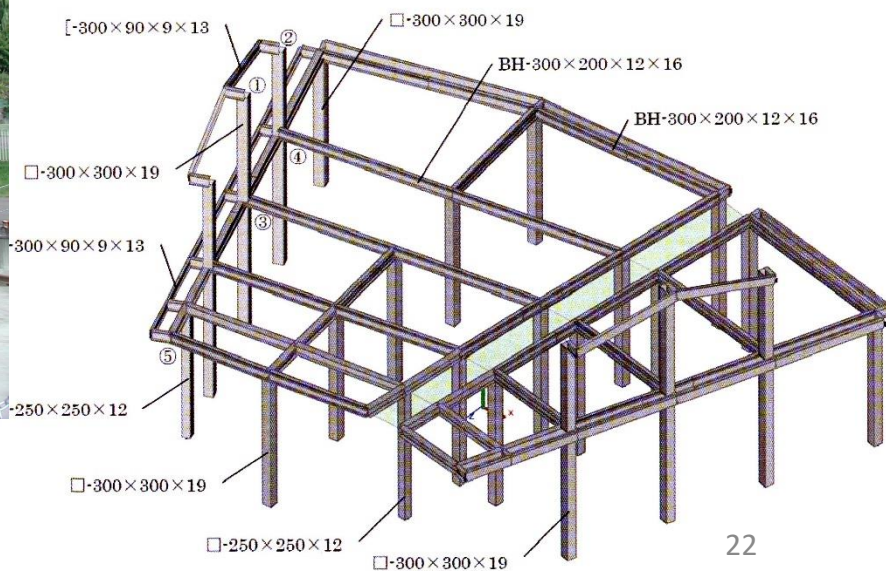
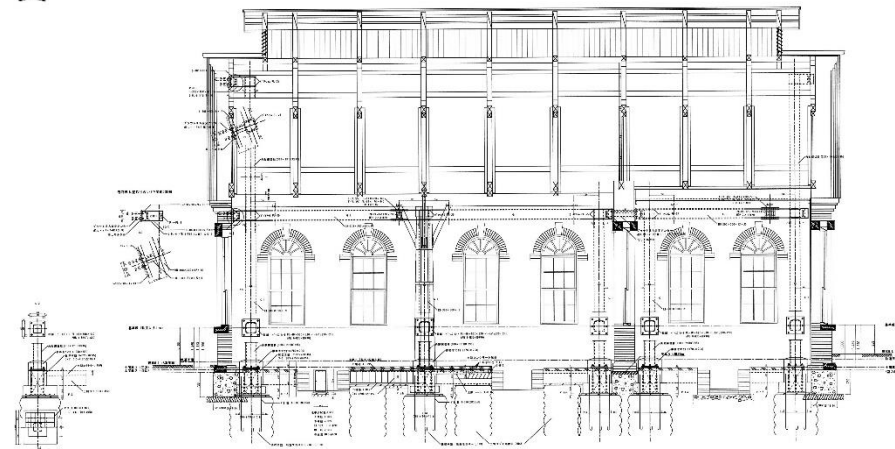
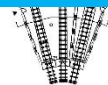
Before reinforcement, the building may deform 70 cm in a medium earthquake.

Steel framework supports cultural properties during earthquakes to reduce deformation.

Examples of structural reinforcement of cultural property buildings

A locomotive Depot. 1885, Temiya, Otaru city, Important cultural heritage

Seismic Reinforcement with Steel Structure



Examples of structural reinforcement of cultural property buildings

Railroad facilities - substation, storage battery room
(Usui Pass, Gunma Pref.), 1911 Important cultural heritage



Foundation reinforcement,
steel reinforced beams and columns



Reinforced brick gable wall with
vertically inserted rebar

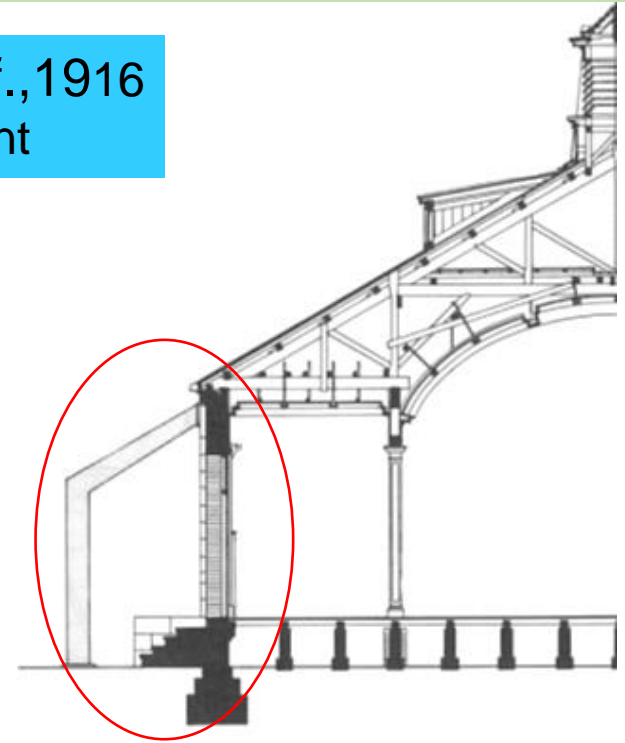


Examples of structural reinforcement of cultural property buildings

Old prefectural assembly hall in Yamagata Pref., 1916 Repair, Restoration, and Seismic Reinforcement



before



after

Exterior buttresses added to restore beautiful interiors and provide seismic reinforcement

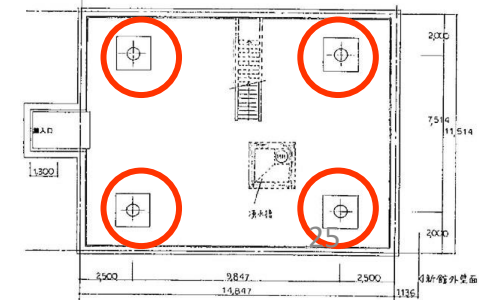
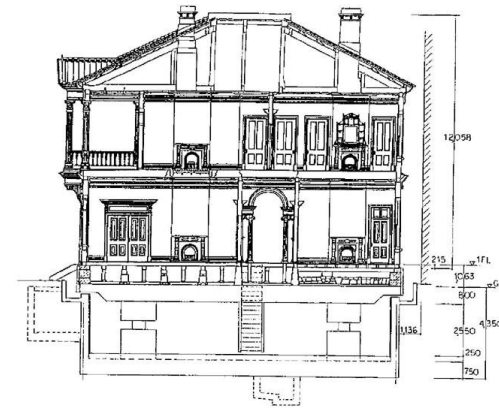


Examples of structural reinforcement of cultural property buildings

The No.15 house in former Kobe foreign settlement, Kobe City, 1882, Important Cultural Heritage



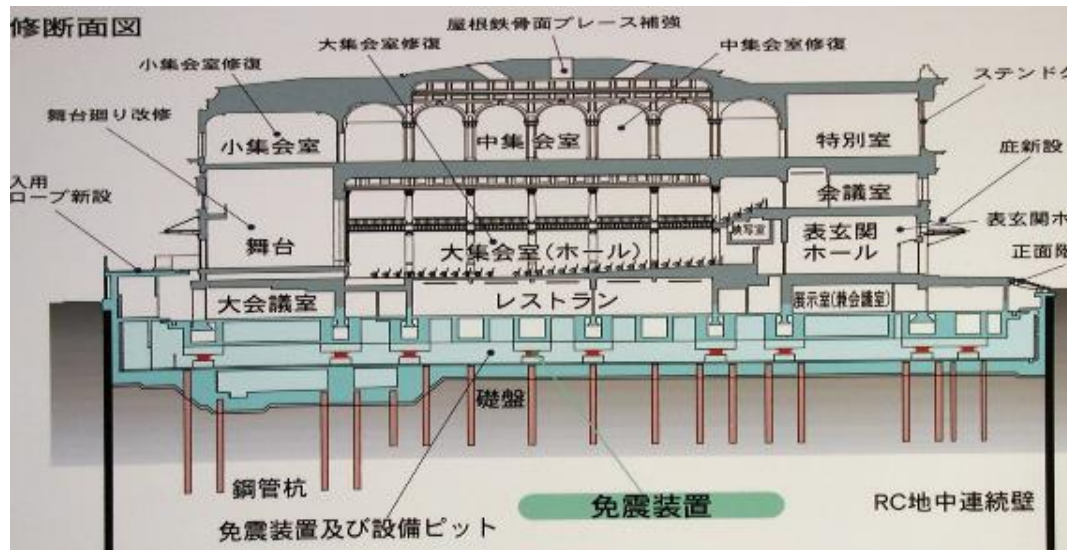
- 1995 Collaped by Hanshin-Awaji Great Earthquake
- 70% of damaged materials were reused for repairment
- 1998 Seismic isolation method secures earthquake resistance



Examples of structural reinforcement of cultural property buildings

Osaka Municipal Central Public Hall 1918

Conservation and revitalization Project
1999~2002
" Seismic isolation retrofit work"

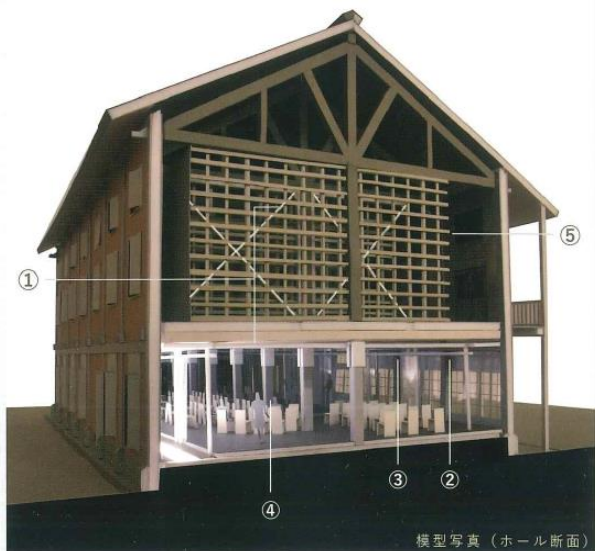


Seismic isolation devices were installed in the basement of the building.

Examples of structural reinforcement of cultural property buildings

Tomioka Silk Mill and Related Sites- World cultural heritage

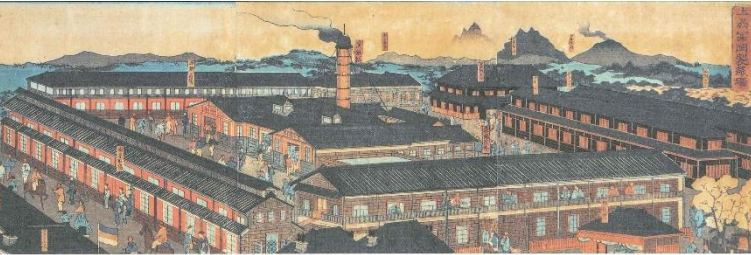
Repairment, seismic reinforcement, utilization using **House-in-House** method
The west cocoon warehouse of Tomioka Silk Mill, 1872, Gunma Pref.



Examples of structural reinforcement of cultural property buildings

Tomioka Silk Mill- World cultural heritage

Active promotion to reuse historical precious buildings as a unique venue after the renovation and reinforcement.



2020年10月 国宝「西置繭所」OPEN ガラスの多目的のホール誕生

旧国庫「西置繭所」の保存整備工事が2020年に完了しました。10月に新ガラスホールが生まれ、多くの方々にご利用いただけるようになりました。今回の工事では、保存修理と耐震補強、そして活用するための増築が併せて行われ、1階は、補強員の造形を引いたガラスのホールとギャラリーが、ハイス・イン・ハイス手法で完成されました。

1|西置繭所（概要）

西置繭所は、1872（明治5）年築の原料繭の処理所で、戦後の復興、残ったエリアを継ぎ、茶室茶店高田の二階建てで、完成まで、完成が1914年に完了した大規模な建物です。4階の各専修棟3層では、相模原産蚕が輸入された1974（昭和49）年を境として建てられたため、建築様式や構造から見てガラスホール建設前の建物の状況は読み取れます。

ホール

1階の北側には、多目的ホールが整備されました。専用機軸のための設備を備えたガラスのホールで、より多用途に活用しやすくなりました。また、増築部分、既存の和室書斎中のガラスのホールという部分には、イベントに活用出来るように、ガラスの足場とした、造形の空間を確保したことで建物の美観の維持と立派な建築を残すことができました。

収容人数：300人（国庫時代の古来のホールに合わせた規模）
 広さ：約240㎡（ホール）
 高さ：約10m（ホール）
 その他：ホールには、エレベーター、トイレ、空調設備が完備されています。

ホール

1階の北側には、多目的ホールが整備されました。専用機軸のための設備を備えたガラスのホールで、より多用途に活用しやすくなりました。また、増築部分、既存の和室書斎中のガラスのホールという部分には、イベントに活用出来るように、ガラスの足場とした、造形の空間を確保したことで建物の美観の維持と立派な建築を残すことができました。

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2|展示場（用途）

展示場は1階の南側にあり、展示スペースが広く、照明設備が充実しています。また、展示スペースの周囲には、ガラスの廊下があり、展示品の保護と見やすさを確保しています。

3|会議室

会議室は1階の南側にあり、会議スペースが広く、照明設備が充実しています。また、会議スペースの周囲には、ガラスの廊下があり、会議品の保護と見やすさを確保しています。

4|教育プログラム

教育プログラムは1階の南側にあり、教育スペースが広く、照明設備が充実しています。また、教育スペースの周囲には、ガラスの廊下があり、教育品の保護と見やすさを確保しています。

富岡製糸場で学ぶこと

富岡製糸場は、日本最初の工場跡であり、国の歴史遺産として登録されています。その当時の製造工程や、当時の生活の様子を知ることができます。また、当時の建築様式や、当時の生活の様子を知ることができます。

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We would like you to realize the wish within your own subconscious mind. Taking shape, it is truly original, our wedding style.



「西置繭所 多目的のホール」の利用にあたって

富岡製糸場は世界遺産であり、西置繭所は国宝にも指定されています。その価値と魅力を多くの方にご利用いただくことを目的として、ユニークベニューとしての活用を図っています。

過去の活用例：講演会・展覧会・結婚式・コンサートなど

多目的ホールの利用の範囲	利用ガイドラインに則した内容となります。詳しくはお問い合わせください。
面積・収容人数	248㎡・200人 ※結婚披露宴等のため制限を設ける場合があります
利用できる時間と料金	午前部：9:00 - 13:00 55,000円 午後部：13:00 - 17:00 55,000円
利用できない日	富岡製糸場の休場日に準じる 年末12月29日～31日 ※土曜・祭日等で臨時休業となる場合があります

詳細は下記までお問い合わせください
 富岡市 世界遺産観光部 富岡製糸場課
 Tel: 0274-64-0005 Fax: 0274-64-3181 E-mail: seishijou3@city.tomioka.lg.jp

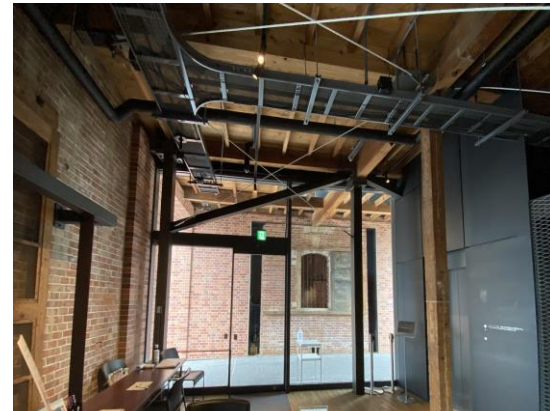
Tomioka Silk Mill Unique venue plan

- Symposium, Seminar
- Concert, Exhibition
- Ceremony
- Educational Program, etc.

Examples of structural reinforcement of cultural property buildings

World Heritage Visitor Center “Gunma” for **Tomioka Silk Mill** and Related Sites

Old brick warehouse, 1903, was renovated and reinforced to use as the visitor center.



Progress in earthquake resistance measures for cultural property buildings

(1) Jan. 1995 Hanshin-Awaji Great Earthquake

⇒ 1996 1/17 Publication of Guidelines for Ensuring the Safety of Cultural Property Buildings during earthquake

(2) March 2011 Great East Japan Earthquake

⇒ 2013 Publication of "Guide for Seismic Diagnosis and Reinforcement of Important Cultural Property buildings.

(3) April 2016 Kumamoto Earthquake

⇒ 2017 Revision of the same guidance (to include brick and reinforced concrete construction, etc. incorporating seismic countermeasures for non-structural members.)

⇒ 2020 Publication of a guide to seismic countermeasures for groups of traditional buildings

Fire-fighting Equipment: water gun, drencher



Himeji-jo Castle



Futarasan Shrine:drencher



Shirakawa village



Ouchi-shuku village



Miyama kita village

Registration of Cultural Property Buildings

Institutionalized in 1996 after the Great Hanshin-Awaji Earthquake of 1995 with the amendment of the Law for the Protection of Cultural Properties.

Registration Criteria for Registered Tangible Cultural Properties —Buildings, civil engineering structures and other structures—

□ 50 years have passed since its construction in principle, and which falls under any of the following items.

(1) Buildings that contribute to the historical landscape of the country

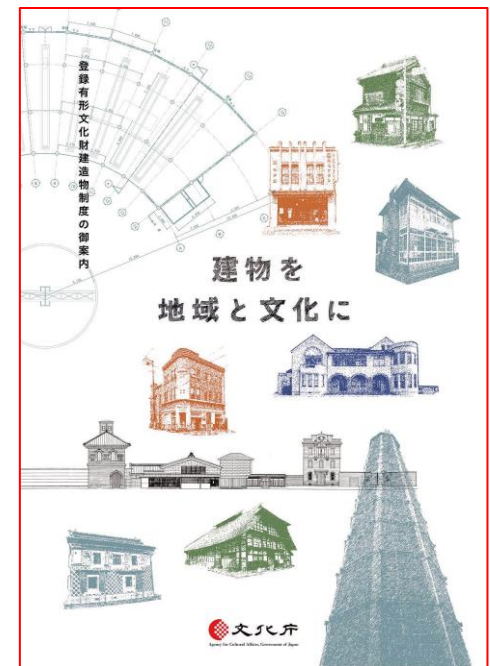
- Buildings that are widely known by a special nickname, etc.
- Buildings that are useful for learning about a place
- Buildings that appear in a painting or other work of art

(2) Buildings that have become the norm for modeling

- Buildings with outstanding design
- Buildings with prominent designers and builders
- Buildings that are early works of many later builders
- Buildings that are characteristic of the period or type of building

(3) Buildings that are not easy to recreate

- Buildings with superior technology and skills
- Buildings that use techniques and skills that are now rare
- A building with an unusual shape or design, of which there are few similar examples



Number of Cultural Property Buildings National Designation /Registration/ Selection As of August 2022, Japan

Important cultural heritage <National Treasure>
2,548 items, 5,336 buildings <229 items, 292 buildings>

Important Preservation District for
groups of traditional buildings
126 districts

Registered Cultural Buildings
13,422 items