

# **Guidelines for Ensuring Safety of Cultural Properties (Buildings) During Earthquakes**

(January 17, 1996)

These guidelines are designed to present potential scenarios of earthquake damage and basic measures for culturally important buildings and other structures during an earthquake, as specified in Cho-Ho-Ken No. 41, "Ensuring the Safety of Culturally Important Buildings and Other Structures during an Earthquake" issued by the Director-General of the Cultural Properties Protection Department of the Agency for Cultural Affairs on January 17, 1996.

# **Guidelines for Ensuring Safety of Cultural Properties (Buildings) During Earthquake**

## **1. Introduction**

(1) Basic concepts for maintaining the safety of cultural properties (buildings) and other structures during earthquakes

Since Important Cultural Properties (buildings) and Historic Buildings in Important Preservation Districts for Groups of Historic Buildings (hereafter, “cultural properties (buildings)”) may be significant due to their design, technological, historical, and/or academic value, it is difficult to establish uniform standards for their repair. However, since the maintenance, management, periodic repairing, locational conditions, and utilization methods of a considerable number of cultural properties (buildings) are affected by seismic conditions, it is important to maintain their safety during an earthquake.

Therefore, it is necessary to try to reinforce structures whenever possible, and support this with an appropriate set of measures other than reinforcement. It should be noted that these guidelines are designed to show the basic concepts for ensuring safety; specific methods for reinforcement, standards and items for structural assessment, etc., are slated for inclusion in separate technical guidelines.

During earthquakes, the safety of cultural properties (buildings) should be maintained to reduce the impact on human life. For this purpose, reinforcement work should be undertaken whenever possible so that the culturally important building does not lose its value; if important cultural losses are incurred by the reinforcement work, then it may become necessary to limit entry into the building.

In addition to repair work to improve seismic resistance, it is also effective to enhance maintenance, management, and utilization methods, and improve the environment and disaster prevention facilities in the surrounding area. Thus, it is also important to make an effort to implement these measures.

These measures should be implemented by building owners, managers, and management organizations (hereafter, “owners”). Nevertheless, it would be preferable to include the opinions of architects and other building experts to simulate earthquake damage, to formulate measures to prevent such damage, and to consider the necessity for making major repairs. While it is necessary to implement such measures quickly, the measures might impose a substantial financial burden on owners. In such cases it may be necessary to take alternative steps such as carrying out reinforcement work in conjunction with major repairs, and limiting entry to reduce danger. In some cases, notices announcing the risks of earthquake damage are substituted for entry limits.

(2) Simulating earthquake damage and formulating and implementing plans for dealing with such damages

To ensure the safety of cultural properties (buildings), etc. during an earthquake, it is necessary to envision specific types of potential damage beforehand, and to formulate and implement measures for limiting such damage. It would also be desirable for owners to envision secondary damage, such as landslides and fires, that such buildings can sustain when a major

earthquake occurs in their vicinity.

Specifically, this entails getting advice from experts to make structural diagnoses. At the same time, old photographs, personal memories, first-hand accounts, and other records should be examined to determine what sort of earthquake damage has occurred to the building in question or the surrounding area in the past. This information should then be compared with the current survey to consider ways to envision damage that may occur during an earthquake.

The following points must be taken into particular consideration when envisioning potential earthquake damage:

1) Understanding damage that may have previously been sustained by the building in question and surrounding structures

- Were any people injured and, if so, what sorts of injuries occurred?
- What kind of overall structural damage occurred in the building in question?
- What kind of damage occurred to the various members of the structure?
- Was there secondary damage in the surrounding area (fires, landslides, etc.)?

2) Comparing present conditions with conditions during past earthquakes

- Understanding changes to buildings due to additions and improvements
- Comparing utilization methods (use of buildings, frequency of use, number of users, etc.)
- Comparing surrounding conditions (changes in topography, encroachment of urbanization)
- Comparing the degree of deterioration in the culturally important building, etc., in question

Owners should keep items related to earthquake damage in mind and work to formulate and implement the following measures:

- Revising maintenance and management methods (see addendum 2)
- Revising utilization methods (see addendum 3)
- Repairing and reinforcing buildings (see addendum 4)
- Improving surrounding environment (see addendum 5)
- Enhancing disaster prevention facilities, etc. (see addendum 6)

It should be noted that measures should be formulated from the perspective of minimizing damage.

## **2. Items that should be kept in mind for daily maintenance and management**

To maintain the intrinsic strength of cultural properties (buildings), etc., it is extremely effective to manage them appropriately on a daily basis. In daily management, owners should refer to the “Handbook for the Preservation and Management of Cultural Properties (Buildings)” edited by the Nationwide National Treasure Important Cultural Property Owner League, and supervised by the Cultural Properties Protection Department of the Agency for Cultural Affairs (October 1994), and “Handbook of Fire and Crime Prevention of Cultural Properties” edited by the Cultural Properties Protection Department, Agency for Cultural Affairs (March 1970). The following points should be given special attention:

(1) Understanding damaged parts

The following points related to durability should be kept in mind while making an effort to discover and understand damaged parts.

- Main structural members such as columns and/or beams may tilt

- Rain leakage and parts where roof damage may result in leaks
- Parts where members have rotted (especially bases of columns, connecting parts of structural members, joists and sleepers under floors, etc.)
- Parts that have been damaged by insects
- Parts of walls that are cracking, peeling, etc.
- Condition of damage and deterioration of chimneys, outer walls, and other brick structures
- Uneven subsidence

#### (2) Partial and emergency repairs

When damaged areas can be confirmed, efforts should be made to make partial and emergency repairs on a daily basis.

#### (3) Preventing personal injuries, fires, etc., during an earthquake

Efforts should be made to always be aware of and systematically acquire, construct, develop, etc., the necessary equipment to deal with personal injuries, fires, and other calamities that may result from an earthquake, with special attention given to the following points:

- Anchoring interior equipment (tall furniture, lighting equipment, canopies, etc.)
- Preventing objects, fixtures, etc., from falling or sliding
- Limiting areas where fire is used
- Making every effort to extinguish fires, flames, etc.
- Always having portable fire extinguishers, fire-resistant fabrics, etc., on hand

#### (4) Securing materials for emergency responses

Efforts should be made whenever possible to always have water tanks, ropes, and waterproof sheets on hand to deal with emergencies.

### **3. Points to keep in mind when using buildings**

When dealing with cultural heritage buildings, etc., which are opened to or used by large numbers of the general public, it is particularly important to always keep safety in mind. To make visitors and users aware of dangers, owners should put up railings, fences, signs, etc., that clearly identify nearby hazards based on (1) in 2 above and hypothetical damage that may occur. In addition, they should have an understanding of visitor behavior and consider appropriate actions that visitors should take (such as evacuation) during an earthquake. If an especially large number of visitors is expected for a special event, it would be advisable to deploy volunteers and others to handle emergency situations.

For cultural properties (buildings) with uses (such as schools, theaters, meeting halls, auditoriums, etc.) covered by Article 2, Section 2 of the Building Standard Law of Japan, owners should make structural diagnoses (The Agency for Cultural Affairs plans to indicate items and standards for structural assessments in technical guidelines for reinforcement). At the same time, utilization plans must specify supervisors and specific uses of cultural properties (buildings), and their surroundings (or area, if the heritage site is land).

### **4. Repairs made during reinforcement work**

#### (1) Necessity of repairs

To improve the seismic resistance of cultural heritage buildings, etc., appropriate repairs should be made periodically or when needed.

Major and minor repairs are part of management. Minor repairs include partial repairs made without disassembling main structural members (such as columns, beams, roof trusses, etc.), and reinforcement made by adding structural members. Major repairs include disassembly repairs made when structural members are completely disassembled, semi-disassembly repairs made when walls and decorative members are disassembled, and complete overhauls of roofs and associated work. In all cases, owners must make a concerted effort to make repairs for reinforcement. At such a time, it would be advisable to receive guidance from architectural experts.

## (2) Minor repairs for reinforcement

When making minor repairs necessary to reinforce cultural properties (buildings), owners should observe the following items so as not to damage the value of the property.

1) Major structural members and members that are part of a design (members or materials containing carvings, colors, etc., used to make a design) should not be damaged.

2) Repairs to roofs, walls, etc., containing nondurable materials should be made so as to minimize possible loss of traditional designs, material quality, structural methods, etc. Particular care must be taken for reinforcements made to walls so as not to eliminate the traces of the original methods.

3) When using additional members for reinforcement work, efforts should be made to make these additional members easily removable for future full-scale repair work.

## (3) Full-scale major repairs

Before starting full-scale major repairs to cultural properties (buildings), owners should conduct foundation surveys and structural diagnoses of the buildings (The Agency for Cultural Affairs plans to indicate items and standards for structural assessment in technical guidelines for reinforcement). Based on these results, a close working relationship should be established with the Agency for Cultural Affairs to set guidelines and formulate plans for repairs.

It should be noted that engineers and other persons having experience in repairing cultural heritage buildings should be consulted when making detailed repair plans.

## **5. Environmental improvement**

### (1) Preserving the surrounding landscape

Since changes in the surrounding landscape caused by an earthquake can have a major effect on the preservation of cultural heritage buildings, etc., owners should always be aware of the state of stone walls, precipices, ponds, large trees, etc., in the surrounding area as well. If it appears that there may be a potential danger, it will be necessary to formulate a development plan that is related to environmental preservation.

It should be noted that in formulating and implementing such a plan, efforts should be made to preserve the historical ambience of the surrounding area.

(2) Improvement of the environment within buildings

Moist environments cause members to rot and attract harmful insects, which can cause a noticeable decrease in the strength of cultural heritage buildings, etc. Therefore, owners should make an effort to ventilate building interiors and areas underneath floors, and provide for adequate drainage of the property to prevent the build-up of moisture.

**6. Improvement of disaster prevention facilities, etc.**

(1) Establishment of fire-fighting facilities

During an earthquake, there is a risk that fire hydrants cannot be used if the flow of water in the supply pipes is cut. Therefore, owners must seek the advice of fire-fighting organizations to ensure that other sources of water (such as rivers, wells, water tanks, etc.) are available. When cultural properties (buildings) are in dense residential areas, or have natural vegetative roofing materials (e.g. thatching), special attention should be given to enhancing fire-fighting capabilities.

(2) Establishment of fire containment zones

To prevent the spread of fires during an earthquake, it is effective to set aside open spaces as fire containment zones. Therefore, owners should try to establish a fire containment zone around their cultural properties (buildings) and make sure combustible materials are not left unattended.

(3) Implementation of disaster prevention training, etc.

Owners should have an understanding of the locations and functions of fire-fighting facilities as well as methods of utilizing them. They should also conduct periodic inspections and have a firm knowledge of evacuation methods.

In addition, they should receive guidance from fire-fighting organizations and undergo periodic fire-fighting training.

**7. Maintaining safety in Important Preservation Districts for Groups of Historic Buildings**

(1) Promoting the reinforcement of traditional structures

The “Implementation of System of Preservation Districts for Groups of Historic Buildings” (Cho-Ho-Ken Notice No. 192, issued September 30, 1975 by the Director-General of the Cultural Properties Protection Department of the Agency for Cultural Affairs) stipulates that municipalities need to promote reinforcing historic buildings by establishing guidelines for such reinforcements that are compatible with maintaining historic buildings indicated in the Plan for Preserving Preservation Districts for Groups of Historic Buildings and incorporating them into the plan.

It should be noted that reinforcement guidelines should be formulated based in part on “Methods for Accurately Assessing Seismic Resistance of and Reinforcing Wooden Housing,” supervised by the Housing Bureau of the Ministry of Construction, edited by the Japan Building Disaster Prevention Association and the Japan Federation of Architects and Building Engineers Association, and revised in 1995.

## (2) Formulating and implementing disaster prevention plans for Important Preservation Districts for Groups of Historic Buildings

Given the historical nature of preservation districts for groups of historic buildings, there are narrow streets (which hinder evacuations and fire-fighting activities), dense areas of wooden structures (which run the risk of collective collapse and are vulnerable to fires), and risks associated with the surrounding landscape (landslides, etc.), among other potential hazards. When there is a comprehensive list of safety issues in applicable preservation zones and surrounding areas, the zones may have existed for quite some time. When municipalities conduct new surveys to understand how safety has been maintained in such areas, the results also provide information about the elements which make up the historical ambience of preservation zones. Therefore, efforts should be made to use these results to formulate disaster prevention plans that incorporate alternative measures (such as improving local fire-fighting facilities, establishing fire-prevention belts, undertaking work to increase the safety of steep slopes, etc.) that will avoid the risk of losing the unique qualities of traditional structure groups and the historical ambience of the area.

## **8. Response immediately following an earthquake**

### (1) Evacuation

Aftershocks may occur after a strong earthquake. Thus, when an earthquake strikes, people inside cultural properties (buildings) should be evacuated to a local evacuation center as soon as possible while taking special precautions to avoid falling objects like roofing tiles, and follow the directions of fire-fighting organizations and other authorities.

### (2) Emergency measures required for dealing with extreme damage

When cultural properties (buildings) are damaged by an earthquake and this results in bodily injury to one or more people, priority should be given to assisting the injured. After sufficient assistance is rendered, owners can focus on saving their buildings and associated items, and, when necessary, take the following steps:

#### 1) If there is a danger of fire spreading in cultural properties (buildings), etc.

Efforts should be made to put out fires. If it appears that a fire will definitely spread and cause destruction, proper measures should be taken, including dismantling the cultural heritage buildings in question and/or removing them from the premises.

#### 2) If cultural properties (buildings) sustain major damage

Vulnerable items should be removed and placed in a safe location, and the damaged sections should be covered with waterproof sheets to prevent water damage. To prevent sagging, support columns should be reinforced and measures taken to restrict entry into vulnerable areas. When damaged sections may block public roads or otherwise have a major impact on the surrounding area, the materials should be dismantled and/or removed as quickly as possible.

#### 3) When main structural members are tilting significantly

Temporary support should be provided by support columns, wires, or other means, and measures should be taken to limit entry into the building.