System and Project Planning for the Repair of Architectural Monuments in Japan

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I. System of repair projects

1. Legal system of protection of architectural monuments

1897: Law for the Preservation of Ancient Shrines and Temples
1929: Law for the Preservation of National Treasures
1950: Law for the Protection of Cultural Properties

2. Designation etc. of architectural monuments

- National treasures, important cultural properties (buildings): Designation by Law for the Protection of Cultural Properties
- Registered tangible cultural properties (buildings): Registration by Law for the Protection of Cultural Properties
- Preservation Districts for Groups of Historic Buildings: The municipality makes the designation on the basis of municipal bylaws. Important Preservation Districts for Groups of Historic Buildings are selected on the basis of the Law for the Protection of Cultural Properties.
- Cultural properties (buildings) designated by local public organizations: Designation is made on the basis of prefectural or municipal bylaws relating to the protection of cultural properties.

3. Restoration of important cultural properties, and the Law for the Protection of Cultural Properties

- The owner of the cultural property must manage the cultural property.
- Any repairs to the cultural property are to be undertaken by the owner.
- The government may issue a subsidy for the management and/or repair of cultural properties (National subsidies 50 – 85%. Subsidies from prefecture or municipality are added to this figure).
- When making changes to the current status of an important cultural property, or any other actions which affect its preservation, permission is required from the Commissioner of the Agency for Cultural Affairs.

4. Specifics of restoration

・ Radical repair

Dismantling and repair: Repair that is accompanied by dismantling of all the components of the building.

Partial dismantling and repair: Repair that is performed without dismantling some of the core section, for example pillars and beams.

- Maintenance and repair

Reroofing: Reroofing with Hinoki bark, shingles, roof tiles, thatch, etc.
Painting: Painting with urushi lacquer or other colors.
Partial repair: Repair of a portion of the building, such as the wooden parts, walls, or floors.

Architectural monuments have these kinds of repairs performed on a cyclic basis to convey their value to future generations. Radical repair is performed every 100 to 300 years, while maintenance and repair is done every 15 to 60 years in the interval.

5. Preservation of restoration techniques

With the amendment of the Law for the Protection of Cultural Properties in 1975, new rules were put in place relating to the preservation of techniques for the conservation of cultural properties. In the context of the aging of the skilled workforce and dwindling number of successors becoming an increasingly serious problem, the government took proactive measures to preserve the skills and techniques necessary for the conservation of cultural properties. Relevant skill areas include repair techniques as well as carpentry and roofing.

The Minister of Education, Culture, Sports, Science and Technology selects “Selected Preservation Techniques” which are defined as “traditional techniques or skills which are essential for the conservation of cultural properties and which require measures for their preservation.” At the same time, the Minister certifies persons and/or organizations which possess and/or work to preserve those skills or techniques, encouraging the polishing of those skills and techniques, the development of successors, and the creation of video footage and other records of those techniques.

In building-related matters, the Minister selects conservation techniques such as building repair, architectural woodworking, *kikujutsu* (use of carpenter’s square to make curved roof lines), architectural painting, architectural decoration, roofing with roof tiles, roofing with hinoki bark, and roofing with shingles, as well as the production and manufacturing techniques for the materials used for restoration, such as harvesting of hinoki bark and manufacturing of bamboo nails.

Conservation associations (architecture) in Japan

Architectural repair: The Japanese Association for Conservation of Architectural Monuments
Architectural woodworking: The Japanese Association for Conservation of Architectural Monuments
Architectural painting: Nikko Cultural Assets Association for the Preservation of Shrines and Temples
Roofing with roof tiles: The Japanese Association for the Preservation of Techniques for Traditional Tiles

Hinoki bark and shingle roofing: National Association for the Conservation of Roofing Techniques for Temples and Shrines
Nihonkabe (wood-core Japanese style wall): National Cultural Property Wall Technical Preservation Meeting

6. Securing materials for restoration

The procurement and stable supply of materials used in restoration, such as wood, hinoki bark, and urushi lacquer, is extremely important.

The Agency for Cultural Affairs established "*Furusato Bunkazai no Mori* (Forests for our Cultural Properties)" as a center for the stable procurement of wood, hinoki bark, urushi sap, thatch, and other plant matter used in restoration work, and to develop skilled workers to produce those resources. Specifically, this entailed: (1) Selecting the "*Furusato Bunkazai no Mori*" as forests for harvesting and/or producing resource materials; (2) Establishing and maintaining "*Furusato Bunkazai no Mori* Center" as a facility for holding training programs and also as a center for education and disseminating information; and (3) offering training programs, experiential study sessions, and workshops etc. mainly at the *Furusato Bunkazai no Mori* Center.

7. Developing conservation architects

Traditional techniques or skills which are essential for the conservation of cultural properties have insufficient numbers of successors, for reasons such as the time required to master those techniques and the fact that the work is not economically advantageous. Persons possessing selected restoration techniques and organizations for their preservation are to work on honing their own skills while developing successors.

Development and training programs

- The Japanese Association for Conservation of Architectural Monuments:
  Training programs for developing conservation architects and woodworkers
- Nikko Cultural Assets Association for the Preservation of Shrines and Temples:
  Training programs for developing experts capable of doing and restoring paint work
- The Japanese Association for the Preservation of Techniques for Traditional Tiles:
  Training programs for the development of experts to produce roof tiles and perform roofing techniques
- National Association for the Conservation of Roofing Techniques for Temples and Shrines:
  Training programs for the development of experts to perform roofing work with hinoki bark, shingles, and thatch
- National Cultural Property Wall Technical Preservation Meeting:
  Training programs for the development of plaster work experts

Development and training programs for conservation architects are given by the Japanese Association for Conservation of Architectural Monuments. To meet the needs of the 160 or so conservation architects around the nation, the Association offers development programs as well as training programs for skill development in three levels: Mid-level, Manager level, and Executive level.

- **Trainees program**: Newly hired architects take this program for two years for basic training (600 hours).
- **Mid-level training program**: Those architects who have completed the Trainees program take this program for three days each year for lectures, practical training, and on-site activities to acquire specialized knowledge and techniques.
- **Manager level training program**: This program is offered for two days each year. Participants engage in dialogue on important matters relating to the implementation of design supervision as they work to improve their qualification as conservation architects.
- **Executive level training program**: This one-day program is given each year to persons in supervisory positions to study and discuss important matters relating to the implementation of design supervision.

8. Restorers of important cultural properties

When repairing important cultural properties as a nationally subsidized project, a Manager level architect, pre-approved by the Agency for Cultural Affairs, must be used.

- **Senior Manager level architect** (For repairs of national treasures, large scale architectural structures, and architectural structures from Kamakura period and earlier etc.)
  Must have at least 12 years of practical experience in the repair of important cultural properties if a bachelor's degree holder, 16 years of practical experience if a college diploma holder, or 20 years for a high school diploma holder (the degree or diploma must be from a proper architectural program), and have taken the Cultural Agency's "Seminar for Manager Level Repair Technicians of Architectural Monuments (Advanced Course)."
- **Regular Manager level architect** (For the repair of relatively simple architectural structures, other than the above)
  Must have at least 6 years of practical experience in the repair of important cultural properties if a bachelor's degree holder, 10 years of practical experience if a college diploma holder, or 14 years for a high school diploma holder (the degree or diploma must be from a proper architectural program), and have taken the Cultural Agency's "Seminar for Manager Level Repair Technicians of Architectural Monuments (Regular Course)."

Trainees program → Mid-level training program → Cultural Agency's Expert Seminar → (Manager level architect) → Manager level training program → Executive level training program

9. Organization of important cultural properties restoration

Project client: Owner of cultural property (Organizes a project committee if necessary.)

Design manager: Manager level conservation architect

Worker: Direct operation; Subcontracting

- In Kyoto, Shiga, and Nara prefectures, where important cultural properties are especially numerous and repair projects are continuously implemented, conservation architects are employed as staff of each prefecture's board of education and accepted commissions of the repair work from the project client (direct operation).

Project client (owner) → Implementation of project commissioned to prefecture →
Work done by entity to which project was commissioned

- Other prefectures: In prefectures other than the three above, the project client commissions the design supervision work to a design supervision organization such as the Japanese Association for Conservation of Architectural Monuments. The owner then decides on a company to do the work on the basis of competitive bidding (subcontracting).

Project client (owner)
→ Commissions design supervision to a design supervision organization
→ Contracts with company to do the work based on competitive bidding

10. The role of conservation architects

In the case of radical repair, the manager level conservation architects is generally stationed permanently in an office on the restoration sites, in a systematic effort to ensure nothing goes wrong during restoration. At the work site, the manager level conservation architect performs design and supervision operations, implements detailed investigations, considers the direction of the repair, and creates records.

Organization of the design supervision office

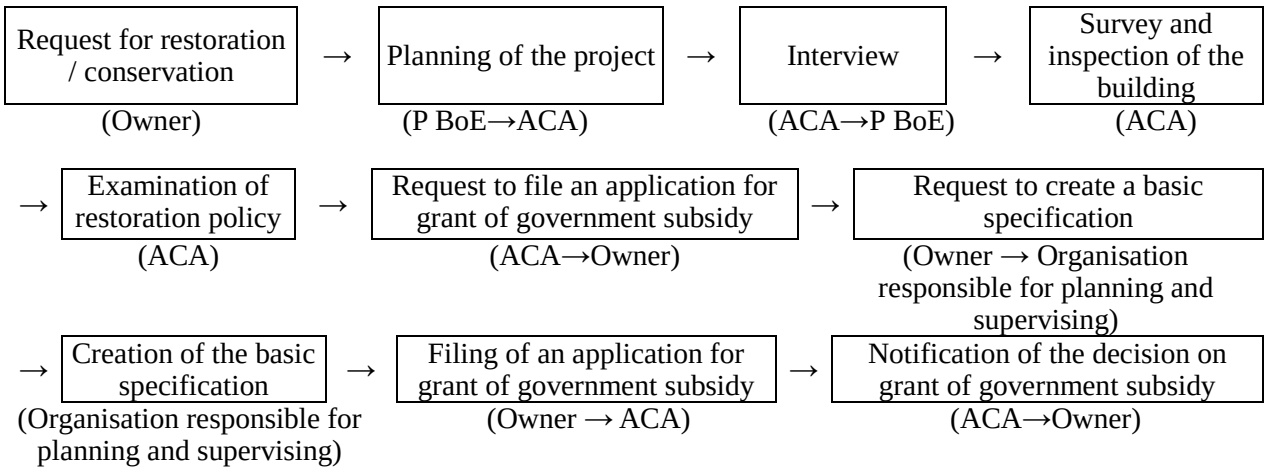
- Superintendent (Manager level; part time): General supervision of work site.
- Manager (Manager level; full time): Responsible for supervision of work site.
- Technical staff (full time): Assists the manager and creates restoration drawings etc.

(The number of technical staff assigned to the project may be zero to multiple people depending on the scale of the project)

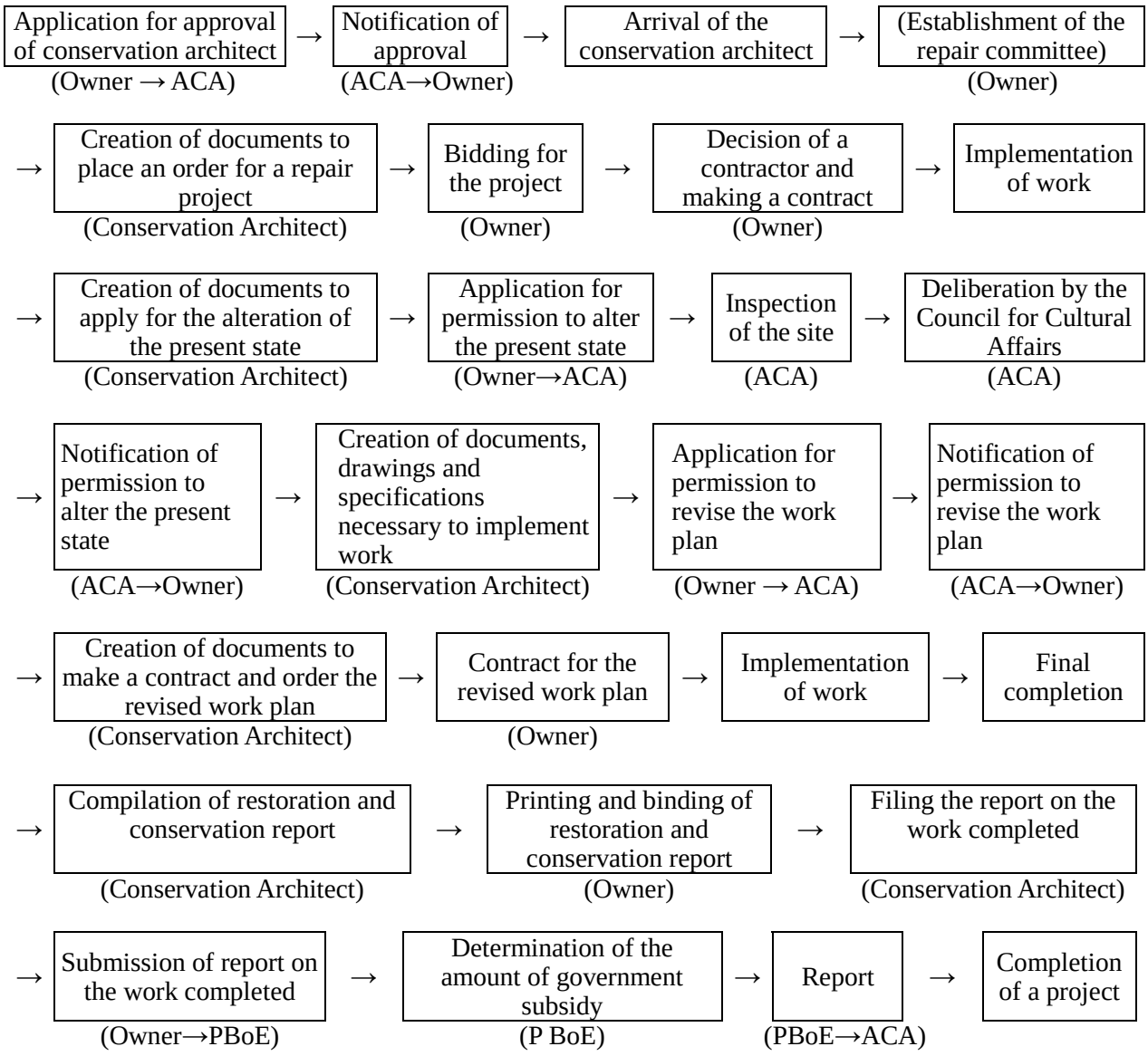
II. Work plan

1. Planning of a project and decision on grant of government subsidy

ACA: the Agency for Cultural Affairs　PBoE: Prefectural Board of Education



2. Implementation of a project



3. Description of restoration work

Temporary construction; dismantling; foundation; masonry; woodworking; roofing; plastering; fittings; metal fittings; miscellaneous work; incidental work

4. The basics of restoration work and the sequence of the work

"Restoration" is more than simply "repairing." Rather, its basic significance lies in the fact that it is performed to maintain the value of the architectural structure. For that purpose, there is a need to (1) Perform repairs that are grounded in detailed, scrupulous research and surveys, and reliable informational materials; (2) Employ and hand down traditional techniques, and reuse ancient materials; and (3) Create and retain records which clearly identify the policy and details of the repairs.

Identifying the current state of the structure, and building a temporary roof

The structure's state of damage, techniques used in its construction, building methods, and repairs performed in later years are investigated to identify the current state of the structure. This is used as the basis for planning the method of repair, time required, costs, and other aspects of the repair plan, before the work is embarked upon. The first step is to investigate the present situation, make measurements, and take photographs to use as records.

In Japan, with its large annual rainfall, we install a temporary roof over the construction site to protect the structure from wind and rain and to ensure smooth and safe progress of the work.

Dismantling and scrupulous investigation

Once the temporary roof is in place and the scaffolding assembled, we embark on dismantling the structure. As the general rule is to avoid changing the position of the original components, we affix number cards to the components we remove as we prepare for dismantling. After the preparatory steps are finished, we begin by removing the fixtures, *tatami* mats etc. Then we take apart the components, working from the top of the building and sequentially downward (roofing material → walls → fixtures in the ceiling and floor etc. → roof truss → beams → framework → foundation). While this is in progress, we take supplemental measurements and photographs at each step, and perform the following in an orderly manner: (1) Measurement of dimensions; (2) Assessment of damage; (3) Investigation of specifications; (4) Creation of records of components; (5) Investigation of traces of past repairs; etc.

(1) Measurement of dimensions

Detailed measurements are made of the dimensions of the floor plan, rise, curve of the eaves, and each component, verifying with the planned dimensions of the time of the original construction.

(2) Assessment of damage

The state of damage and the causes are investigated for each component, and measures to address the damage are considered.

(3) Investigation of specifications

For each component, the following are investigated to identify techniques: Species; configuration of joints and couplings; tools used; dimensions of finish; etc. Conventional specifications and the age of component are also investigated.

(4) Creation of records of components

For every component comprising the architectural structure, the following are identified and compiled in a report: Quantity; species; quality; style; dimensions; finish; joints and couplings; degree of damage; original components and those added later; reusable/non-reusable components; degree of repair required; age of component; etc.

(5) Investigation of traces of past repairs and restorations

The following are investigated for each component: Traces of previous joints and couplings; pieces of old materials put to other uses (such as in the roof truss or under the floor) in repairs done in later years. In addition, materials such as inscriptions and writings in India ink are investigated, clarifying the age of each component. Drawings depicting the restored, original state, and changes made over the ages, are prepared.

(6) Investigation of historical materials and documents

At the same time as the investigation of the building itself, we also search relevant literature and historical documents, and look for similar examples. Other studies conducted as necessary include material analysis, tests to assess strength, resistance etc., structural diagnosis, and investigation of the underground structure.

We then take this information comprehensively to review the restoration plan. One of the important things to consider is whether to maintain the current state of the building or to restore it, and in the case of the latter, whether to restore it to the original form or to choose one of the later modifications. It is also necessary to assess the structural safety of the building and suggest reinforcement plans as needed.

Repair and assembly of components

The general rule is to reuse the original components as much as possible to the extent that doing so does not compromise the conservation of the architectural structure. Even damaged components are not to be replaced wholly but rather repaired by splicing or other methods. Any weak areas are reinforced by adhesive (synthetic resin) or metal fittings. In this way, we reuse the components as much as possible. Any replacement materials or materials used for splicing are matched to the original in terms of species and quality, with the surface finish performed using traditional techniques as a general rule. Any replacement materials or materials used for splicing are marked in an inconspicuous area with a branding iron to indicate the year of repair, so that they may be clearly distinguished from the original, ancient materials.

When the components have been repaired and the supplementary materials harmonized with the rest of

the components, the building is assembled using traditional techniques for the completion of the restoration.

Keeping records of the restoration

In the repair of architectural monuments, the keeping of records of repair is of extreme importance. Documents are prepared, such as photographs before, during, and after the repair; rubbed drawings; blueprints; restoration drawings; restoration report; etc.

Components such as frog-leg struts, nosings, and bracket arms, which embody the period characteristics of an architectural structure, as well as traces of past repairs left by tools on the surface of pillars etc. are recorded as rubbed drawings. Rubbed drawings are also made of the patterns on eaves-end tiles, as they also have period characteristics.

Out of the various types of records, the restoration drawing is one of the most important. Pre-repair and post-repair drawings are made. Restoration drawings are made when radical repair is performed, using A0 size Kent paper and finished in ink with drawing pen or fine brush. The restoration report is an organized and edited publication of the material compiled and created during the project period, and includes various survey reports, records, photographs, drawings, and documents.

Restoration and technology

As we have seen, the repair of architectural structures is performed using traditional techniques and materials as a general rule. In cases where traditional techniques are not enough to correct certain types or extent of damage, we have come to make effective use of scientific techniques and materials newly developed in and after the mid-1960s. Some areas in which conservation science and repair technologies are put to use are adhesion, strengthening, or repair of wood or stone parts, prevention of peeling of colors and paints, and curing of earthen walls. Scientific methods are also utilized in such areas as the determination of the chronological age of a component, and identification of species or region of production.

Restoration and structural reinforcement

The causes which lead to the need for restoration are, in addition to age-related damage, often to do with structural defects as well as with geographical conditions and natural disasters such as earthquakes.

In the case of wooden architecture, we have employed traditional methods such as diagonal beams and cantilevers mainly in the roof truss and eave areas to support the heavy roof and deep eaves in our structural reinforcement. For tiled roofs, we have used creative methods which forego the use of clay on sheathing to decrease the weight of the roof. To protect against earthquakes, we have used traditional techniques such as the use of battens, but modern methods which employ steel frames to

further enhance safety are also being used.

The need for earthquake-proofing has particularly been in the spotlight since the Hanshin-Awaji earthquake of 1995, in which a large number of wooden structures were destroyed. Since then, the necessary earthquake-proofing measures were put in place after an earthquake resistance test was performed without fail whenever a building in a radical repair project was deemed structurally unstable.