

Case Studies of Collaboration between Architects and Contractors in Japan

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Abstract: The aim of this paper is to show some typical cases of collaboration between architects and contractors on Japanese building construction projects. To be concrete, this paper deals with real projects of two famous Japanese architects, Mayekawa Kunio and Murano Togo, and considers how they collaborated with contractors. The Tokyo Metropolitan Art museum is examined as Mayekawa's project and the Kyoto Takaragaike Prince Hotel as Murano's project. To grasp the collaboration methods of Mayekawa and Murano, I conducted the following surveys: analysis of both projects' records, and interviews with architects and contractors who joined each of the projects. Then I show organizations and sharing roles and responsibilities and, building construction process of the both projects.

1. Introduction

Until the middle of the 18th century (Edo era) in Japan, the main project delivery system was the design-build process. A master builder of wooden construction controlled carpenters and managed the process, and then they built houses, temples and shrines by Japanese traditional construction methods (Hashimoto, 1995). Furthermore, master builders also designed, so the origin of architects' profession in Japan was the master builders' (Fujii and Tsurumaki, 1997).

In the late 18th century (Meiji era), the concept of 'architect' came to Japan from the West. Then, a British architect traveled to train young Japanese architects in the architecture department at the Engineering University, which became Tokyo University (Yamamoto, 1980). A professional institute of architects was also formed in Japan imitating RIBA (Royal Institute of British Architects) and AIA (the American Institute of Architects). After that, Japanese architects tried to establish their profession and separate it from construction.

However, architects and contractors have collaborated closely to confirm building quality. The collaboration was not based on explicit systems, like contract documents and handbooks. Architects and contractors just collaborated and shared roles tacitly. Today, such situations are changing to some extent. Some tacit collaboration has been replaced by clear roles and responsibilities, strict contracts, and so on.

Therefore, the aim of this paper is to show some typical cases of collaboration between architects and contractors on Japanese building construction projects. To be concrete, this paper deals with real projects of two famous Japanese architects, Mayekawa Kunio and Murano Togo, and considers how they collaborated with contractors. The Tokyo Metropolitan Art museum is examined as Mayekawa's project and the Kyoto Takaragaike Prince Hotel as Murano's project.

Mayekawa and Murano are typical examples of architects who collaborate with contractors to achieve high quality buildings. However, their collaboration methods seem different from each other. On projects led by Mayekawa Kunio, architects worked on more parts of construction than on other projects. On the other hand, contractors worked on more parts of design on projects led by Murano Togo.

To grasp the collaboration methods of Mayekawa and Murano, I conducted the following surveys: analysis of both projects' records, and interviews with architects and contractors who joined each of the projects. After that, I analyzed the projects according to the following perspectives: how architects and contractors share their roles and when they communicate with each other.

2. Case 1: Project led by Mayekawa Kunio

2.1 OUTLINE OF RESEARCH

2.1.1 Overview of Object

Mayekawa Kunio (1905~1986) is one of the architects representing modernism in Japan. He studied under Le Corbusier from 1928 to 1930 in France. After returning to Japan, he studied under the American architect, Antonin Raymond, and established Mayekawa Kunio Associates and Architects & Engineers in 1935. He strove for the spread and development of modern architecture in Japan. His works were awarded The AIJ Prize for Design, the most authoritative prize presented for architecture in Japan, five times. He also worked establishing the profession of architects, and served as JIA president (1959~1962) and UIA vice-president (1965~1969).

One of Mayekawa's characteristic design methods was the

Technological Approach. This aimed to promote development and sharing of fundamental building technology, and stoic and fastidious plastic design. As a result, by collaboration with specialist contractors, Mayekawa's Original Tiled Panel System, Weatherability Steel, and PC (architectural precast concrete) were developed.

The Tokyo Metropolitan Art Museum (1975) is a public art museum located in Ueno Park in Tokyo. Three representations of the *Technological Approach*, Mayekawa's Original Tiled Panel System, Weatherability Steel and architectural precast concrete were used. The site area is 16,000 square meters, building area is 6,000 square meters and the total floor area is 32,000 square meters. The number of stories is two, with two basement floors, and it is a reinforced structure, and partially steel. The axis of the whole composition and flow is set as an *esplanade* on the ground floor, sunken garden and entrance lobby one story beneath ground level, and sculpture halls two stories beneath ground level. Continuous arches are hung over them. Four exhibition buildings, a plan exhibition building, and a cultural-activities building are arranged around it. Repair work has been performed since 2010 and it is due to be used continuously even after 35 years have passed since completion of works.



Fig.1 The Tokyo Metropolitan Art Museum

The building elements where collaboration was performed closely on design and construction are the structure of concrete, whose part is architectural concrete, the ceiling of architectural precast concrete, the tile on the wall surface, which partly adopted Mayekawa's Original Tiled Panel System, and the doors and windows, which partly adopted Weatherability Steel based on the *Technological Approach*.



Fig.2 Mayekawa's Original Tiled Panel System

2.1.2 Research Method

There are two reasons for choosing the Tokyo Metropolitan Art Museum as a subject of research. First, the preserved data is abundant and can be used. Second, sufficient interviews are possible since architects and contractors who participated in the project are available. With the above, concrete examination was able to be performed regarding collaboration between architects and contractors.

2.2 RESEARCH RESULTS

From these two viewpoints, "organizations and sharing roles and responsibilities" and "construction process", I consider the collaboration in the Tokyo Metropolitan Art Museum building construction project. First, I show the organizations that participants in the project belong to, and the relation between organizations and sharing roles and responsibilities (Fig. 3). Then, I survey the collaboration in the building construction processes.

2.2.1 Organizations and Sharing Roles and Responsibilities

The owner of the Tokyo Metropolitan Art Museum building construction project was Tokyo government, and the architect was Mayekawa Kunio Associates, Architects & Engineers, and the general contractor was Obayashi Corporation.

Persons from the Education Bureau of the Tokyo Metropolitan Government resided on the construction site permanently as owner and supervised like participation in site meetings and approval of design variation.

Mayekawa Kunio Associates and Architects & Engineers took charge of design management, architectural design, and environmental engineering as a design firm. Mayekawa supervised in the firm. Furthermore, he inspected and gave directions on the construction site, made the final decisions about important elements, like arches of the sunken garden, sashes, and performed color arrangements. Yokoyama Consulting Architectural Engineers also participated in the project and took charge of structural engineering.

In the construction stage, they performed surveillance by being divided into *Honsha-Kanri* and *Genba-Kanri*. *Honsha-Kanri* (*Honsha* means head office, and *Kanri* means surveillance in Japanese) performed detailed design about unspecified parts, and variation of design in the design office. Two persons took charge of *Honsha-Kanri*. One (A1) took charge of exchanges between Mayekawa or *Genba-Kanri*, and attendance of regular site meetings. The other (A2) took charge of making drawings in response to directions from A1, communicating with A1. *Genba-Kanri* (*Genba* means construction site, and *Kanri* means surveillance in Japanese) resided at the construction site permanently and arranged with the owner, examined and approved shop drawings, construction essentials books, site work management plans, and issued site instructions. Two persons took charge of *Genba-Kanri*. One (A3) took charge of exchanges with the owner or A1, *Honsha-Kanri*, management of the process of making drawings in the design office in order to be sufficient for construction, gave instructions to contractors, and approval of shop drawings. The other (A4) took charge of collation of drawings and execution of work.

From Obayashi Corporation, about 30 persons took charge of site work management. Moreover, a draftsman also resided on the construction site permanently, and drafted shop drawings. Specialist contractors signed the subcontract contract with Obayashi Corporation, and participated in the project. As for this, specialist contractors who collaborated with the architects from

the design stage were also the same.

2.2.2 Building Construction Process

In the schematic design stage, materials and construction methods, which needed collaboration with specific specialist contractors, were chosen (ex. Mayekawa’s Original Tiled Panel System, architectural precast concrete). Therefore, in the design development stage, specialist contractors participated in examination of details, constructability of these materials and forms. Moreover, the architects drafted details with shop drawings.

From the tender stage to commencing the execution of the structural works, the architects explained the design intentions, such as important design parts and cautions on execution of work, for the site work management staff of Obayashi Corporation. Moreover, the architects showed contractors the building that adopted Mayekawa’s Original Tiled Panel System like the Tokyo Metropolitan Art Museum. This was for deepening contractors’ understanding of Mayekawa’s Original Tiled Panel System.

In the construction stage, the owner and persons in charge of *Genba-Kanri* and the site work management staff of the general contractor resided at the construction site permanently. Therefore, daily, whenever a point in question or that needed examining arose, it could be addressed. The contents of the examination by *Genba-Kanri* persons and site work management staff were reflected in shop drawings, and were shared. Moreover, regular site meetings about progress of work, etc. were held once a week, and the owner, the *Honsha-Kanri* persons, the *Genba-Kanri* persons, and the site work management staff participated.

Instructions on changes from the owner, such as use of rooms, were transmitted to the *Genba-Kanri* persons with a change order. The *Genba-Kanri* persons told the *Honsha-Kanri* persons about the changes, and requested additional drawings. The *Genba-Kanri* persons explained the additional drawings to the owner, and they obtained private consent. The *Genba-Kanri* persons transmitted it to the site work management staff.

When a draftsman of Obayashi Corporation and specialist contractor drafted shop drawings, the *Genba-Kanri* persons judged "whether design intentions are correctly reflected in shop drawings", and approved the shop drawings. In some elements, like Weatherability Steel sashes, Mayekawa approved the shop drawings. In addition, the site work management staff checked whether the shop drawings drafted by specialist contractors would suit the construction budget, and the *Genba-Kanri* persons approved them. Moreover, the site work management staff also got the owner’s approval for important drawings, which cost a large amount of money, like of Mayekawa’s Original Tiled Panel

System.

The *Genba-Kanri* persons checked construction essentials books, which contractors summarized before the construction execution, about whether design intentions are achieved when the work is performed. After the *Genba-Kanri* persons’ approval, the work could be started.

Furthermore, the *Genba-Kanri* persons supervised the construction execution of placing concrete. They checked staff charts of site work management staff and checked the test results about forms, steel reinforcement, etc. that the specialist contractors submitted. On the day before placing concrete, the *Genba-Kanri* persons gathered the site work management staff and specialist contractors, and commanded the simulation in order to make contractor’s understanding deepen about roles and responsibilities, procedures and notes. On the day of placing concrete, the *Genba-Kanri* persons checked the time for ready-mixed concrete that was left, and commanded placing concrete.

3. Case2: Project of Murano Togo

3.1 OUTLINE OF RESEARCH

3.1.1 Overview of Object

Murano Togo (1891~1984) is one of the architects representing modernism in Japan along with Mayekawa. He established Murano & Mori Architects in 1929. He designed various buildings both public and commercial buildings, and he was awarded the AIJ Prize for Design three times. While designing buildings with unique details, his knowledge was deep of the Japanese tea ceremony and he also excelled at Japanese-style buildings.

The Kyoto Takaragaike Prince Hotel (1986, the present Grand Prince Hotel Kyoto) is a hotel located in Takaragaike in northern Kyoto. It is one of the projects of Murano’s later years. To attract a summit held in Japan to Kyoto, it was planned as accommodations attached to the Kyoto International Conference Hall. The site area is 29,000 square meters, building area is 7,000 square meters and the total floor area is 37,000 square meters. The number of stories is eight with two basement floors, and the structure is steel-frame-and-reinforced-concrete composite construction. It has a low-layer building, which consisted of curves, and an upper-layer building of an elliptical form. Guest rooms are arranged only on the outside of the passage surrounding a courtyard. Repair work was performed in 2006 and has been used continuously until now.

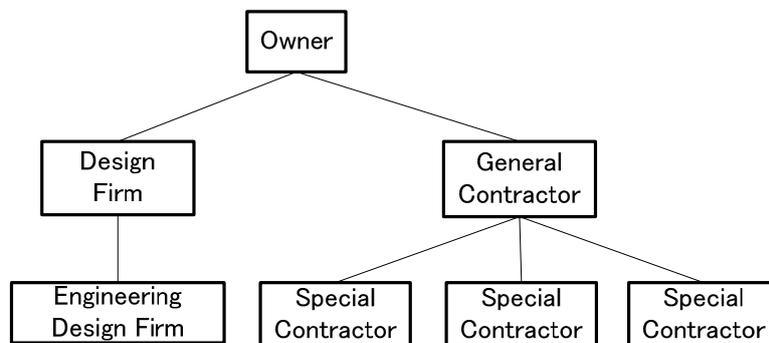


Fig 3 Organizations of the Tokyo Metropolitan Art Museum Building Construction Project



Fig. 4 The Kyoto Takaragaike Prince Hotel

The building elements where collaboration was performed closely on design and construction are outer walls of the low-layer building, on which natural stones were stuck on the three-dimensional phase, ceiling and wall of banquet halls, which are main parts of the hotel, and window sills, which is a characteristic design of the upper-layer building.

3.1.2 Research Method
As with the Tokyo Metropolitan Art Museum, the reasons for choosing the Kyoto Takaragaike Prince Hotel as a subject of research are as follows. First, the preserved data is abundant and can be used. Second, sufficient interviews are possible since architects and contractors who participated in the project are available. With the above, concrete examination was able to be performed regarding collaboration between architects and contractors.

3.2 RESEARCH RESULTS

As with the preceding section, from these two viewpoints, "organizations and sharing roles and responsibilities" and "construction process", I consider the collaboration in the Kyoto Takaragaike Prince Hotel building construction project. First, I show the organizations that participants in the project belong to, and the relation between organizations and sharing roles and responsibilities (Fig. 5). Then, I survey the collaboration in the building construction processes.

3.2.1 Organization and Sharing Roles and Responsibilities

The owner of the Kyoto Takaragaike Prince Hotel building construction project was SEIBU Railway, the architect was Murano & Mori Architects and the general contractor was Takenaka Corporation. Takenaka Corporation also took charge of environmental engineering.

The project was due to be progressed by the design-build process of Takenaka Corporation at the beginning. However, Murano & Mori Architects participated in the project by the requirement of the owner, SEIBU Railway. SEIBU Railway had requested the design of the Prince Hakone (1978) and the Grand Prince Hotel New Takanawa (1982) from Murano & Mori Architects. The general contractor at that project was also Takenaka Corporation.

Murano & Mori Architects took charge of architectural design and structural engineering, and the staff drafted drawings and made scale models as a design firm. Murano himself performed inspection of the site, sketches, drafting drawings, examination of scale models, and arrangements with the owner. A design chief of the design firm, who made concepts about almost all of the projects at Murano & Mori Architects, mediated communication between Murano and architects, and assisted Murano.

In the construction stage, for the *Zumen-Kanri*, five architects participated in the project from Murano & Mori Architects, and they resided at the construction site permanently. At Murano & Mori Architects, some staff who was called *Zumen-Kanri* (*Zumen* means drawings, and *Kanri* means surveillance in Japanese) took charge of drafting architectural drawings, plans for drafting shop drawings and mockups and their examination, and approval and arrangements in the construction stage. An architect, who resided permanently at the Grand Prince Hotel New Takanawa building construction project, played the role of chief of the *Zumen-Kanri*. On the other hand, some in charge of architectural design and structural engineering remained in the office and drafted drawing of unspecified parts under the design chief.

From Takenaka Corporation, about ten architects, structural engineers and environmental engineers, who belonged to the in-house design team of Takenaka Corporation, shared the design from the beginning of the project. Moreover, the chief of the in-house design team of the project of the Grand Prince Hotel New Takanawa (in the following, the New Takanawa design chief) received Murano's offer and participated in the project. He grasped Murano's intentions, and told them to other architects and engineers in the in-house design team.

In the construction stage, the site work management staff included a draftsman, architects, structural engineers, and the New Takanawa design chief of the in-house design team of the general contractor, who resided at the construction site permanently. They examined constructability and compatibility and, drafted detail drawings. Moreover, they judged which parts of the building required time and cost (because the owner might emphasize final performance as important or Murano & Mori Architects might design preponderantly), and which parts could be advanced rationally or should be decided a little early. Then, they managed cost distribution and progress of drafting drawings.

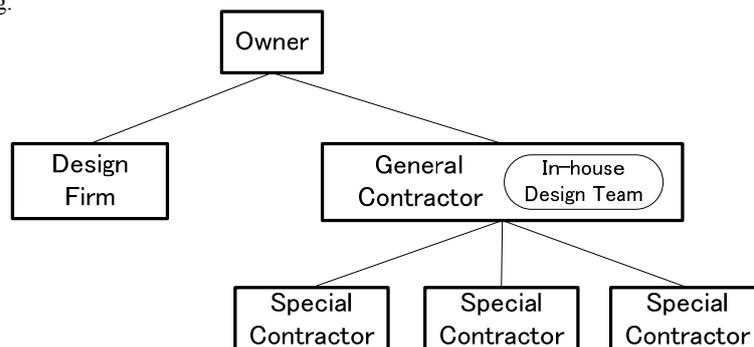


Fig 5 Organizations of the Kyoto Takaragaike Prince Hotel Building Construction Project

3.2.2 Building Construction Process

In the design stage, Murano made sketches and the architects of Murano & Mori Architects drafted drawings, which had scale but not dimension. Moreover, clay models were made and Murano corrected them. The in-house design team of Takenaka Corporation understood these intentions, and they considered the design condition, examined construction methods or cost and then drafted drawings. When there was the necessity for correction of these drawings, Murano & Mori Architects corrected them and also drafted drawings. Such exchanges were repeated.

In the construction stage, the *Zumen-Kanri* persons of Murano & Mori Architects, the in-house design team of Takenaka Corporation and site work management staff resided at the construction site permanently. Therefore, in addition to regular site meetings, they had site meetings almost every morning, and whenever anything disputable arose.

In Murano & Mori Architects, under the design chief, they drafted drawings of portions that were not examined sufficiently in the design stage and communicated them to the *Zumen-Kanri* persons at the construction site. The *Zumen-Kanri* persons interpreted these drawings, put in characteristic details of Murano & Mori Architects, and then drafted architectural drawings. At this time, they consulted with the in-house design team of Takenaka Corporation about constructability, if needed. The *Zumen-Kanri* persons sent architectural drawings and told design intentions to the architects of the in-house design team, and showed details about forms to express and their materials, and how to use the materials (for example, the form of curves of eaves, and the curved surface of marble columns). The elements of buildings, which Murano & Mori Architects designed in the past, were frequently used for illustration. About these, the in-house design team and the site work management staff of Takenaka Corporation examined the most rational methods according to the construction situation, and they selected a specialist contractor based on expertise.

Based on the above examination, or in order to urge examination of parts that should be decided at an early stage, the in-house design team of Takenaka Corporation drafted drawings (full size drawings are included). They also drafted structural drawings considering joints and detailing, and adjusted shop drawings. The draftsman of the general contractor and specialist contractors drafted shop drawings and made mockups if needed. The in-house design team checked them as to whether they reflected design intentions and were achievable. Further, the *Zumen-Kanri* persons checked and examined them and edited the shop drawings and the mock-ups. The above exchange was repeated. The *Zumen-Kanri* persons approved using mock-ups and samples (for example, colors and texture, such as wood and paint materials) in addition to shop drawings. In the case of outer walls of the low-layer building, specialist contractors drafted full-size drawings on the floor of the whole outer walls of the low-layer building, and they placed the actual sandstone material on them, and examined how stones aligned. The *Zumen-Kanri* persons checked this.



Fig. 6 Samples Approved by the *Zumen-Kanri* Persons

4. CONCLUSIONS

This paper examined two construction building projects to show typical methods of collaboration between architects and contractors in Japan. The first case is the Tokyo Metropolitan Art Museum, which was led by Mayekawa Kunio. The second one is the Kyoto Takaragaike Prince Hotel, which was led by Murano Togo. I showed organizations and sharing roles and responsibilities and, building construction process of the both projects.

In the future studies, I will show more details of these projects' building construction process and their features. Moreover, I will examine how these typical collaboration methods have changed in the present day, and what problems have arisen.

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