

A Study on Traditional Carpentry Tool Skills Applied in Restoration of Historical Monuments in Taiwan

* Pen-Shang Hsu **Shang-chia Chiou

- * PhD Candidate, Graduate School of Design, National Yunlin University of Science and Technology
- * Part-time Lecturer, Department of Interior Design, Tung Fang Institute of Technology and Shu Te University
- * * Professor, Graduate School of Design, National Yunlin University of Science and Technology

Abstract

The announcement of the Cultural Heritage Preservation Act in 1982 indirectly triggered the movement of restoration and preservation of historical monuments in Taiwan. At the same time, continuation of traditional carpentry skills was also growing in significance internationally. By studying the history adaptation of tool skills in traditional carpentry, the relationship between engineering techniques and tools used in woodworking and specific questions concerning the historic background and cultural variations (such as regional culture, organization and regulations of craftsman gangs, etc.) can be verified.

Through interviews with traditional carpenters participating in historical monument restoration and analysis of technical approaches and tools adopted in actual projects, the following theory from examination of restoration operations has been established: 1. Advanced machines have replaced traditional skills. 2. Under the impact of technical specialization, traditional all-around tool skills have declined. 3. New building regulations and pay factors have resulted in differences in tool use. Subsequently, based on this theory, this study intends to compile a technical history of traditional carpentry as well as an explication of tools adopted in restoration of historical monuments in the hope of finding new tool skills, engineering approaches and techniques 「adaptation」 to the present day society, in order to reestablish and further develop the practical subjectivity of traditional carpentry tool skills applied in restoration of historical monuments.

Keywords: Taiwan, historical monument restoration, technical history, tools and skills

I. Research Motivation and Purpose

In 1982, the Cultural Heritage Preservation Act was announced, which later indirectly promoted the movement for restoration and preservation of historical monuments. Additionally, the continuation of traditional carpentry skills has experienced a growing trend globally. There is a set of mentoring scheme among the traditional carpenters, which passes down the principle of techniques and skills. By memorizing the housing construction act and rhyming formula, one can be qualified for the task in restoration of historical monuments after accumulating plentiful of construction experience.

Moreover, the restoration for the brick, roof tile, wood, stone sculpture and color painting of the historical monuments relies entirely on handiwork. Only carpenters with extensive art attainment and abundant of practical experience are qualified for the task. Quality of the crafting depends on the familiarization of the carpenters in their handicraft skills. Since every carpenter comes from different craft origins and one master only passes down a type of exclusive instruction, there are different techniques and styles reflected on the construction.

However, the current construction for restoration of historical monuments in Taiwan (which is based on the “Measures Governing Engineering and Procurement for the Restoration of Historic Monuments” established by the Ministry of the Interior) is assigned to the construction firm with the lowest tender. Since there is consideration for cost and profit, the awarded firms frequently will hire non-professional craftsman for the restoration of the historical monuments. Under the situation with strong dependence on machinery tools and quantification of craftsmen, the traditional crafting skills and conveyance of aesthetical technique in traditional tools application have deteriorated.

This research aims at investigating the history for the “application of tools and skills” of the traditional craftsmen by comprehending the *in-situ* construction techniques for the restoration of Manka Qingshan Temple located in Taipei City. In addition, this research will investigate the relationship between crafting skills of historical monuments restoration and tools while also examining the specific questions concerning the historic

background and cultural variations (such as regional culture, organization and regulations of craftsman gangs, etc.). Therefore, there is a reference and investigation for the craftsman training in the hope of finding new tool skills, techniques and “adaptation” to the present society. Furthermore, this research is expected to reestablish and further develop the practical subjectivity of traditional carpentry skills applied in the restoration of historical monuments.

II. Literature Review

2-1 Case Analysis: Manka Qingshan Temple (艋舺青山宮)

The Manka Qingshan Temple in Taipei City geologically located in south and faced toward north direction. The temple is situated not only by the Tamshui riverbank but also in the center of the commercial centre of Gueiyang Street. Besides, the front of the temple is surrounded by rows of town-house building. The temple is structured with a front hall, main hall and rear hall while the entrance is decorated mainly by stone carving. Besides, exquisite carving with granite and basalt can be seen in the temple, which displays a rich Japanese style. The rear hall of Manka Qingshan Temple is considered as an old-fashioned architecture with its pillar, beam, door and window built by wood. On the other hand, the Sanchuan Hall has an octagon coffer with marvelous and delicate carving. Every beam, pillar, door and window in the temple is built by wood which surrounds the atmosphere with archaistic construction. Until today, it has become one of the important conventional temples in Taipei City.

2-2 Organization and Regulations of Craftsman Gangs

Currently, the layout of Qingshan temple is reconstructed during the post war by Wang Shi-Nan, the adopted son of Wang I-shun who was a famous craftsman from the His-Ti clique(溪底派). The main distinctive features of the Sanchuan Hall were the octagon net (八角結網) and the mesh situated under the courtyard. At that time, the temple style was largely influenced by Wang I-Shun of the Hsi-Ti clique who came from China. By examining the construction style of the temple, Qingshan temple is a continuation of the roof design and netting techniques from Manka Longshan temple. The design fully reflected the construction quality and style of the second generation from Hsi-Ti clique during the post war.

The temple style designed by the Hsi-Ti clique has the following characteristics in their construction:

1. “Dou Gong” (斗拱) : There are three unique features for the design of a special arch known as “Dou Gong” from the Hsi-Ti clique
 - (1) “Guan Dao Gong” (關刀拱) with pithy contour is commonly used. The upper edges of the arch interior have pointed design while the lower edges have curling petal design, which reflects the cutting edge of a sword.
 - (2) “Ci Hu Gong” (雌虎拱) which has a gradual arch body, non-contracted entrance and short length at the bottom of the arch is rarely adopted.
 - (3) Interior of the eaves frequently adopts the “Xin Zao Dou Gong” (心造斗拱) which is mainly constructed by double or triple “Tiao”.
2. Meshed “Dou Gong” (網目斗拱) : It is a highly decorated flattening technique by interweaving “Dou Gong” and horizontal beam under the eaves. This will produce the net which covers the open space.
3. “Bu Kou”(步口): The canopy rolling technique is commonly adopted to build the special porch known as space. There is a space between the porch and main area which is known as “An Chu”. Besides, hanging flowers or flower baskets will be placed under the eaves.

2-3 Research Limitation and Scope

The methods adopted for the restoration of traditional historical monuments differ with the different types of damage on the constructions and components. Therefore, the restoration methods implemented are frequently different. According to Professor Ho in his literature titled “Investigation on the Damage Factors and Restoration Methods for Traditional Architectures”, there are five types of construction methods adopted in the current restoration for traditional architectures. Since there is limitation on the crafting tools, this research will focus mainly on the restoration skills and replacement of the crafting tools.

1. Restoration method for the pedestal and flooring.
2. Restoration method for the wooden structure (Fig.1)



(Fig.1) Removal and installation of the beam: Figures showing from the upper left, upper right,

lower left and lower right are “before the construction”, “during the construction” and “after the construction”.

3. Restoration method of the Wall (Fig.2)



(Fig.2) Restoration for the wall: Figures showing in clockwise order are “before the construction”, “during the construction” and “after the construction”.

4. Restoration method of the roof (Fig3)



(Fig.3) Restoration of the roof: Figures showing in clockwise order are “before the construction”, “during the construction” and “after the construction”.

5. Restoration method of the decoration architecture (Fig.4)



(Fig.4) Restoration of the decoration architecture: The left figure shows the wood carving restoration while the restoration for color painting is shown on the right.

III. Restoration skills and tools for historical wooden structure

3-1 Restoration skills for large wooden structure

Before conducting restoration and disassembly for the wooden structure, architects should convene carpenters with different specialties to draft the disassembly plan, explain the disassembly procedures, methodology, and protective means. Initially, fragile parts should be dismantled. Before preceding each task of the disassembly, detailed inspection of the connection and dowel joint should be implemented. Then, the disassembly procedure is recorded by photographing the process. Each component should be numbered orderly for the sake of important reference during the assembly. (Fig.5)



(Fig.5 Qingshan Temple Large wooden structural damage)

1. If the original structure and material of wooden structure are entirely damaged, the components are reproduced according to the original size, connection style, and structure of the worn wooden components.
2. If the original structure and material of wooden structure are partially damaged, the parts are restored according to the regulated restoration methodology.
 - (1) Split handling: The moderate split can be filled by polyepoxide and fixed with iron hoop.
 - (2) Beam cap wrapper: The decayed portion of the beam cap is removed. Then, the beam cap is wrapped and glued to the wood with identical size and material. Before conducting the wrapping procedure, inspection is conducted on the beam cap and connection part. If there is any crack, the component is replaced.
 - (3) Tenon pullout and displacement: During the process of installing the beam frame, adjustment to the correct position is done to treat beam displacement, short column crooked, and tenon pullout. Moreover, bamboo nail or glue can be used to bind the components together.
3. Tiny wood sculpture should be restored according to its original appearance. Currently, the surface of the sculpture can be restored. However, detailed inspection on the sculpture is necessary to check for damages on the connection part.

3-2 Restoration tools

3-2-1 Hand tools

Most of the restoration hand tools are carried over from the ancient time without significant modification. Most of them are designed for functionality of wood sawing, shaving, and connecting. Summary for the analysis is as below:

1. Planer knife (鉋刀 Fig.6)

The planer knife is composed of knife-edge, planer, and platen. Each component can affect the functionality and usage of the planer knife directly. The classification and functionality of the planer knife are listed as following:

- Plane jointer (合刨): To joint boards.
- Long plane (長刨), planer, and block plane: To shave wood, polish, and chamfering.
- Edge-trimming plane(修飾刨): To trim arc, curve, and edge of wood.
- Scraper planer (刮刨): The angle between knife edge and planer is greater than 50 degrees. Use to shave reverse grain wood.
- Straight planer (平線刨): To trim the surface of channel bottom, window frame, sliding door track. Also known as “Che Ku Li” (車庫里)
- Rabbet plane (槽刨): To shave the rabbet line. Adjust the width and depth of rabbet.
- Circular planer (圓刨): To shave protruding or concave line rabbet.
- Sash planer (起線刨): There are various types according to its customization or specific models. It can shave the board for a result which is similar to the machinery-made product.



(Fig.6) Planing tools and the use of the types

2. Saw (Fig.7) Saw the types of carpenter tools and the use of photos

- Bow saw: Commonly known as Taiwanese saw. The saw blade is around 60 centimeters. The wood in the middle of the saw handle is pressed to adjust the angle of bow and blade.
- Pruning folding saw: It is the most commonly saw used in cutting three layers plywood and angle bar.
- Double-sided saw: Commonly known as Japanese saw. It was used in the early time and has saw blades on two sides. It can be used to trim or cut the wood and it produces smooth sawing grain.
- Curved saw: The shape of the saw is long and thin, which is similar to the triangle of sailfish’s mouth. It was used to saw the curved wood board but has been replaced by electrical curved saw.



(Fig.7) Saw the types of carpenter tools and the use of photos

3. Chisel and drill tools (Fig.8)

- Flat chisel: Thick blade. It is used to trim the hole and track. The width of blade can vary from 3mm to 60mm.
- Trimming chisel: Commonly known as “Bei Zai”. (杯仔)The shape is similar to the flat chisel, while the blade is flatter. It is used to trim or shave.
- Chipping chisel: The width is 4 cm and the thickness is 2 cm. The chisel has flat head without blade. It is used to dig through the hole and commonly known as “Tong Zai”. (通仔)



(Fig.8) carpenter chisel tool types and use of photos

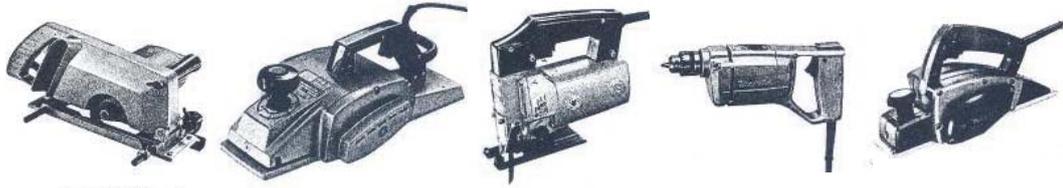
- Inside and outside round chisel: It is used to dig round holes for the interior and exterior.
- Bow drill: It is used to clip the board drill and dig the hole. Some of the functionalities have been replaced by the electrical drill.

3-2-2 Electrical tools (Fig.9)

As electrical tools have evolved into mobile and flexible machinery, they have been widely used in the construction site.

- Mobile round saw machinery: It can be used for many different purposes, especially for cutting artificial board and wood.
- Mobile electrical cutting saw: It has larger saw blade. The blade angle can be adjusted. It is mostly used to trim the board instead of being cutting tool. The adjustable horizontal angle is 50 degrees in left and right respectively. The adjustable vertical angle is 30 degrees upward and downward respectively.

- Mobile electrical line saw: It is not only used for cutting the exterior curved line, but also trimming the interior closed curved line.
- Electrical hand drill: Install the wood nail, metal devices, or drill the hole.
- Electrical planer: It is effective, efficient, and versatile in different tasks.
- Mobile router: It is extensively used in cutting wooden surface and emptying of the closed curved line.



(Fig.9 Electrical tools)

3-3 Restoration procedure

Figure 10 is the refurbishment for the “Pai Lou” (牌樓), “Gui Dai” (規帶), “Cui Jiao” (垂角), “Bu Kou Liang” (步口樑), the coffer exterior, the front hall eaves, and newly constructed frame of Arch truss, “Mu Gua Tong” (木瓜筒). photos of local production in Qingshan Temple.



(Fig.10) Historical monuments repair site restoration in Qingshan Temple

IV. Issue of the Restoration Construction Managed by Craftsman

Construction is a building task with innovative and fictitious operation while restoration is a type of construction service. However, it is a task involves repairing and restoring the original appearance as well as the renovation and reconstructing of the ruined architectures. As the new construction initiated with nothing, the present construction act cannot apply to every construction in the field of restoration for historical monuments. In a new construction, everything is planned and managed. In a new construction, the building plan should be well-planned and design should be flawless. Besides, the building task should be accurate and well-arranged. Then, the workers can carry out their responsibilities and complete the construction. If the materials comply with the construction standard, unwanted incidents can be avoided. By following the prescribed order, the construction will gradually accomplish.

On the other hand, the restoration construction for historical monuments has to face many issues and unpredictable natural phenomenon. As time passes, the historical monuments may encounter environmental factor which changes the appearance of the architectures. For instance, outer force may cause displacement while the materials may experience natural deterioration. Moreover, there are unseen and unpredictable damages which cannot be regulated. During the restoration process, unforeseen changes and unpredictable factors may appear. Hence, the restoration of historical monuments is also known as the “special construction”. The restoration of the historical monuments is the construction which emphasizes the preservation of origins. Additionally, the purpose of restoration is to preserve the tangible and intangible historical value as well as establishing the regeneration of the architecture. Unlike the new construction with predetermined goal and functional plan, the restoration of historical monuments requires the accurate comprehension of ancients’ unique skills. In presence, historical monument is known as “Cultural Heritage” by the professional, which signifies the influence of unique skills. However, the regulations in Taiwan require the constructor to be a certified architect while the tender must be the construction firm. Therefore, the status and mentoring scheme of the craftsmanship have to face different challenges. It is an issue for the researcher to consider restoration of historical monuments as important as the new construction.

V. Conclusion

By investigating the practical experience of restoration for Manka Qingshan Temple in Taipei City, it is noticeable that the government is concerned about profit more than the preservation of crafting skills. Besides, the issues on talent cultivation, continuation of traditional craftsman skills, application of traditional tools, relationship between skills and tools are frequently neglected. Moreover, the quality of skills extensively depends on the operation technique of mechanical tools but not the familiarization of hand tools. This research has concluded the following viewpoints after investigating the issues on preservation for restoration of historical monuments and skills of crafting tools:

1. The advancement in application of mechanical tools has replaced the traditional crafting skills

Since the prosperity of technology, demand for new tools with fast, accurate, and quantification operation has replaced the application of traditional tools. For instance, the shaving and sawing of wooden materials in bulk are previously done by planer knife and manual saw. Currently, it has been replaced with electrical planer and electrical saw. Besides, the measuring tape and laser instrument has replaced the traditional measuring tool known as “Gao Chi” (篙尺) (Fig.11). The manual curved saw has also been replaced by the electrical curved saw while electrical trimmer is used instead of manual trimmer in the present days.



(Fig.11 篙尺)

2. The gradual decline on the specialization of innovative techniques and traditional tools techniques

Currently, the construction of restoration for historical monuments is distributed by the tendering system. Since the construction firm has to consider their profit, the restoration of wooden structure has become the specialization of “quantification of mechanical machinery”. Regularly, the construction is completed by individual operation or specialization of different profession to increase the productivity and reduce the cost. Indirectly, there is gradual decline on the application of traditional skills and hand tools.

3. Construction act and wages factor indirectly caused the difference in tools application

The restoration of historical monuments should allow the craftsmen to undertake the construction instead of subleasing by the construction firm, especially the one-way traditional technical construction such as wooden structure, tiny wooden structure, color painting, crafting, clay modeling, temple painting and pottery art. Subsequently, the craftsmen can make more profit but they relatively have to be responsible for the construction. In addition, the traditional crafting skills and application of tools can be utilized. Thus, the quality of the imitation for the ancient architecture can be improved. If the workload of craftsmen increases, the younger generation will be promoted to join the field. This will allow not only the preservation of traditional skills but also protection against the application and skills for traditional tools. Relatively, the construction skills and quality can be maintained. Furthermore, there will be positive development for crafting tools application in the restoration of historical monuments.

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