THE TECHNICAL HISTORICAL TASK AND APPLICATION FOR THE RESTORATION AND CONSERVATION OF ARCHITECTURAL CULTURAL HERITAGE IN KOREA

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Abstract.

In Korea, the restoration and conservation works for architectural heritage started during the 1970s with the development of economy as a national policy project. The recovery of heritage was only based on the art historical point of view without taking into account for technical studies or investigations. The interest of our own traditional technique was disrespected under the Japanese technology with their historical point of view and after the Korean War (1950) because other urgent duties had to be done. The restoration techniques were depending on some carpenter’s skills. The remaining building techniques were disregarded or ignored with no documentation. With the fast development of the country, mass projects for the restoration of architectural heritage were held but because of the lack of technicians much modern equipments and machines were used.

The basic building technique of Korea is based on the Gyugyojoonseung (4 equipments such as the straight and round ruler, leveling device and black ink device for drawing lines) devices. The traditional methods such as the Joonseung method based on mechanic principles and Gyugyu method based on geometrics were under the shades of the interest towards historical formality and chronicle styles. The craftsman had to neglect the scientific and reasonable way of building techniques to meet the needs of the aesthetical and stylistic point of view.
The traditional techniques are still clearly defined as the technique is inside of the structure which is not exposed. Also for old structures, as the form and structure has been changed during time flow it is more difficult to clarify the original technique. The restoration of architectural heritage is based and decided by the stylistic analysis, structural safety and capability of construction. There are some opinions opposing for the restoration as it is interrupting the current state of the building for its originality. At this point the historical technique is a secondary priority problem. As for the rational realism point of view, the old technique is not important for them and the conservation of the original of the building has had different repairing and interventions throughout the past as a result of neglecting the technical point of view in the definition of originality.

Some opinions for the importance of our traditional technique have been discussed and some of them are now being newly introduced. Some of the technique has been used in the restoration works for the Sungnyemun gate which was burnt down in 2008.

1 INTRODUCTION

Cultural heritage conservation and restoration focused not only for the building or monument but also to the site where it was situated for the historical research and positive material from the end of the 20th century. This theory had the purpose to expand the definition of authenticity of restoration from the development of science and technology with historicity. Some conservators are having doubts about the realistic possibilities of the theory since there are identity and integrity problems. The debate for historical authenticity and consistency has the objective for harmonizing the Anastylosis Method of restoration with modern design. The methodology of cultural heritage restoration has been in great discussions for the past years with the pass of time and physical change.

The restoration works in Korea started from the 1970s when the development of the country was emerging fast as one of the national policy. As it was done with a rapid pace, the procedure of preparation such as research and studies for restoration wasn’t done abundantly with the dependence only on the artistic perspective. Traditional technique was disregarded from the thoughtless and rough restoration works during the Japanese colonial era (1910~1945) with less awareness of historical consciousness and the devastated environment of Korea after the Korean War (1950~1953). It was only used and dependant to some craftsman. The remaining cultural heritage buildings were dismantled without any documentation or surveying of the structure or building technique and the restoration works began to be executed using modernized equipment and machinery as the policy of the government was focusing for the work to be done in a rapid pace in a wide range.

Since the Japanese colonial era, restoration of Korean cultural heritage have lost much of its own structure with changes and removals of building elements resulting in loss of the originality of the monument. Especially the interventions and changes without any documentation work have made it difficult to reveal the original form and made distorted interpretations and social chaos of the authenticity of the building.
2 CHANGE OF PERCEPTION FOR THE RESTORATION OF ARCHITECTURAL HERITAGE

During the early 20th century, Korean cultural heritage had big changes. The Japanese Government-General of Korea (1910-1945) began to start a political investigation of the Joseon (nowadays Korea) historical relics and materials. The investigation was executed for 7 years classifying them in 4 groups (gap, ul, byung and jung)\(^1\). The investigation for the classification of cultural heritage of Korea lead by Dr. Sekino Tadashi (1867-1935) was the base information of the designation for National Treasure and Treasure of Korea\(^2\). The classified relics were the criteria for experimental restoration, demolition, structural change and purpose of use.

The Seokguram grotto in Gyeongju (dismantlement and restoration, 1913-1915)\(^1\) and Pa-goda of Mireuksaji temple site in Iksan (repaired in 1915)\(^2\) are the representative examples of repair and restoration using concrete on stone cultural heritage. The function of the Jinamguan Hall in Yeosu (reconstructed in 1718, 44th year of King Sukjong), a wooden guesthouse for governmental officials during the Joseon dynasty, was changed to an elementary school in 1910 resulting with change of structure and openings. In 1910, Japan’s annexation of Korea was processed resulting destruction and change of function for town walls and governmental buildings resulting lose of originality. Not all, buildings in the Kyungbokgung palace (symbol of the Joseon dynasty) were deformed, relocated and destroyed in 1915 with the reason for the construction of the Japanese Government-General of Korea.

Buildings which were experimentally restored or repaired during the Japanese colonial era are still remaining without any restoration of the original form as there are some problems with authenticity and conservation. The Seokguram grotto in Gyeongju which was restored in 1915 had problems for biological colonization, water leakage and efflorescence etc. It has been continuously repaired from 1917. In 1977, the entrance of the grotto was installed with a glass gate prohibi-
ing tourists to go in the grotto and a HVAC system was installed controlling the environment of the inner grotto. However, there are debate and conservations for safety matters of the relation between the existing cracks and vibration from the HVAC system until present times and there are much critical opinions for it with responsibility matters.

The Jinnamguan Hall (wooden structure) in Yeosu was renovated as a public elementary school removing its walls, studs and sub-girts to make the whole structure opened. It has also removed some inner columns on the side of the building. Nowadays, the majority of people assume that this governmental hall was an open structure with no windows with a form of a pavilion. Structural problems are in bigger risk since the structural acting elements were removed, the building is having serious horizontal load resulting displacement and movement of the whole structure tilting on one side. The Jinnamguan hall has been facing structural problems after the wrong renovation works in 1910 but the issue for this building is to preserve and maintain it at the current state. fig 3 fig 4

fig 3 Current Jinnamguan Hall in Yeosu
fig 4 Traces of the removed wooden elements

There are political and practical issues related with this matter not only for the hall but for various existing buildings for the evaluation and discussion. With the lack of recognition and consideration, there hasn’t been made a standard building/restoration code regarding its structural instability and making a standard rational criteria is essential.

Restoration works for architectural heritage in Korea has been done since the establishment of the Cultural Heritage Act (1962) from the works in Bulguksa temple (1969). Since then the Tomb of Admiral Yi Sun-sin in Asan, Hwaseong Fortress in Suwon, Haengjusanseong Fortress in Goyang and recently the Temple Site in Neungsan-ri were restored. Restoration works nowadays are being done indiscriminately without a logical reason or enough historical research. The object of it differs from purpose and principal agent with critical opinions from the academic authorities. At first, these restoration works were done in a national state with the purpose to endure the patriotic spirit of the people, but as it is now done the local government by state, the purpose is more to expand it to a touristic resource.

The first restoration work was done in Bulguksa temple in 1969. It was done from 1969 to 1973 as one of the government priority of interest. As it was the first example of restoration after the independence of Korea, many experts were in confusion and tension since there wasn’t much historical evidence or study done for the restoration given the limited time. As a result, the remaining ruins of the base and arch type stairs were repaired and reorganized and each wooden
structure was reconstructed according to the plan. The restoration works in Bulguksa temple was an example of admitting the limitation of historical research for the realistic and practical decision, leaving an opportunity for raising the problems of authenticity for historical sites.

The restoration work in Bulguksa temple was repairing and restoring the remaining stone infrastructure like the Cheongungyo and Baegungyo Bridges (National Treasure No.23). Buildings were built like the Bumyounglu and Jwakyunglu with galleries in the Joseon architectural style. As the buildings that were restored were different styles with the remains, cultural heritage restoration raised the need for a co-operative excavation and historical research for the importance of maintaining the historical authenticity. Though the restoration work done in Bulguksa temple gave importance for excavation and historical research, the work wasn’t done idealistically. Excavation and maintenance are still separately considered in architectural sites nowadays and the historical drains and remaining site is normally buried and a new site is built on top of it. fig 5

fig 5 Bulguksa Temple before restoration (Joseon old picture book)  
fig 6 Bulguksa Temple after restoration

Starting from the 1980s the restoration project started for the Joseon palaces which were destroyed and damaged during the Japanese colonial era. The most damaged Changgyeonggung Palace was restored from 1985 to 1986 and Gyeonghuigung Palace from 1988 to 2002. The Changdukgung Palace was restored to its original form (1991–2004) and the Kyungbokgung (1st 1990–2009) and Deoksugung (2004–2015planned) is ongoing.

After the local self-governing system was introduced in 1995, the local authorities have given various types of restoration forms for historical sites depending on their point of view of cultural identity. The Namhansanseong Fortress (1998–now) is being restored with the purpose to enhance the cultural pride of the local people and use it as a touristic resource. The historical site park construction of the Imyeonggwan Guesthouse in Gangneung (1999–2006) and restoration of the Jeju-mok Government Office are also one of the similar examples of local government projects. As one of the Baekjae culture maintenance project, the East stone pagoda of the Mireuksa temple site in Iksan was restored in 1993.

In the 2000s the Protection of Ancient Cities Act (2005) was legislated and restoration projects for individual/separate buildings became mega projects for the maintenance and restoration plans of historical ancient capital cities in Gyeongju, Buyeo, Gongju and Iksan. The purpose is to pre-
serve the ancient city and recover the scenery. As a current project, the Hwanglyongsa Temple Site in Gyeongju, Mireuksa Temple Site in Iksan and Junglimsa Temple Site is being done.

From the start of the restoration in the 1960s until nowadays, restoration of cultural heritage sites/buildings were proceeded by government policy. A policy for the restoration was set first and the selection of the style (dynasty, form and size etc) of the site/building was selected and designed according to it. This type of restoration is a form of stylistic restoration focusing on the historical event or outcome not giving importance in the technological history of architecture. Thus it is more to achieve visible success to the policy than preserving the historical authenticity of the site/building.

Political restoration of sites/buildings is focusing on the complete form of a specific era. The research for historical evidence is not being taken into account seriously. Partial restoration and conservation of the remains are easily neglected for the reconstruction of a complete form. The structure of the restored building is focusing on the actual structural stability not the historic technical evidence. Effort to preserve the remaining original particles for its structural stability and partial restoration depending on historical research for the consistency of history and syntactic restoration is not being attempted.

3 PRESENT SITUATION AND ISSUE

The Sukguram Grotto in Gyeongju was firstly dismantled and restored in 1915. It was reinforced with concrete on the exterior of the dome but faced problems like high humidity, biological problems (moss) and leaching of cement which had to have continuous repair works from 1917. Effort for the conservation environment was executed from 1917 to 1923 with 3 attempts for installing waterproofing layers and maintaining the drainage system. The 4th repair works was done from 1964 to 1966 installing an additional reinforced concrete dome outside the existing concrete structure and HVAC system. For the big noise and vibration from the HVAC system and existing cracks on the rocks, there were doubt and criticism for the structural safety of the

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3 Selecting a specific time, normally the golden age of the site/building, neglecting the evolution of architectural history
grotto form the 1970s until now. The monument is being structurally analyzed and monitored from 1997 until present times.

The Sukguram Grotto in Gyeongju was first found with a partially damaged dome in 1909. Documents with information of the original form or building technique could not be found. When the grotto was restored by Japanese experts, they used concrete imported from Japan. It is quite clear that the monument was experimentally restored.

The restoration of the Sukguram Grotto using concrete has faced various raise of problems and repairing for its conservation environment, structural stability and vibration etc. Now grotto is being divided by a glass window with limited access of people for viewing. The inconvenience of viewing and restriction of access is due to doubts of structural safety and this problem is still being raised. A structural analysis and monitoring is being done continuously but some opinions are also negative for the methodology of monitoring and made the situation even worse. As an alternative for such controversy, there are some plans to make a replica named as Sukguram Grotto 2.

The Stone Pagoda at Mireuksa Temple Site in Iksan was also reinforced with concrete like the Sukguram Grotto in Gyeongju. The stone pagoda was constructed during the reign of King Mu (600–640) of Baekjae as a 9 storied structure and collapsed in the 17th century only until the 6th floor remaining. The exact cause of collapse has not been revealed until now and the damaged slope was reinforced with concrete in 1915. The reinforced concrete was dismantled and removed for 3 years (2002–2004) with the amount of 180t.

The way and methodology of the removal of the concrete and restoration of the stone pagoda had many debates in different perspectives. There were opinions to remove the covered concrete as the reinforcement done in 1915 was an uncivilized way of strengthening the structure as there was lack of historical consciousness. On the other hand, some were supporting the methodology since using cement/concrete at that time was an appropriate and advanced way of stopping the collapse of the structure as the material was an innovative new material for construction.

With a main 2 point of view towards the stone monument, there are also worries for the structural stability. The pagoda has been having serious structural problems since the material was highly weathered and weak. It was also tilting to 1 side which made an unstable structure. The pagoda took a safety inspection in 1997 with people insisting that the concrete which is bonding with the original stone material is having originality problems since it doesn’t match with the original form. The results of the monitoring were reported 4 times to the cultural heritage committee. The committee recommended a careful attitude towards the dismantling process with various methods for the documentation of each building element and plan for the restoration of the building according to it.

The dismantlement and restoration of the Stone Pagoda at Mireuksa Temple has groped problems and directions for the whole of cultural heritage restoration. Through the dismantling process, research historians revealed that the cause of collapse of the pagoda wasn’t because of heavy rain or thunder storms. Currently the study of the cause of the collapse of the monument is being done using various ways and theory by Reverse engineering and case studies of other brick/stone pagodas which were affected by the earthquake and other natural disasters.

The dismantlement and restoration project of the stone pagoda was firstly 3D scanned for the documentation and actual survey, analysis of the material properties such as compressive strength, specific gravity and surface weathered condition etc. Through using the 3D scanner, the dimensions of the stone pagoda could be analyzed precisely for the mechanical property of the structure knowing the proportion of each element and this was reflected in the plan of restoration. Various
tests were done like the test for bearing power of soil for basic stress calculation, bonding methodology for the broken elements and analysis of the relation between surface friction between materials according to its roughness of the surface. However the decision of the design for the previous north and south side where concrete was bonded has not been made. The 3rd floor of the stone pagoda had an exact plan for restoration.

The Jinnamguan Hall in Yeosu, a wooden structure, has had continuous repair works from 1964 and a structural monitoring was done from 1990. A precise actual survey was carried out in 2001 with a dismantlement and restoration design plan. However there were some questions for the restoration of the building since it is a wooden structure which isn’t considered to be too serious and the range of restoration wasn’t decided.

The structural monitoring for the hall had been done from 1995 and the decision for restoration was approved through the cultural heritage committee. According to the data through structural monitoring, the building was facing dangerous problems as the building aren’t bonded well enough and joints of the structure were missing.

4 COLCLUSION

The restoration works that were done by the Japanese experts during the early 20th century has given us many problems and lessons. The restoration works that were done in the 1970s were done too fast in proportion of the developing speed of the economy with lack of research and experience, structural principle and building technique.

The cultural heritage that were restored in the early 20th century are still having many problems without recovery for its structural instability and inappropriate environment. Reinforced structures using concrete are having problems for its reversibility for its original form and the deformed shape has now become as it was the original shape distorting the architectural history for their function, form and structure.

In this condition the priority for the restoration and preservation of Korean architectural cultural is to research and study for the technical history. Through the research it could be possible to reveal the actual structure and function. It will extend for the solution for future conservation.

Restoration and conservation was mostly based on the stylistic and anastylosis method. In the syntactic point of view with advanced modern technique, much discussions and studies should be done for a practical and continuous design for restoration.

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REFERENCES
