A Study of Techniques for Moving Traditional Buildings
and Their Role regarding the Historic Preservation Movement in Taiwan

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Abstract
The concept of saving a building from destruction by moving it is nothing new. But with creative thinking and passion, traditional techniques have played a new role in Taiwan. This study reveals that both "Community Development by Participation" and the "Historic Preservation Movement" between the 1980s and 1990s offered the opportunity for the transformation of techniques for moving endangered buildings. The reasons for their success are not only the fostering of a subjectively supportive atmosphere, but also the advantages offered by the techniques themselves. Based on low-tech and economical principles, moving buildings became an acceptable alternative to demolition. Moreover, its participation-friendly character also encouraged citizens to become actively involved in the building-moving process. Thus, building-moving techniques have played an important role in the historic preservation movement in Taiwan over the past ten years by, among other things:

1. The establishment of a participatory platform: The application of the available techniques provided opportunities for negotiation and communication between private and public sectors. With this advantage, the crisis of demolition was delayed, while the participatory platform was taking shape.
2. The concept of "Temporary Revitalization": As the technology to move buildings expanded, the concept of extracting a building from the threatened site and then returning it to its original location emerged. Between removing the building and replacing it, its "revitalization" as a temporary exhibition space providing a window for future development was invented.

Keywords: building-moving techniques; historic preservation movement; participatory platform; temporary revitalization

1. Introduction
The moving of buildings has been practiced in many parts of the world for centuries. One can find its use from villages of Southeast Asia (Fig.1.) to Continental America (Fig.2.). The original reasons for moving buildings were basically practical and financial¹. It was often simpler and cheaper to move a building, or buy one from your neighbor, than to build one from scratch. Meanwhile in Taiwan (Fig.3.), the reasons were not limited solely to economics. There were two additional reasons; one was Fengshui² and the other was the dividing of inherited property. Traditionally, people believed in a connection between a family's prosperity and the orientation of the residence. When a family encountered serial misfortunes for no apparent reason; it called for the opportunity to adjust the orientation of the house. Building-moving techniques were employed also in the dividing of inherited properties. The main building would be moved to the eldest son's property.

This study represents the first review of building-moving in Taiwan. The moving of buildings in Taiwan

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has been a common practice since the end of the nineteenth century. Its development can be traced in four periods. These are "the formative period", "the developing period", "the peak period", and most recently "the transforming period" (Table 1.).

During the formative period, the building types associated with the activity were single-storey bamboo, wood, or brick houses. Later on in the development period, because of problems of subsidence along the coastal plain, there were increasing needs for elevating the buildings. Situations of this type provided the opportunity for building-moving techniques to be further developed. In the 1970s, the Taiwanese government launched the so-called "Ten Major National Development Projects". The planned national highway system necessitated the moving of buildings and the building-moving trade reached its peak period at this time. The types of building that were moved also expanded from single-storey brick houses to include multi-storey reinforced concrete buildings.

Table 1. Development of Building-moving Activities in Taiwan Based on the Authors' Field Studies

| Periods               | Main Factors                        | Building Types                        |
|-----------------------|-------------------------------------|---------------------------------------|
| Formative period      | 1. Cherished resource                | Residential Building types:           |
| (1890s)               | 2. Fengshui                          | Construction types: Bamboo, wood, brick.|
|                       | 3. Division of inherited property    |                                        |
| Developing period     | Compensating for ground subsidence   | Residential Building types:           |
| (1906–1970)           |                                     | Construction types: Bamboo, wood, brick.|
| Peak period           | Major public developments            | Residential, temples                  |
| (1971–1977)           |                                     | Construction types: Brick, RC.        |
| Transforming period   | 1. Community developments            | Residential, institutional             |
| (1997–recent)         | 2. Historic preservation             | Construction types: Wood, brick, RC, steel.|

Following the abolishment of martial law in 1987, a democratic political system was implemented in Taiwan. There was an increasing opportunity for public involvement that allowed ordinary people to release their long-suppressed civic voice. In the early 1990s, the government advocated the concept of "community development by participation", and tried to establish a new mechanism for the decision-making process by encouraging dialogue between the private and public sectors. Almost at the same time, "the cultural heritage preservation law" was amended, which helped to increase the momentum of the urban preservation movement. Under the influence of these two movements, the designation of historic buildings flourished, and issues such as the conflict between urban development and historic preservation were re-evaluated. The traditional building-moving techniques were increasingly considered in such meetings as alternatives to demolition. This made historic preservation the main factor in the decision to move buildings during the transforming period. The building types involved switched from residential to institutional during this later period.

The objective of this paper is to investigate the following questions: How did the moving of endangered buildings revitalize itself and find a new role under the influence of the historic preservation movement in Taiwan in the 1990s? And, how does the historic cityscape benefit from these activities? Two key aspects are discussed with reference to a number of cases: First of all, what concepts influence the formation of the building-moving decision? And secondly, what role do building-moving techniques play during the decision making process?

2. Building-Moving Techniques - A Retrospective

Before discussing further the relationship between the moving techniques and historic preservation, it is necessary to identify the principles and characteristics of traditional building-moving techniques.

In a traditional agricultural society, the demand for building-moving was unstable, and the moving teams were randomly organized. Since the accumulation of experience depends on practice, the development of the technique was a slow but steady process. For example, because of considerations of Fengshui, developments in "orientation adjusting" techniques were emphasized during the formative period. In the developing period, however, the ground subsidence problems caused "elevating" to be the main concern. Thus, by the end of the developing period, the techniques required for physically moving a building such as raising it on its foundations, changing its compass orientation or transporting it to another site were already developed.

According to our field survey, the process of moving a building and the tools used can be described as follows: They are "reinforcing", "separating and lifting", "moving", and "positioning" (Fig.4.). To successfully implement a project, four different sets of equipment need to be utilized. They are the "reinforcing devices" of Step 1, the "jacking equipment" of Step 2, and the "rollers and traction device" of Step 3 (Table 2.).

![Fig.4. Building-moving Process](image-url)
Step 1 - Reinforcing
Lumber and rope were used in the early years. Lumber was positioned along the inner and outer walls approximately 45cm above the ground floor of the structure. It was then lashed in place with rope and further tightened with smaller wooden sticks that twisted the rope to reinforce the building and to prevent it from cracking or falling apart during the moving process (Fig.5.). Later on during the peak period, RC and steel reinforcements were substituted for wooden ones.

Step 2 - Separating and lifting
First, the structure is separated from the ground, and then jacks are put underneath the lumber, elevating the structure to the required level to accommodate the rolling device beneath. Hand operated jacks have been slowly replaced by computer-controlled jacks.

Step 3 - Moving
Two devices are used in this stage: one is the rolling device, and the other is the traction device. The rolling system consists of three elements: a layer of wooden planks to provide a smooth surface along which the building can be moved, a row of round wooden rollers, and a pile of wood blocks and bricks for supporting the structure above (Fig.5.). The traction device consists of two elements: a rope connected to the building, and a wooden capstan called a Chia-Tau or Ma-Que for pulling the building to the designated location (Fig.6.). As a later development, steel rollers replaced easily worn wooden ones, and the manually operated capstan or Ma-Que was replaced by a machine-powered winch.

Step 4 - Positioning
This step prepares a new site for receiving the relocated building.

Carefully examining the development of building-moving techniques, one finds that there are two particular characteristics in the materials used. First of all, unit materials such as wood blocks, bricks, and wooden rollers are utilized. By their very nature they are convenient to transport and easy to replace. They can also be easily adapted to various conditions on the site. Secondly, the lumber, etc. is lashed to the building using ropes. These are reusable and easily tied and untied with high efficiency. The only drawback from today's viewpoint was its labor-intensive character. Thus, later developments were aimed towards low replacement rate (i.e., durable materials), ease of installation, cost-effectiveness and high performance materials, at each of the four-steps in the moving process (Table 2.). All these changes reflect the social and technological progress in society. However, the basic four-step process remained unchanged and its form today could still be recognized by previous generations. To summarize, the techniques are by nature economically viable and low-tech, but highly compatible in a variety of situations. These characteristics made an important contribution to the historic preservation movement later on.

Table 2. Development of Building-moving Devices

| Evolution of devices |
|----------------------|
| 1. Reinforcing devices |
| Lumber | RC beam |
| 2. Jacking devices |
| Screw | Hydraulic | Computer-controlled |
| 3. Rolling devices |
| Wood rolling set | Steel rolling set |
| 4. Traction devices |
| “Chia-Tau” | “Ma-Que” | Machine-driven winch |

Fig.5. Reinforcing & Rolling Devices

Fig.6. Traction Device-“Chia-Tau”
3. Case Studies

Based on the above-mentioned characteristics, how does the building-moving technique play a role during the decision-making process of preservation and thereafter during the moving process? These issues will be further discussed in the following case studies.

The four chosen case histories all took place in the 1990s. Each represented different problems of local development. They are, in chronological order: the Wang-Kun Temple in Erh-Chieh, 1997; the School of Pharmacy Building, NTU, 1999; the Old Hsin-Hua Town Hall, 2000; and the Kao-Hsiung Railway Station, 2002 (Table 3.).

3.1. Case Description

(1) The moving and preservation of the Wang-Kun Temple:

The Wang-Kun Temple is a traditional temple with brick walls and a wood framed roof and was a popular place of worship for the local people. With a total area as small as 335m² and out-of-date facilities, the suggestion for a new temple to honor the Gods was proposed by the Temple's administration. However, the community organized opposition to the demolition of this historical religious center. Design and the public sectors became involved and finally reached an agreement with the local community to build a new temple as well as to keep the existing building. In order to make way for the new building, the old temple needed to be moved. Since this was the first example of saving an historic building by moving it, the challenges were multiple. First of all, the decision-making process had to follow the traditional method that was manipulated by a small group called the "Representatives of the Temple". Decisions were made through rituals to get the consent of the Gods. However, concerned citizens wished to challenge this method by promoting community participation. Thus, the community developing organization was formed and it became the debating platform concerning these issues. The possibility of keeping the old temple and constructing the new addition was discussed, and the reuse of the old temple as a community cultural center was also considered. Secondly, during the discussion on how to relocate the building, two techniques were brought to the table; dismantling and moving intact. The moving technique was chosen because the new location was only 160m away and by moving, most parts of the building could be kept intact. Most importantly, the technique was easy to understand as well as cheaper and faster in execution. This decision made the fundraising easier, especially from the public sector. The Council for Cultural Planning and Development recognized the concept and subsidized 156 thousand dollars for the moving activity. The "thousand-people-temple moving" activity was then planned to encourage the participation of the general public in the saving of the old temple. The activity was successful, with two sides once opposed to each other standing side by side and pulling the ropes together (Fig.7.). This was the first time in Taiwan that the traditional building-moving technique was used to save a public building of historic value. Its special character also drew the attention of the media. The event was highly publicized through TV and newspapers and it became a nationally well-known historic preservation event. Furthermore, it influenced the preservation debate in other areas thereafter. The same concept was applied elsewhere and valuable experiences were accumulated through time.

(2) The moving and preservation of the School of Pharmacy Building, NTU, Taipei:

 Built in 1930 with a floor area of 450mm², this two-storey brick building was the only building from the School that survived from the Japanese colonial period (1895-1945). Due to increasing demands for research space, the low-rise historical building was to be replaced by a proposed 13-storey research center. The proposal and blue prints were brought to the Executive Committee of Taipei Urban Design and Land Use Development Council. After a long discussion, the proposed design was passed with the stipulation that the oldest building in the school should be saved. The Council recommended that the experience gained from the Wang-Kun project be implemented. The architect was requested to make appropriate design changes to coordinate with the new requirements of the school, and the old building was moved 22 meters north to make way for the new research centre.
The moving and preservation of the Old Hsin-Hua Town Hall:

Built in 1934 with a floor area of 235m$^2$, the site of this one-storey reinforced brick building was planned to become an underground parking structure by the Hsin-Hua town planning committee. The building permit had already been granted and it seemed too late to have the building saved, but concerned citizens asked the team from the National Yunlin University of Science and Technology for assistance.

Based on the Wang-Kun experience, the team proposed to adopt the moving technique with new imagination. The building was to be first pulled out, and after the underground car park was constructed, to be pulled back to its original location. During the discussion, the major problem was how to persuade the town mayor to change his mind without challenging his authority. By carefully planning the moving activity, the media showed the mayor and volunteers pulling the building together. The atmosphere was filled with joy and excitement, and portraying the officials in a very positive way earned the love and respect of the citizens. The town mayor not only saved face despite not keeping his original decision, but also won the admiration of the public. Moreover, this was the first time in the history of building-moving activity in Taiwan that a building was removed and replaced on the same spot. During the one-year construction period, an exhibition was mounted in the moved building to display the moving events and the future development of the site.

The moving and preservation of the Kao-Hsiung Railway Station:

Built in 1941 with a floor area of 650m$^2$, the site of this two-storey reinforced concrete building was planned to be the terminal for three new major transportation developments. The railway station is the gateway to the city and as such it bears the collective memory of both citizens and travelers.

A planned budget to preserve and reuse the station was sponsored by the public sector. A committee consisting of city officials, scholars, professionals, and concerned citizens was organized. The decision was made to pull out the main structure and to put it back after completion of the new construction. The old station was reused as the venue for the "Windows of Kao-Hsiung" exhibition during the eight-year-long waiting period. This not only lit up the darkness of

| Table 3. Case Analysis |
|------------------------|
| **1. Wang-Kun Temple** | **2. School of Pharmacy Bldg.** | **3. Old Hsin-Hua Town Hall** | **4. Kao-Hsiung Railway Station** |
| Bldg. Year & Scale | 1929, 335 m$^2$, 1F | 1930, 450 m$^2$, 2F | 1934, 235 m$^2$, 1F | 1941, 650 m$^2$, 2F |
| Bldg. Type | Religion | Educational | Institutional | Transportation |
| Construct. Type | Wood & Brick | Brick | Reinforced Brick | RC |
| Challenge | Traditional concept of new is better | Demand for more space | Zoning changed to parking | Terminals of 3 major transport projects |
| Strategy | a) Community Develop. By participation b) Introduce Moving Technique c) Introduce reuse d) Promotion | a) Design Review Board ask for Saving of Building b) Follow Wang-Kun Experience | a) Provide Financial Aid b) Moving Act. As Healing c) Promotion d) Pull out & back e) Exhibit/Wait | a) Public Sector takes lead b) Detail Plan. Before Act. c) Promotion d) Pull out & back e) Exhibit/Wait |
| Moving Path | Move 160m South, Rotate 180° | Move 22m North | Rotate several times, Move 310m away & back | Move 85m away & back |
| Budget | 156,000 Dollars | 438,000 Dollars | 156,000 Dollars | 3.3 million Dollars |
the construction period, but also provided a showcase for the citizens to envisage the future development of this area (Figs. 10. and 11.). A Japanese construction company that originally built the old railway station executed the moving project and a Japanese moving technique was utilized. The main difference between the Japanese and the Taiwanese approach was the rolling device (Table 2.). The Japanese rolling device consists of a set of steel rolling bars on top of a row of steel tracks. Two layers of steel tracks were then laid between the building and rolling bars. The Japanese method is more precise but costly. Because of previous experience and sufficient planning time, detailed planning was possible. It covered all the events including media promotion and citizen participation prior to moving (Fig. 9.), observation facilities during moving, and the design and construction of the "Windows of Kao-Hsiung" exhibition after the initial move.

3.2. Case Analyses

3.2.1 Challenges of preservation

Based on the above description, one could see that the challenges of each case varied from one another, including:

(1) Respect to the Gods. In the case of Wang-Kun Temple, the worshipers believed that a newer and bigger temple would pay more respect to the Gods. Thus, it is common to demolish an old temple and build a new one. This has been a major challenge to the preservation of historic temples in Taiwan.

(2) Functional change or shortage of space. In the case of the School of Pharmacy Building, the original function was no longer viable and the floor area was seriously inadequate. To build a new one was a reasonable decision.

(3) Re-zoning problem. In the case of the Old Hsin-Hua Town Hall, the concept of urban planning was basically development-orientated. Thus, new developments such as widening roads or re-zoning areas as new parking zones became the destroyers of historic buildings.

(4) Major public developments. In the case of the Kao-Hsiung Railway Station, when major projects such as highways or transportation terminals are realized, whatever comes into conflict with the new development will be demolished.

3.2.2 Formation of the building-moving decision

Facing these challenges, we should further analyze what concepts influenced the formation of the building-moving decision? Secondly, what roles do building-moving techniques play during the decision making process?

There were three major factors that influenced the formation of building-moving decisions, including: introducing the concept of "Community Development by Participation"; the influence of the historic preservation movement; and the role of traditional building-moving techniques. These are explained as follows:

(1) Introducing the concept of "Community Development by Participation". The traditional decision-making process entrusted to a small group of Representatives of the Temple was changed. By introducing both the concept of "Community Development by Participation" and building-moving techniques, the case of Wang-Kun Temple in Erh-Chieh successfully balanced the old and the new. Furthermore, this experience became the reference model for other cases with similar problems.

(2) Influence of the historic preservation movement. The historic preservation movement influenced the above-mentioned cases in different ways. One of them was through the advocacy and assistance of both scholars and professionals, such as in the case of the Old Hsin-Hua Town Hall. The other was through the recommendation of the urban design review committee, such as the case of the School of Pharmacy Building. Another one was through cherishing the urban collective memory, such as the case of the Kao-Hsiung Railway Station. Through these analyses, one can understand that due to the influence of the concept of preservation, the endangered historic buildings had a second chance. The public sectors, on the other hand, took prior experience seriously and were willing to provide a budget for an overall planning scheme in advance. This move further magnified the effect of these preservation activities, and promoted a new aspect of urban redevelopment in Taiwan.

(3) Role of traditional building-moving techniques

1) The available techniques were an advantage in
negotiation. The building-moving techniques were available and moving was more economical than the construction of a new structure. Thus, it was more favorable and had become an alternative to demolition during the demolition-preservation debate.

2) The techniques were participation-friendly. There are two special characteristics of building-moving techniques. First of all, the process is easy to understand. The equipment used, such as jacks for lifting or rollers for moving, were easy for the layman to relate to daily experience. Thus, it was easier to gain support during the communication process. Secondly, it is also easy to accommodate new events. The third step of the building-moving procedure, the moving step, was suitable for community participation. With careful planning, the techniques and the concept of preservation were brought together through the action of hand-pulling the building by the community.

3) The moving activity became the focal point of the media: It is actually quite a peculiar activity. In addition, the festival-like event draws attention from the mass media, especially if the building is controversial. That is why this kind of activity was essential in almost every case. Through massive media coverage, it not only deepened the concept of preservation, but also stimulated a sense of glory in the participants' hearts. Identifying with one's own community was further strengthened by the visible spectacle and personal participation.

4) Establishment of on-site preservation. In the cases of Hsin-Hwa and Kao-Hsiung, the techniques not only preserved the historic buildings, but also had the capability to move buildings back to their original locations after the completion of underground construction. The building-moving activity evolved through the practice of several examples, from merely saving buildings by relocating them, to preserving them by pulling the building back to its original location. This was the progressive contribution of the techniques.

4. Conclusion

The development of the building-moving trade went through the formative period, the developing period, reached its peak period in the 1970s and then declined. The study reveals that both the "Community Development by Participation" and the "Historic Preservation Movement" between the 1980s and 1990s offered the opportunity for transformation of the endangered building-moving technique. The reason for its success is not only because of the subjectively supportive atmosphere, but also because of advantages offered by the technique itself. Based on its low-tech and economical nature, it became an acceptable alternative during demolition-preservation debates. Moreover, its participation-friendly character also encouraged citizens to join in the building-moving process. Thus, building-moving techniques have played an important role in the historic preservation movement during the last ten years including:

1. The establishment of a participatory platform.

2. The concept of "Temporary Revitalization". The experience was accumulated and transformed through the practice of various cases. The concept of reuse was first introduced for the revitalization of the relocated Wang-Kun Temple. With increased capacity of the building-moving techniques, the concept of pulling the building out and then back to its original location then arose and was executed in the case of Hsin-Hwa and Kao-Hsiung. Here we encountered the darkness of a waiting period for the new construction. In between pulling out and putting back, the "Temporary Revitalization" period was invented. Taking the preservation of Kao-Hsiung station as an example, through careful planning, the old station was transformed as "Windows of Kao-Hsiung" during the eight-year-long waiting period. The future perspective of this area was presented to the citizens through an exhibition. Created by traditional building-moving techniques, the concept of "Temporary Revitalization" is a true vernacular experience regarding preservation activity in Taiwan.

In short, the concept of saving a building from destruction by moving it is nothing new. But the low-tech nature of the Taiwanese building-moving technique provided the possibility for participation.
With creativity and passion, it played a new role in local redevelopment under the dynamic social conditions of the 90s. Two benefits were created. On the one hand, it softened the conflict between the conventional idea of development and the trend towards preservation. On the other hand, it awakened people's enthusiastic participation in their environment and preserved the collective memory of a city.

Acknowledgments
The sources of images shown in the text are indicated as follows:
1) Fig.1. see Reference 3.
2) Fig.2. see Reference 1.
3) Figs.3., 7. and 8. provided by Mr. Chih-Jan Lin.
4) Figs.4., 5. and 6. drawn for this article.
5) Pictures in Table 2. and Table 3. provided by Mr. Chih-Jan Lin.
6) Drawings in Table 2. and Table 3. drawn for this article.
7) Fig.9. provided by Kao-Hsiung City Government.
8) Figs.10. and 11. provided by the author.

Notes
1) The relocation of buildings has been part of Indonesian indigenous culture for centuries, and also a common occurrence in the United States since the late 18th century. The fact is that it was frequently easier to move a building than to construct a new one.
2) Based on an interview with the building-moving industry, concern for Fenshui is one of the most significant factors in the early period.
3) They are the National Highway, the Taichung Harbor, Nuclear Power Plant, etc. Based on an interview with the building-moving industry, there were about 40 building-moving companies at that time. The number of companies declined to around 15 after 1977.
4) The period from the mid-1980s to the early 1990s is more like a precursory stage. After the mid-1990s, because the government started to carry out community participatory policies and attempted to make participatory community design more popular in Taiwan.
5) The law was enacted in 1982, and first amended in 1997. After a 15-year-long implementation, the concept of historic preservation has become more popular than before, especially concerning urban redevelopment.
6) Membership of the temple administration is an honorable position. It normally consists of senior members or persons of virtue and prestige in the community.
7) The average price charged by local companies ranged from 500 US Dollars/m² – 1,000 US Dollars/m². While the average price of Japanese companies was about 5,000 US Dollars/m².

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