buildings

MDPI

Article

Historical Study and Conservation Strategies of "Tianzihao" Colony (Nanjing, China)—Architectural Heritage of the French Catholic Missions in the Late 19th Century

Yinghan Li, Xuanfan Li, Qiaochu Jiang and Qi Zhou *

School of Architecture, Architectural History and Theory, Southeast University, Nanjing 210096, China; 230179004@seu.edu.cn (Y.L.); 220160019@seu.edu.cn (X.L.); 230198410@seu.edu.cn (Q.J.)
* Correspondence: 101001781@seu.edu.cn

Abstract: The "Tianzihao" colony was built by the French Jesuits in the 1890s. As one of the earliest examples of the French Catholic Church's mission in China, as well as the only case in Nanjing, it shows the historical scenes of Western missionaries in Nanjing 120 years ago. It is a demonstration of cultural exchanges between China and the West after China opened to the Western world in the late 19th century. In architectural style, the "Tianzihao" colony is Western-style townhouses, but a large number of traditional Chinese architectural technologies were used for it, and therefore it is characterized by Western space and Chinese technology. The "Tianzihao" colony was badly damaged during these decades, with a lot of decayed building materials and structures on the verge of collapse. Based on the historical research and technical analysis of the "Tianzihao" colony, this article explores the conservation strategies and methods of reusing the architectural heritage. In addition, this article is to study the characteristics of the times before introduction of Western architectural technology in Nanjing based on an analysis on the building technology used for the "Tianzihao" colony. The authors participated in the conservation and restoration project of the "Tianzihao" colony, and the objective of this study was achieved through some qualitative methods, including collection and analysis of archival data, analysis of old maps and photos, architectural mapping and a large amount of historical information found in the conservation process.

Keywords: modern architecture; architectural heritage; architectural conservation; Catholic architecture; architectural technology

Citation: Li, Y.; Li, X.; Jiang, Q.; Zhou, Q. Historical Study and Conservation Strategies of "Tianzihao" Colony (Nanjing, China)—Architectural Heritage of the French Catholic Missions in the Late 19th Century. *Buildings* **2021**, *11*, 176. https://doi.org/10.3390/buildings11040176

Academic Editor: Paula Lopez-Arce and Ainara Zornoza-Indart

Received: 29 March 2021
Accepted: 16 April 2021
Published: 19 April 2021

1. Introduction

The "Tianzihao" colony is the legacy of the French Catholic Church, which preached in Nanjing in the late 19th century. As the only complete diocese remaining in Nanjing, it consisted of churches, residential townhouses, commercial spaces, public venues and streets (Figure 1). We completed an in-depth historical study of the "Tianzihao" colony through investigation, mapping, and renovation. Research on the "Tianzihao" colony, which is located in a city significant in Chinese history—Nanjing—is helpful for us to draw a clearer picture of the activities of Catholicism after its return to China at the end of the 19th century.

In 1599, Matteo Ricci (S.J) (1552–1610, was an Italian Jesuit priest and one of the founding figures of the Jesuit China missions) first came to Nanjing for preaching [1]. In the late 17th century, however, due to the official ban of Imperial China, open Catholic missionary activities in China were interrupted and many foreign missionaries were expelled. Preaching activities could only be carried out secretly. It was not until the mid-19th century that Catholicism resumed its official mission in China [2]. The "Tianzihao" colony, built upon the return of the Catholic mission after its 150-year-long interruption, is proof of cultural exchanges between China and the West when China opened its door to the Western world in the late 19th century. Catholic missionaries brought new architectural

styles and technologies, and at the same time made some changes in the living patterns and life concepts of the Chinese people at that time.

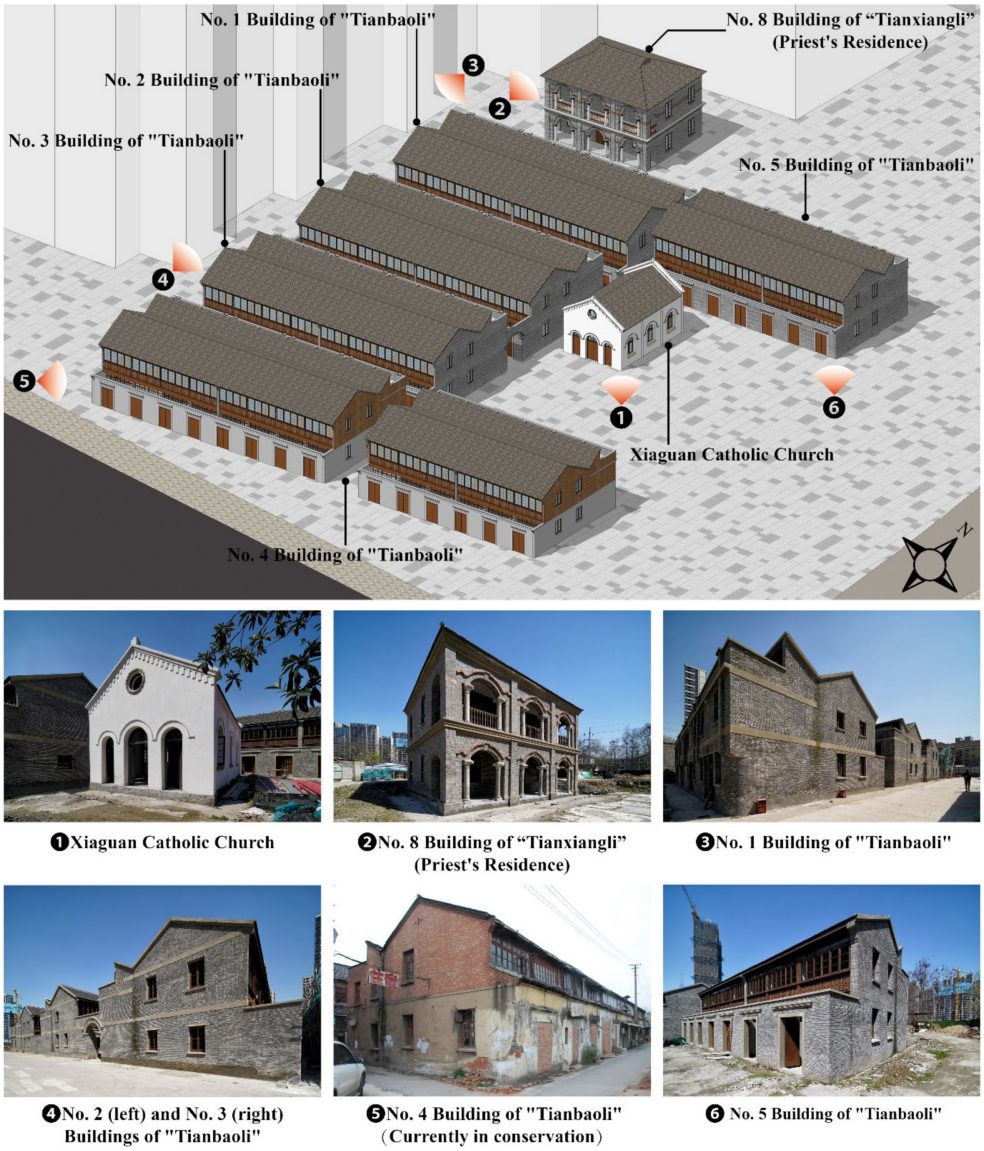

Figure 1. Composition of the "Tianzihao" colony.

After detailed investigation and research on the "Tianzihao" colony, we recorded the authenticity information of its buildings and streets in terms of space, scale, construction technology, and technical characteristics. And through our efforts in protection and renovation, "Tianzihao" will be adapted to a place fit for modern life while its historical authenticity most well preserved.

1.1. Literature Review

Historical buildings take up a large proportion of the existing buildings in Nanjing. When it comes to their conservation and retrofitting, many issues should be taken into consideration. It is essential to seek balance among strategies such as heritage restoration, re-functionality, and energy retrofit to ensure that the unique aesthetic, historical, and architectural value and the precious materials of architectural heritages are not damaged when the functions of historical buildings are changed to meet current and future needs.

Nanjing is one of the cities with the largest number of architectural heritages in China. The Chinese government conducted three nation-wide surveys of modern architectural

heritage in 1991, 2006 and 2012, and created the Conservation Lists of Outstanding Modern and Contemporary Architectures as a reference for the conservation, retrofitting, and renovation of modern architectural heritage [3]. More than 1500 historical buildings in Nanjing are included in those lists. Both the Chinese government and society attach increasing importance to the conservation of modern architectural heritage.

As the efforts of China's architectural heritage conservation continued, the issue of "authenticity" in architectural heritage conservation aroused widespread discussion. Architectural heritages included in the conservation lists are strictly protected by law, which leads to many restrictions in their retrofit design. Based on the requirements of China's cultural heritage administrations, the authenticity of historical buildings must be preserved and restored to the best it can be, which leaves little room for change, especially in terms of re-functionality and consolidation of the architectural heritage. However, from a forward-looking perspective, appropriate retrofitting of architectural heritages is essential.

China was a late starter in the theoretical research of architectural heritage conservation, and the building conservation charters of the West were not based on the wood structure system of East Asia. Therefore, Western theories and methods sometimes may be inapplicable to the practice of architectural heritage conservation in China. Given this context, this article focused on strategies and methods applicable to the conservation of the authenticity of Chinese modern architectural heritage based on a case study of the renovation of the "Tianzihao" colony.

In 1931, the Athens Charter for the Restoration of Historic Monuments raised the issue of historic buildings and sites' protection [4]. As the first internationally recognized programmatic document for the conservation of architectural heritage, the Athens Charter clearly pointed out that the preservation of ancient buildings that represent a certain period of time and have historical value is of educational significance for future generations. Some basic conservation principles and measures were also determined in the document.

In 1964, ICOM promulgated the International Charter for the Conservation and Restoration of Monuments and Sites in Venice, Italy, also known as the *Venice Charter* [5]. The *Venice Charter* extended the concept of historical monuments, emphasized the importance of the conservation of historical environment, and expounded on the basic concepts, theories, and principles of historic monuments' conservation. Serving as the universal guidance to the conservation of cultural heritages in all countries even in present days, the *Venice Charter* has been playing a positive role in facilitating the conservation of China's architectural heritages.

In 1994, UNESCO, ICCROM and ICOMOS jointly promulgated the *Nara Document on Authenticity* in Japan. The *Nara Document on Authenticity* is conceived in the spirit of the Charter of Venice, 1964, and builds on it and extends it in response to the expanding scope of cultural heritage concerns and interests in our contemporary world [6]. The *Nara Document on Authenticity* extended the concept of "authenticity" from the perspective of diversity based on the culture and characteristics of Oriental wooden architecture. It advocates that "all judgements about values attributed to cultural properties as well as the credibility of related information sources may differ from culture to culture, and even within the same culture. It is thus not possible to base judgements of values and authenticity within fixed criteria. On the contrary, the respect due to all cultures requires that heritage properties must considered and judged within the cultural contexts to which they belong [7]".

In 1982, the Chinese government promulgated the Law of the People's Republic of China on the Protection of Cultural Relics, which was the first law on the protection of cultural relics after the founding of the People's Republic of China [8]. Article 21 stipulated that "the principle of keeping the cultural relics in their original state shall be adhered to [9]", but did not specify the concept of "the original state".

In 2000, ICOMOS China promulgated the Principles for the Conservation of Heritage Sites in China, a standard document for the conservation of Chinese heritage. It was based on the *Venice Charter* of 1964 as well as the specific context of and the accumulated experience in the conservation of Chinese cultural relics and historical sites [10]. The

Principles for the Conservation of Heritage Sites in China elaborated on the "principle of authenticity", pointing out that the purpose of architectural heritage conservation is to preserve as much authentic historical information and related values as possible in a comprehensive manner.

In 2007, the China State Administration of Cultural Heritage, ICCROM, ICOMOS, and UNESCO jointly released the *Beijing Charter* during the International Symposium on the Concepts and Practices of Conservation and Restoration of Historic Buildings in East Asia [11]. The *Beijing Charter* inherited and enriched the idea of cultural diversity on the basis of a series of international architectural heritage conservation conventions. In line with the essence of the *Venice Charter*, the *Beijing Charter* established relevant guidelines for the conservation and repair of wooden structure-based cultural relics of the Orient, contributing to the standardization of the conservation of wooden structure cultural relics in China and the entire East Asia.

In 2015, ICOMOS revised the *Principles for the Conservation of Heritage Sites in China*. On top of putting emphasis on the historical, artistic, and scientific value of architectural heritage, it included in the research results and practical experience of architectural heritage conservation across the world [12]. It incorporated the Oriental wood structure system as a unique component into the study of international architectural heritage conservation, and also evaluated the restoration techniques for traditional Chinese ancient architecture. The revised principles emphasized the importance of proper use of traditional restoration techniques on top of approving their applicability. It also recognized the reasonable part of the traditional restoration techniques for the Oriental wood-structure system and the differences in restoration methods due to the different nature of the architectural materials.

Chinese scholars have done plenty of research on Western-influenced architecture built after 1840. The book series *Study and Preservation of Chinese Modern Architecture* by Professor Zhang Fuhe from Tsinghua University collected a large number of articles and case studies related to the conservation of modern Chinese architectural heritage, in which China's efforts in architectural heritage conservation were summarized and analyzed in detail [13]. Another important book in this regard is *Introduction to the Protection of Historical Cities-An Integrated Approach to Cultural Heritage and Historical Environmental Protection* by Professor Zhang Song of Tongji University [14]. The book sorted out and analyzed the definition and scope of historical protection, elaborated in a comprehensive way on theories and practices of cultural heritage and historical environment protection, and introduced theories and laws of architectural heritage protection in other countries.

Many scholars have conducted research on modern architectural heritage in different regions of China, and summarized the ideas and technologies in the conservation of different types of architectural heritages. Despite the fact that consensus has been reached in many aspects based on the study of the theory of architectural heritage conservation by Chinese experts and scholars, disputes still remain over the determination of authenticity and its protection methods in the practice of architectural heritage conservation.

1.2. Aims and Methodology

This article focused on strategies and methods applicable to the conservation of the authenticity of Chinese modern architectural heritage based on the case study on the renovation of the "Tianzihao" colony in Nanjing, China. The authors participated in the conservation and restoration project of the "Tianzihao" colony. Based on the historical research and technical analysis of the "Tianzihao" colony, this article presents an in-depth study of the "Tianzihao" colony through investigation, technical analysis, mapping, and conservation.

Also, this article is to study the characteristics of the times before introduction of Western architectural technology in Nanjing based on an analysis on the building technology used for the "Tianzihao" colony. The aims of this study was achieved through some qualitative methods, including collection and analysis of archival data, analysis of

old maps and photos, architectural mapping and a large amount of historical information found in the conservation process.

1.3. The Historical Background of the "Tianzihao" Colony

The "Tianzihao" colony is situated in Xiaguan, Nanjing. Nanjing, located in East China and the lower Yangtze River (Figure 2), has been the political, economic and cultural center of southern China since ancient times. It is the former capital of China. Xiaguan is located in the northwest of Nanjing City, with the Yangtze River in the west and the Huimin River in the east. Historically, it referred to the riverside area along the Nanjing City Walls outside the Yijiang city gate and near the entrance of Huimin River (Figure 3). It was a wasteland outside the city until the end of the 1840s. Xiaguan became the site for the port opening of Nanjing in modern times. Foreign powers built docks along the river in Xiaguan successively, and Xiaguan became the distribution center of Nanjing for the export and import of Chinese and foreign goods, and rapidly developed into one of the most prosperous areas in Nanjing. Subsequently, the Shanghai–Nanjing railway and the Jin–Pu railway opened to traffic successively, thus making Xiaguan a national hub for land and water transportation.

Figure 2. Location of Nanjing.

The "Tianzihao" colony is the outcome of Imperial China's forced opening to the outside world after the 1840s. Xiaguan witnessed the beginning of modern Chinese history. In 1840, Imperial China was defeated in the first Opium War with Britain [15]. Representatives of the two sides negotiated in Jinghai Temple in Xiaguan (Figure 3). On 29 August 1842, the first treaty in defeat in the modern history of China–The Treaty of Nanjing between China and Britain—was signed on the HMS Cornwallis, a British warship [16]. This is the starting point of modern Chinese history. After that, foreign forces began to enter the

ancient feudal empire. The United States, France and other countries followed Britain. Imperial China was forced to sign a series of treaties with them, by which the countries enjoyed privileges similar to Britain. During the process, religion, as an important carrier of ideology, was repeatedly emphasized in a series of treaties [17]. The restrictions on Western missionaries were gradually cancelled, and missionary activities, which had discontinued since 1724, were restarted.

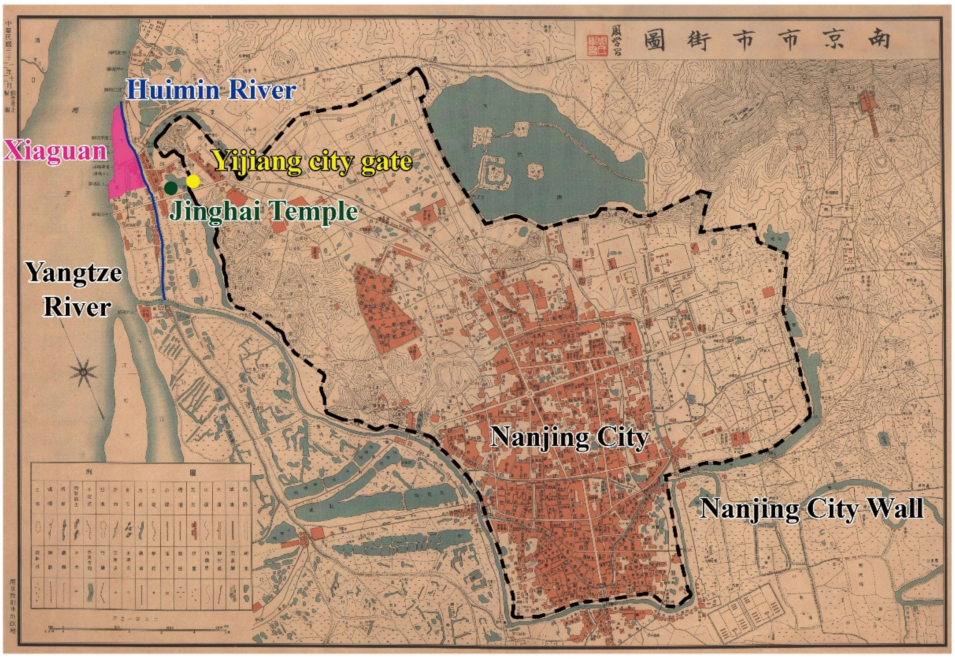

Figure 3. Location of Xiaguan (Map of Nanjing City in 1941).

In 1844, the Treaty of Whampoa between France and Imperial China was signed, and the French obtained the right for religious protection (the right and obligation of the secular authorities granted by the Holy See to protect the spread of Catholicism in non-Catholic countries) in China. According to the treaty, "France may establish Catholic churches and cemeteries in the trading ports. The Imperial China has the obligation to protect the churches" [18]. In 1856, the Vatican entrusted the Jesuits of Paris province to take over the Apostolic Vicariate of Jiangnan, which was restructured based on the Diocese of Nanjing, with jurisdiction covering the Jiangsu and Anhui provinces [19]. In 1858, the Treaty of Tianjin between France and Imperial China was signed. Based on the treaty, the right of France for religious protection was further strengthened [20]. Xiaguan, Nanjing, was designated as one of the trading ports. (In fact, Nanjing did not officially open its port until 1899 for the influence of an anti-government war) In the same year, the Holy See tacitly recognized the right of France for religious protection. However, the two sides had disputes concerning how to deal with religious property in China, as well as the right to administer the missionary area in China. This lasted until 1888 when the Propaganda Fide of the Holy See issued a circular letter to all foreign missionaries in the Far East, ordering them to obtain passports and supplies from France [21].

On 17 June 1865, Adrien-Hyppolyte Languillat (1808–1878, a French Jesuit. In 1856, he was appointed as bishop of the Southeast Apostolic Vicariate. In 1864, he was transferred to the Jiangnan Apostolic Vicariate), the bishop of Nanjing Diocese, and Adrien de Carrère S.J. (1864–1868, a French Jesuit), a priest, arrived in Nanjing by the French warship Tancrede and met Li Hongzhang, the viceroy of Jiangnan Province and Jiangxi, for a discussion on the restitution of property that had once belonged to the French Catholic Church [22]. Li Hongzhang said, "The Nanjing Catholic Church can get an equivalent piece of land outside the city as compensation, but the old religious property inside the city must be given up". Adrien de Carrère S.J. insisted on claiming the ownership of old religious

property inside the city, and at the same time, he bought a large area of land on the west side of Xiaguan Avenue (Figure 4). In 1890, the French Jesuits began to build a Catholic church on the land.

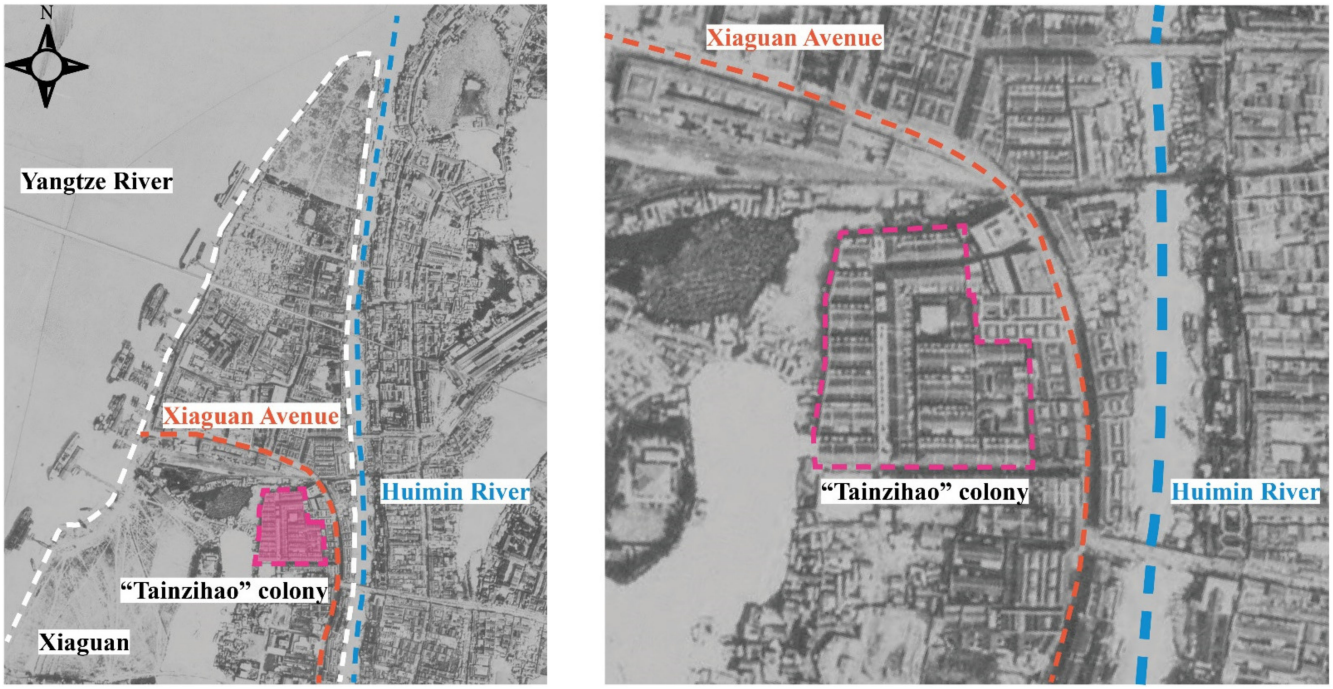

Figure 4. Aerial images for Xiaguan and the "Tianzihao" colony of 1929.

According to the book "Ten-year report of Jinling Customs (1892–1901)" of Jinling (Nanjing) Customs (In 1899, Nanjing opened its port and established the Jinling Customs. Robert Hart, the British Inspector General of Customs, appointed Francis Arthur Aglen, an Englishman, as the Jinling Customs Revenue Officer), by 1901, the French Catholic Church had "113,631 believers baptized in Jiangsu province, of whom 29,490 were Protestants". . . . "The church recently acquired a real estate of considerable size in Xiaguan, which extends to the edge of Xiaguan Avenue (Xiaguan Avenue was the first road in the modern sense of Nanjing. It was built in 1895), and in the near future, there will be an excellent building lot [23]".

1.4. The Construction History of the "Tianzihao"Colony

Just as expected by the Jinling (Nanjing) Customs, around 1916 the French Jesuits began to construct around the completed Xiaguan Catholic Church and built over 10,000 square meters of Western-style brick–wood structure townhouses, which were rented to the poor and refugees who believed in Catholicism (Figure 4).The alleyways of these residences were numbered, and so there appeared many names containing "Tian" that are still in use today, such as "Tianbaoli" (meaning "God's bless"), "Tianxiangli" (meaning "Auspicious God"), and "Tianguangli" (meaning "God's light") [24]. The French Catholic Church also set up schools, infant care centers, and a printing house to serve the missionary activities, thus greatly expanding the influence of Catholicism in Nanjing.

From 1937 to 1949, the War of Resistance against Japan and the War of Liberation broke out successively. As an important shipping hub and military port on the Yangtze River, Xiaguan became a hotly contested fortress during wars. By the end of the war of liberation in 1949, the Tianzihao colony had been severely damaged. A comparison of aerial images taken in 1929 and 1976 showed that several buildings in the north and center of the area were destroyed, and buildings in the surrounding area were also damaged extensively (Figure 5). In 1951, all the foreign missionaries in Nanjing were expelled from China [25], and Xiaguan ended its history as a site for a trading port opening. In the

following decades, once-prosperous businesses in Xiaguan became increasingly depressed. The social structure of the "Tianzihao" colony changed greatly. A previous concentrated area of believers was becoming the residence of ordinary people.

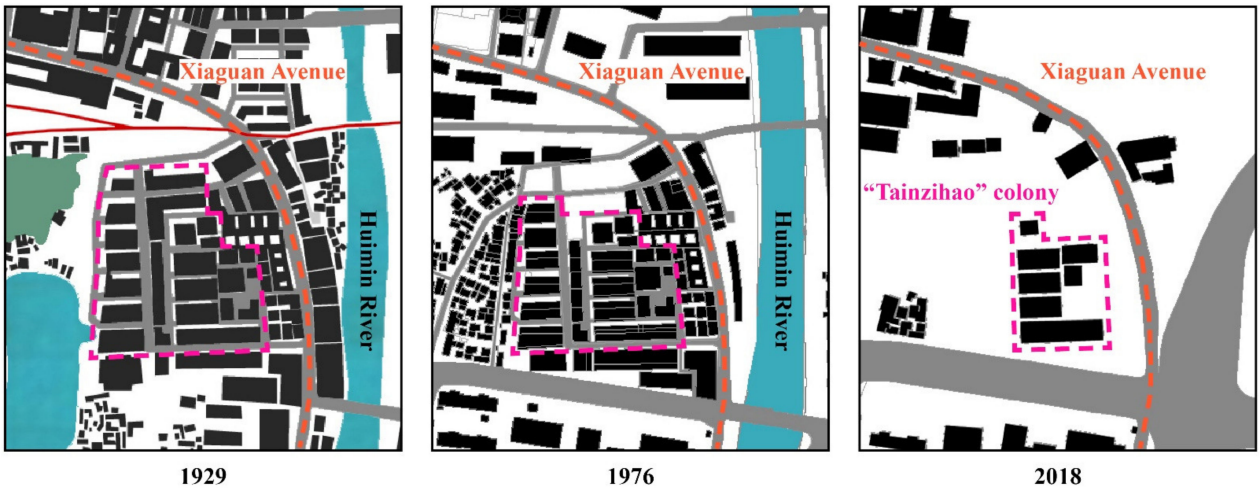

Figure 5. The changes of buildings in the "Tianzihao" colony from 1929 to 2018.

By the end of the 1970s, the whole colony maintained the spatial form in 1949 generally. After the 1980s, with a new round of urban construction, large-scale demolition and reconstruction were carried out in the area of Xiaguan Avenue, and the urban fabric changed greatly (Figure 5). Only seven buildings remained in the Tianzihao colony: Xiaguan Catholic Church, No. 8 Building of Tianxiangli (Priest's Residence) and five Tianbaoli townhouses, which were listed as immovable cultural relics after the third national survey of cultural relics conducted in 2008. After the residents in the colony were relocated in 2013, the buildings were dilapidated and badly damaged. Since 2017, we have begun to rescue, protect, and study the "Tianzihao" colony. By now, the project for conservation is in a construction stage.

2. Case Presentation: The "Tianzihao" Colony

The "Tianzihao" colony is arranged along the north–south direction, with a total construction area of 4888 square meters. The existing seven buildings are all of brick–wood structure. It is surrounded by five "Tianbaoli" townhouses and the No. 8 Building of "Tianxiangli" (Priest's Residence) with the Xiaguan Catholic Church as the core (Figure 6). For the existing architectural texture, spatial pattern and facade modeling, the original historical appearance of high artistic value has been generally preserved.

The Xiaguan Catholic Church was founded in the 1890s. It is of high architectural grade, although its volume is the smallest. There is a small square in front of the building for the convenience of congregations. The Xiaguan Catholic Church has a single-story pitched roof, with two traditional Chinese wooden trusses of supporting beams and four columns inside (Figure 7). For the building, the depth is 10.3 m, width is 6.9 m, and the floor area is about 77 square meters. The main entrance to the south facade is made up of three arches (Figures 8 and 9), with circular rose-like windows above the main entrance, of which the outline borders are beautifully designed and crafted.

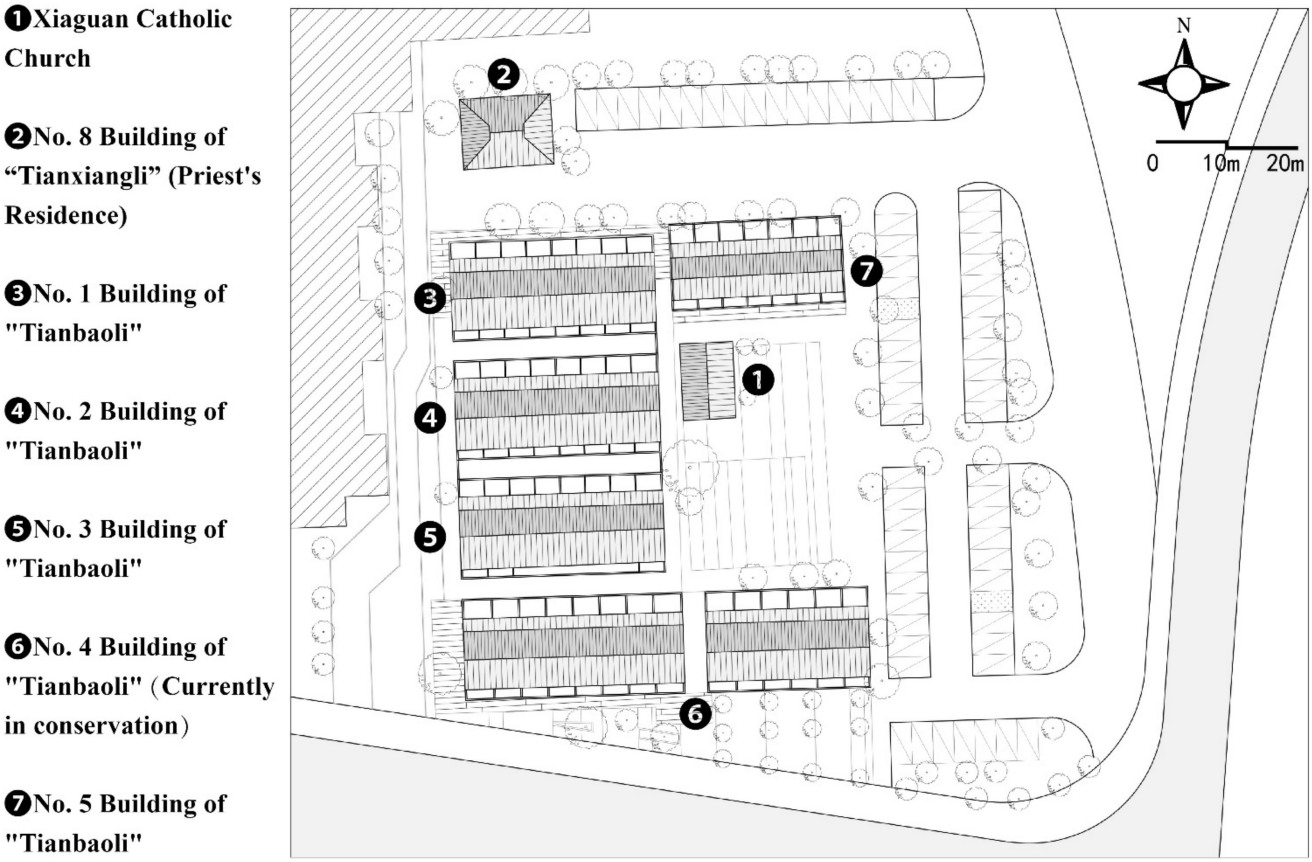

Figure 6. Site plan of the "Tianzihao" colony.

The No. 8 Building of "Tianxiangli" (Priest's Residence) and five "Tianbaoli" townhouses were established around 1916, and so the scale of missionary work in the Xiaguan Catholic colony began to increase greatly at that time.

The five "Tianbaoli" townhouses were the dwelling places for ordinary believers at that time. They are of pitched roof with two floors, and the roof trusses are traditional Chinese wooden trusses of supporting beams (Figures 10 and 11). For each building, the plane is of different length. The houses are divided into 6 households, 8 households, and 14 households according to the standard unit of 3.7 m wide and 14 m deep (Figure 12). The width of the lane between the buildings is about 2.5 m (Figure 13), and there were gates at the end of both sides, which could be closed to outside for safety (Figure 14). Before conservation, only door holes were left. The main structure of buildings in the "Tianzihao" colony was relatively intact, but all kinds of building components had been seriously damaged, and for most buildings the plain brick wall facades had been covered with cement mortar by former residents.

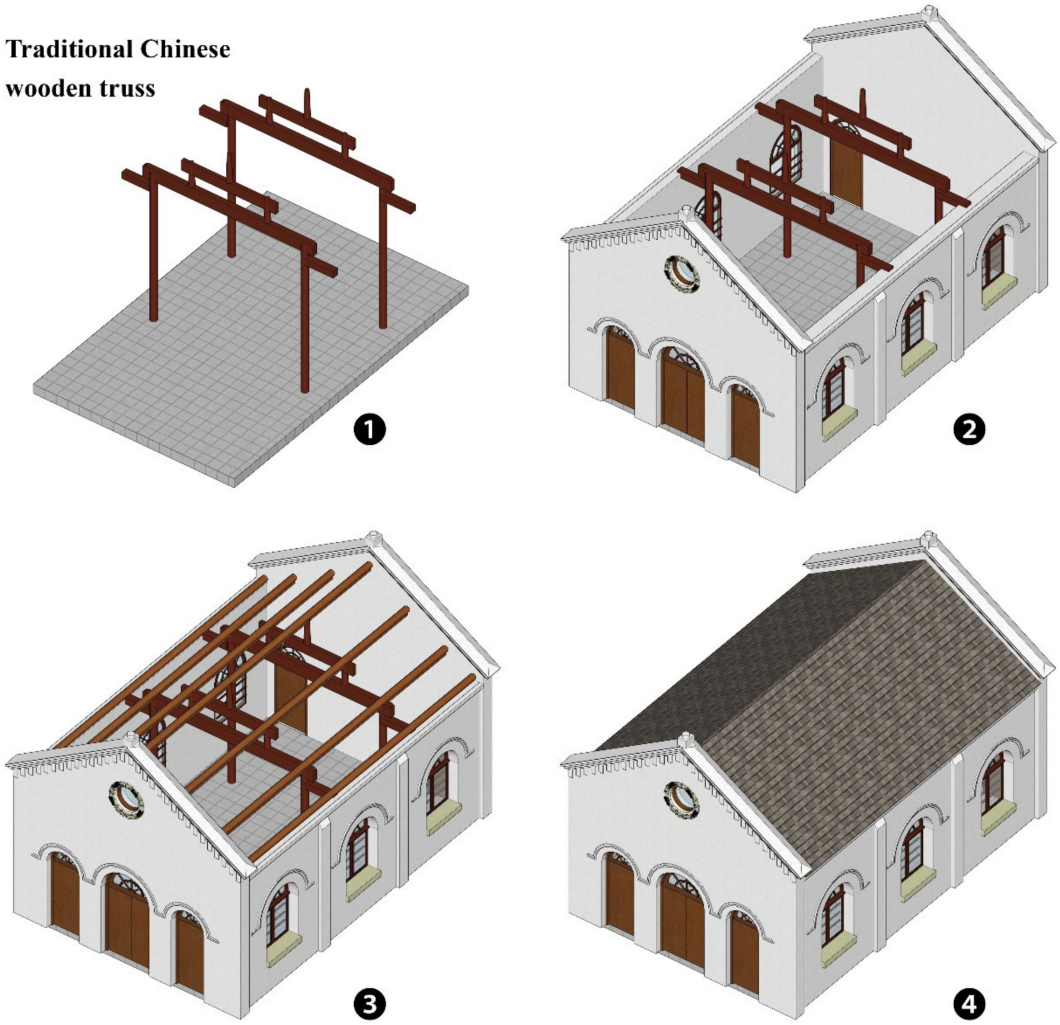

Figure 7. Diagram of the church.

Figure 8. Xiaguan Catholic Church (south facade).

Figure 9. East facade of the church.

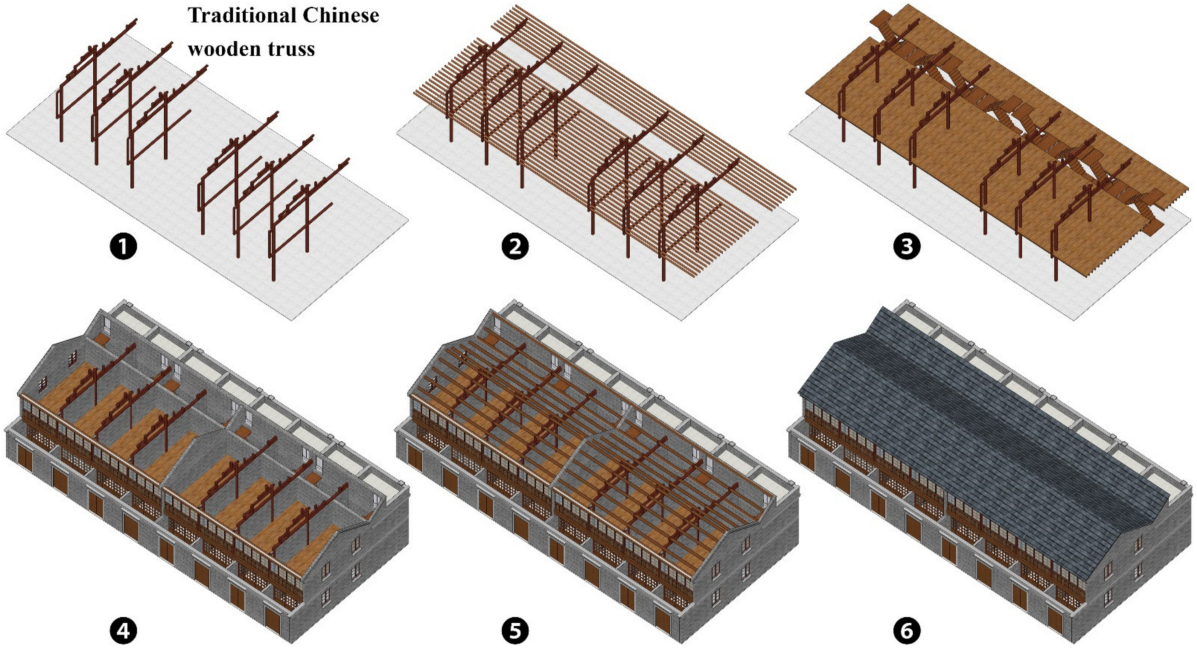

Figure 10. Diagram of the No. 1 Building of "Tianbaoli".

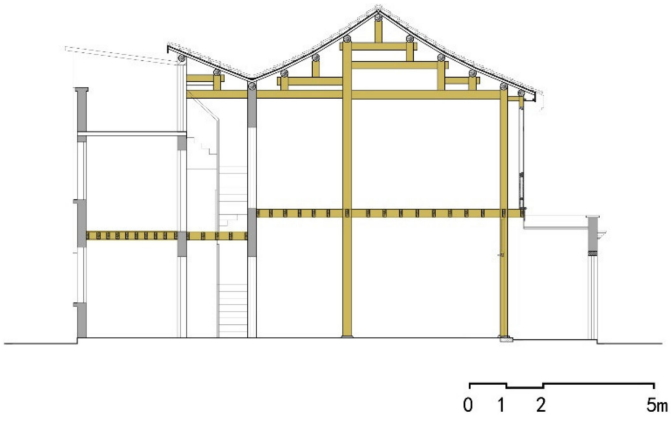

Figure 11. Section of the No. 1 Building of "Tianbaoli".

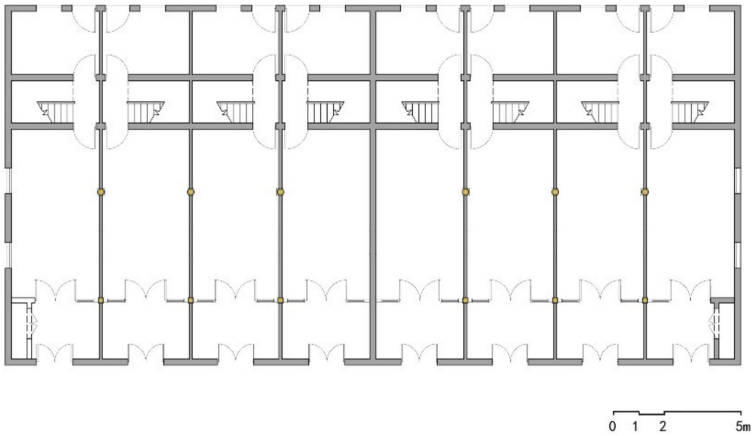

Figure 12. The first floor plan of the No. 1 Building of "Tianbaoli".

Figure 13. Buildings of "Tianbaoli".

Figure 14. The No. 2 Building of "Tianbaoli".

The No. 8 Building of "Tianxiangli" is located at the northern end of the lot; the building was the residence and office for French Catholic clergy. For the building, the length is 12.8 m, width 9.8 m and floor area of 251 square meters. It is of hip roof with two floors, with Western-style triangular roof trusses (Figure 15). The doors and windows of the

building have been damaged, and only openings are retained. The first and second floors of the building are equipped with colonnades of Corinthian columns (Figures 16 and 17). The column caps are molded with plaster and beautifully shaped. The architectural grade is relatively high in the "Tianzihao" colony, reflecting a consummate construction technique.

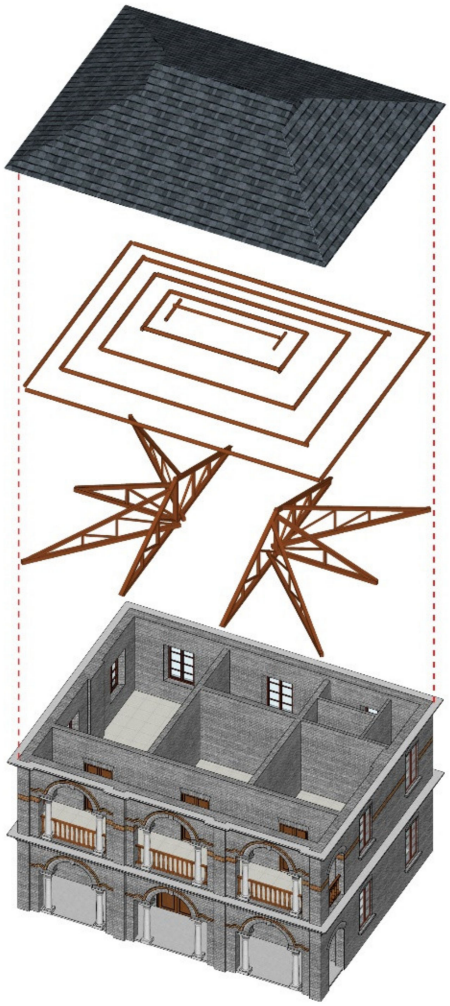

Figure 15. Diagram of the Priest's Residence.

Figure 16. No. 8 Building of "Tianxiangli" (Priest's Residence).

Figure 17. South facade of the Priest's Residence.

3. Discussions

3.1. Architectural Technical Characteristic–Two Types of Roof-Truss Systems

Modern Western architectural technology was spread in Nanjing by two routes: industrial buildings arising from the westernization movement, and churches or hospitals arising from Western missionary activities. The "Tianzihao" colony belongs to the second route.

For the first route, Chinese westernizationists advocated "learning from foreigners to compete with them". They hired British consultants, and in 1866 they set up a munitions factory in Nanjing, i.e., the Jinling Machinery Bureau [26]. The building was in Chinese style of blue bricks, but Western masonry methods were used for it. For the roof, triangular trusses of steel and wood were adopted. This is the earliest spread of Western building technology in Nanjing [27]. For the second route, i.e., technical propagation of Western missionary undertaking, the missionaries who arrived in Nanjing in the late 19th century could draw some illustrations of Western architectural styles. However, they had to hire local artisans due to the absence of professional architects and technicians, and the local artisans created Western-style architectural spaces with traditional Chinese construction techniques. The Shigu Road Church of Nanjing is an example. Built by the French Catholic Church in 1870 [28], it was in the Roman style, but the interior that was supposed to be a brick, four-sided arch structure was actually an imitation wooden structure due to technical limitations.

The architectural space and form in the "Tianzihao" colony are of Western style, but for construction technology, traditional Chinese techniques were adopted mostly, which supports the timeline for Western construction technology spreading in Nanjing. The "Tianzihao" colony was built twice: In 1890, the Xiaguan Catholic Church was built, and two traditional Chinese wooden trusses of supporting beams were adopted for it (Figure 18); in 1916, five "Tianbaoli" townhouses and the No. 8 Building of "Tianxiangli" were built. For the five "Tianbaoli" townhouses, the Chinese wooden trusses of supporting beams were still adopted (Figure 19), but for the No. 8 Building of "Tianxiangli", Western-style triangular roof trusses were used (Figure 20). This shows that in the 1890s, although some Western-style buildings had appeared in Nanjing, Western architectural techniques had not been fully introduced, but in the late 1910s, in Nanjing, there were construction institutions that had mastered the Western-style brick–wood structure system coexisting with traditional construction institutions.

The triangular roof-truss system involves modern mechanical theory, which was impossible to do without regular Western technicians. Therefore, the use of a triangular roof truss means the existence of foreign technicians [29]. Based on a relevant mechanical analysis, the redundant structure of a roof truss can be greatly reduced so as to save wood. Western roof trusses are building systems that consist of a triangular framework—comprising a series of wood or metal beams properly put together—used to bear the weight of pitched roof tiles. This enables an optimum use of the structure, covering large

surfaces at a lower cost than when using beams [30]. Compared with the traditional Chinese-style roof truss, the Western-style triangular roof truss is directly placed on the outer wall without other load-bearing members under it so that the structure can have a larger span and more free space.

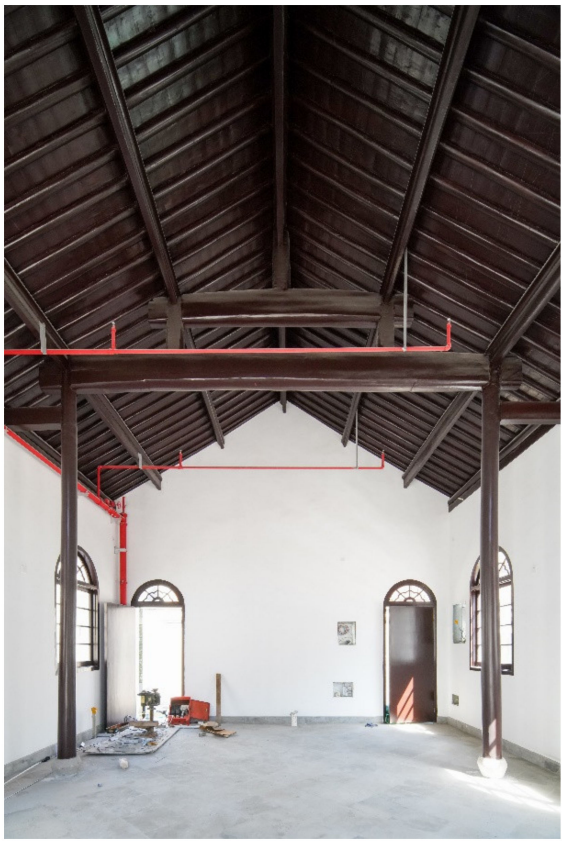

Figure 18. The traditional Chinese roof-truss system of the Xiaguan Catholic Church.

Figure 19. The traditional Chinese roof-truss system of "Tianbaoli" townhouses.

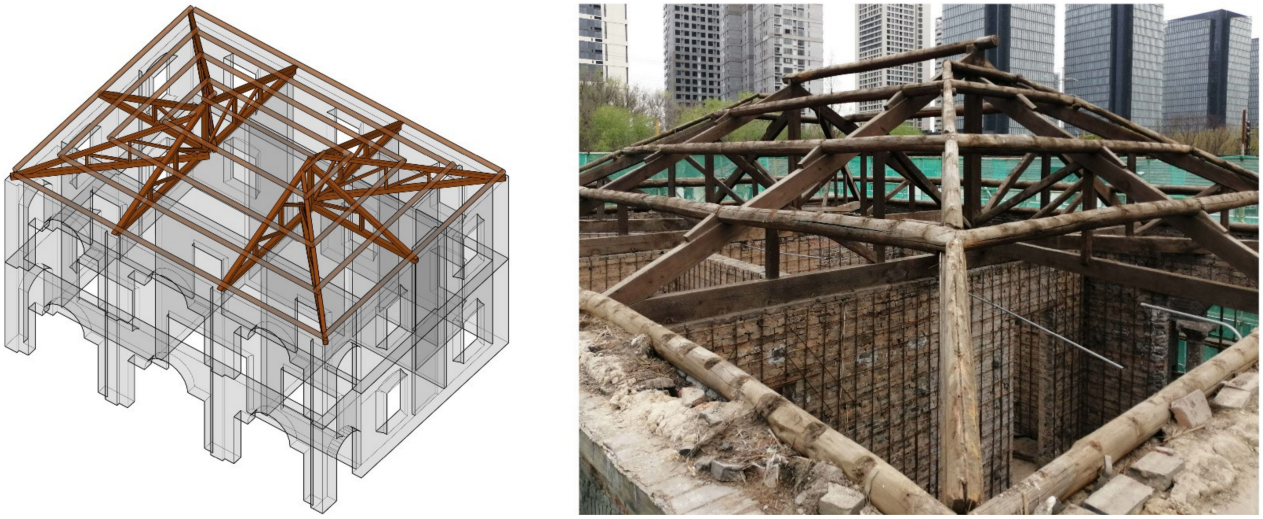

Figure 20. The Western triangular roof-truss system of the Priest's Residence.

Based on the "Tianzihao" colony, it can be determined that by the late 1910s, only a few construction agencies in Nanjing had mastered the technology of the triangular roof truss, which was used for the No. 8 Building "Tianxiangli" (Priest's Residence), which was of relatively high architectural grade. In the "Tianbaoli" townhouses, the most mature Chinese construction technology at that time was used, and roof trusses of supporting beams and partition walls between units were adopted. The partition walls were made of bricks. A field investigation found that there were brick strip foundations under the partition walls, carrying the load jointly with the roof trusses. The possible reason is that the design of Western space failed to match Chinese structure completely, which led to relatively large depth–width ratio for the roof trusses of supporting beams, and the individual load bearing was unstable. Therefore, the partition walls were built as load-bearing walls for both economy and security of the structure.

As an important reference example for the development of modern architectural technology in Nanjing, the "Tianzihao" colony is an important node for Western architectural technology spreading in Nanjing. It provides credible physical dating evidence for the development of Western architectural technology in Nanjing. The "Tianzihao" colony is a typical case of Western architectural technology being comprehensively introduced into Nanjing in the early stage, which shows the construction mode of Sino–Western cooperation at that time and has extremely important scientific and technological value.

3.2. Space and Materials

The architectural space of the "Tianzihao" colony shows a great social science value. Each of the five "Tianbaoli" townhouses may be divided into several residential units, and each residential unit has a standard width of 3.7 m. These are the earliest gathering houses in Nanjing. The residential units are all the same in area and orientation, as well as living quality, reflecting the equal neighborhood relationship, which was a very new concept in the late 19th century. In traditional Chinese courtyard houses, the big family model with a clear hierarchy of agricultural society is reflected, and the living spaces are divided according to seniority rules. The French Catholic Church brought about an urban residential pattern after industrialization in France, which showed the equal living pattern and neighborhood relationship of small urban families under the Western modern industrial social system. The "Tianzihao" colony was probably the first urban settlement space formed by Western ideas in Nanjing in the late 19th century, and its social scientific value should be highlighted.

In terms of building materials, the "Tianzihao" colony showed the idea of "making things done with whatever is available" for selection of materials, as well as the wisdom of building according to local conditions, which reflected the economic development and

building technology level of the late 19th century. The Xiaguan Catholic Church and No. 8 townhouses of "Tianxiangli" are of relatively high architectural grade. The outer walls are plain brick walls made of high-quality blue brick masonry with delicate and regular joints, and exquisite workmanship. However, for the "Tianbaoli" townhouses, the materials were poor. Many walls were built with a large number of broken bricks of different sizes and materials (Figure 21). Therefore, the thickness of the outer walls was up to 40 cm for stability. Due to the narrow lanes for "Tianbaoli" townhouses, in architectural appearance, gable sides and partial facades of the end building are the main. Therefore, the easily visible walls are built with good bricks while the masonry walls on both sides of the lane are built with mixed broken bricks. This reflects the principle of the French Order of Bishops, to do as much as possible with a limited budget, and also reflects the ingenuity of Chinese craftsmen at that time.

Figure 21. A wall made of different bricks of the "Tianbaoli" townhouses.

3.3. Conservation Principles and Methods

Based on the above study for various values of the "Tianzihao" colony, the following conservation principles and methods were formed. The principles of architectural restoration are as follows:

(1) It is advised to keep as many original building components as possible. If the damaged building components can still be used after repair, there is no need to replace them

with new ones. For building components that are old, rare, and of special value, no replacement is allowed, only reinforcement or necessary repairs.

(2) To address structure-related unsafe factors already in the original building or caused by improper repairs in the past, it is permitted to add reinforced structures, use reinforcing materials, and replace damaged components. The newly added structure should be placed inconspicuously, and the replacement component should be marked with the year.

(3) Traditional Chinese techniques should be the first choices in building repair. New technologies and materials conducive to heritage protection can be used after rigorous testing and evaluation, but the traditional techniques and materials with special value must be retained.

(4) Efforts should be made to preserve as many valuable remains from each historical period as possible, regardless of style unity. A well-designed survey is necessary, and remaining historical information must be taken seriously.

(5) In roof-truss repairing, it is advisable to avoid using the method of total disassembly and instead use other engineering measures to ensure overall safety and stability of the structure. It can be dismantled partially or completely if the main structure is deformed and the main components are damaged to an extent that the safety and stability of the structure cannot be restored unless being dismantled. The disassembly and repair should ensure that all unsafe factors are eliminated and no more repair work is needed for a long period of time.

(6) The original state of the missing building components can be properly restored. Restoration must be based on the unanimously recognized corresponding objects of the same kind that still exist. In the case of a few completely missing components, it is permitted to restore on the basis of physical building components of the same age, same type, and from the same region. The material used should be the same kind as that of the original components, and the replicated building components must be marked with the year.

All the conservation methods are reversible and used minimally intervention to ensure that the authenticity of the architectural heritage was not damaged. The methods of architectural restoration were as follows:

(1) We added new functions into the building to attract the public. The function of the building will change from a closed private residence to a public hotel and leisure block, which will play an important role in the revitalization of the Xiaguan area.

(2) We restored the exterior of the building to its original appearance a century ago. Through comprehensive survey and studies on construction technology, building materials and etc., we have drawn a conclusion regarding the original architectural style of the "Tianzihao" colony. Cement mortar that covered the exterior facade was peeled off carefully and manually, and bricks damaged to different degrees were repaired through filling, picking, and replacing (Figure 22). All the parts added or improperly repaired by the residents were removed, and original materials and original techniques were used to recreate the original features of each building, so as to highlight the historical, cultural, artistic, and scientific value of the buildings to the maximum extent.

(3) The original brick–wood structure system was maintained, and the structure was reinforced in a reversible way without changing the appearance of the buildings. For the inner side of the outer wall of the buildings, steel mesh and concrete mortar were used to form a 60 mm thick detachable structural reinforcement layer, which is connected with the wall through planting bars. For the brick walls inside the buildings, this method was used to reinforce both sides (Figure 23). The building foundation was interspersed with the shoulder pole beams at a certain distance. Concrete was used to integrate the shoulder pole beam with the original brick strip foundation through expanding the section (Figure 24). Decayed and damaged members of the floors and roof trusses were replaced, and steel structures were used to reinforce key nodes.

(4) The exterior walls of the buildings in the "Tianzihao" colony can meet the need of thermal insulation in Nanjing, where the climate is mild. Therefore, during the restoration, no additional thermal insulation treatment was done to the exterior walls. However, in response to the poor thermal insulation performance of the original roofs, we added insulation and waterproof layers under the roofs. The insulation layers, which were 5 cm thick, were made of high-density polystyrene insulation materials.
(5) New aluminum–wood composite windows were installed as the original ones were missing. The outer layer of the windows was made of wood, with hollow aluminum alloy wrapped inside. The new aluminum–wood composite windows looked just the same as the original ones, but used double-layer insulating glass. Compared with the original wooden windows with single-layer glass, the new ones excelled in thermal insulation performance, which can meet needs in modern times while keeping the original look.
(6) Modern equipment systems, e.g., the water and electricity system, lighting system, and air conditioning system, were added inside the buildings to enhance comfort.

Figure 22. Restore the exterior walls with different methods according to the damage degree of the bricks.

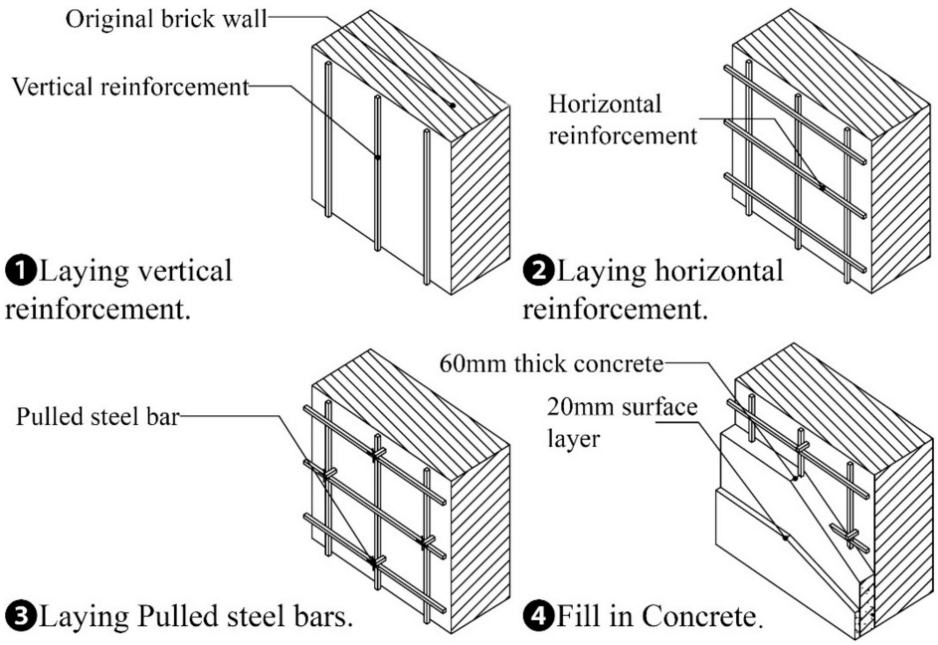

Figure 23. Reinforcement method for walls.

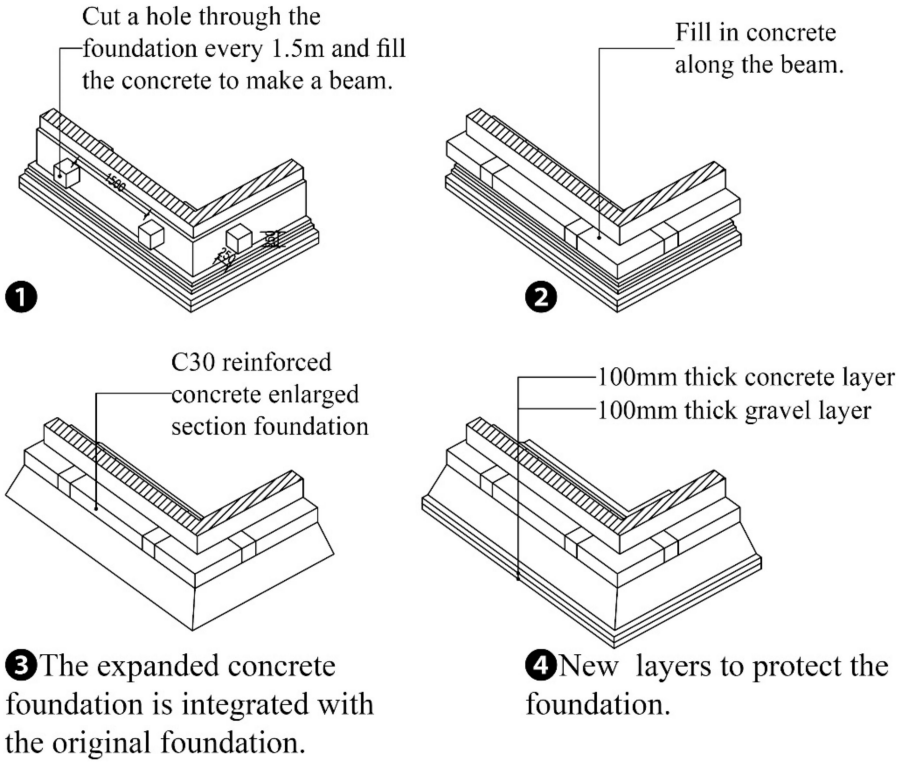

Figure 23. Reinforcement method for walls.

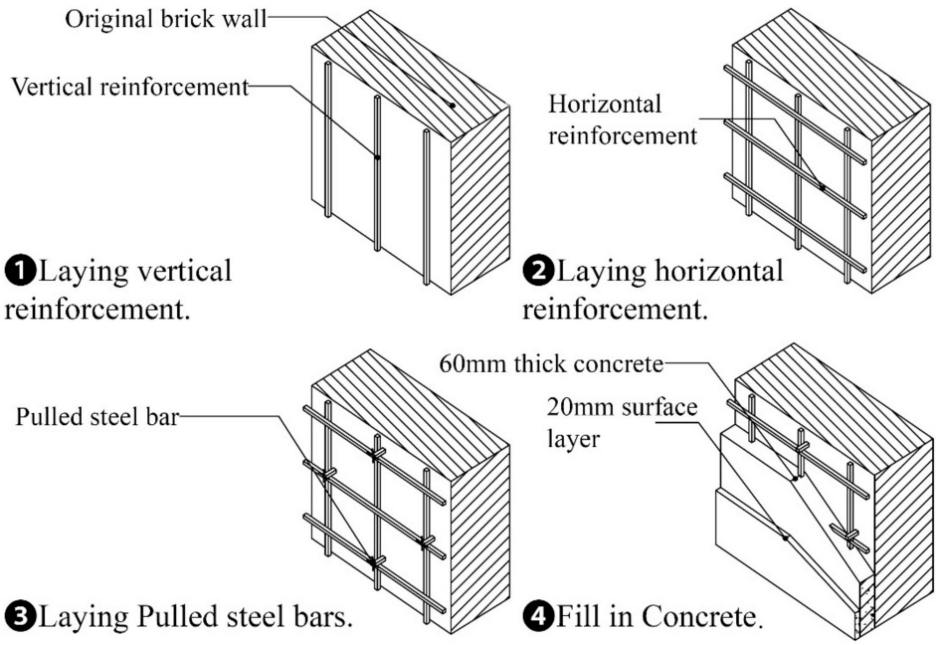

Figure 23. Reinforcement method for walls.

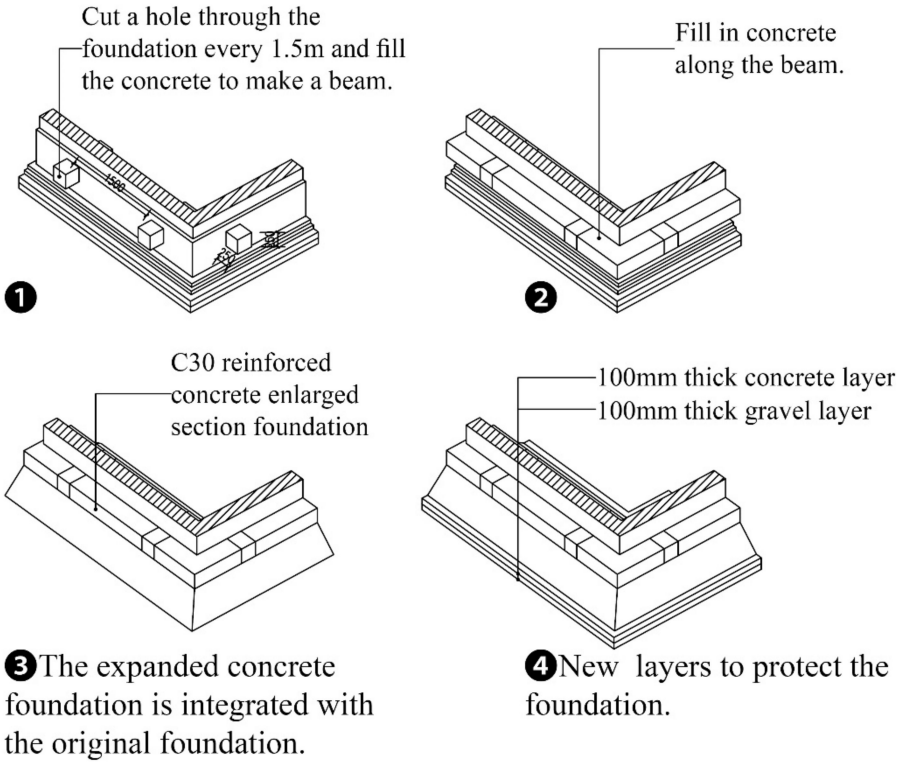

Figure 24. Reinforcement method for building foundation.

4. Conclusions

In recent decades, due to the influence of Western architectural protection theories and Chinese people's increasing awareness of their own cultural identity, greater importance has been attached to the protection of modern Chinese architectural heritage. The principle of "keeping the cultural relics in their original state" has been emphasized in the practice of Chinese architectural heritage protection after the promulgation of *Law of the People's Republic of China on the Protection of Cultural Relics* in 1982. However, most of the restoration

efforts in early days focused on stylistic restoration, and the "original state" was simply interpreted as how the building looked when it was first built.

The Principles for the Conservation of Heritage Sites in China promulgated in 2015 also emphasized the principle of "keeping the cultural relics in their original state" but with further elaboration on and clear definition of "the original state". "The original state" includes both the look before any repair and the information left after renovation and expansion in history. This is consistent with what the *Venice Charter* pointed out: "The valid contributions of all periods to the building of a monument must be respected, since unity of style is not the aim of a restoration." The past few decades witnessed some violations of the principle of minimal intervention as some conservation efforts removed the authenticity information left by restorations in the past, due to which part of the historical information carried by the architectural heritage was missing.

In the restoration of the "Tianzihao" colony, building on our studies in the past, we conducted in-depth research on the authenticity information of the architectural heritage at different historical stages, focusing on the identification and preservation of architectural authenticity information. The information of each historical stage of the architectural heritage should be perceivable by people, and restorations, if overdone, will obscure the historical information of the building itself. The information retained on the architectural heritage may change along with the changing external environment. And the conservation project aims to sort out and restore the existing information of the building. We believe that every restoration of an architectural heritage in the past reflected people's choice of authenticity information in different historical periods. These choices, which embodied the aesthetic values and concepts of certain periods, became new authenticity information retained in the architectural heritage.

The "Tianzihao" colony has been a landmark along the Xiaguan River for more than 100 years. Nanjing residents pay great attention to the buildings here. The "Tianzihao" colony was badly damaged, with many decayed building materials and structures on the verge of collapse (Figure 25). Ordinary people were unable to enter the interior of the buildings and felt extremely anxious. In this context, the project has become the focus. After more than three years of in-depth research, investigation and design, at present, the conservation work is in a construction stage.

Figure 25. Xiaguan Catholic Church before conservation (**left**) and after conservation (**right**).

Through conservation and restoration, the historical features of the "Tianzihao" colony reappear, and its unique construction technology is perfect again, showing the characteristics of the buildings themselves. The public can visit all the details of the buildings. After the reconstruction for the old city of Xiaguan, the buildings of small size, approachability and historical sense of the "Tianzihao" colony have become precious and outstanding in the background of surrounding high-rise buildings (Figure 26).

Figure 26. No. 8 Building of "Tianxiangli" (Priest's Residence) before conservation (**left**) and after conservation (**right**).

Along the Yangtze River is the window for opening ports in modern China, and the "Tianzihao" colony is one of the most important landmarks in the Nanjing section of the Yangtze River. The "Tianzihao" colony is of French-style buildings in combination with ancient Chinese architectural techniques. At present, it is an important architectural case in Nanjing, Jiangsu Province and even all over the country, reflecting the modern architectural style influenced by cultural exchanges between China and the Western world. Its architectural technical features have been protected, and Western architectural styles have been highlighted through relevant research and conservation. This is the carrier and evidence of the cultural exchange and integration between China and the Western world in more than 100 years of modern China.

Author Contributions: Conceptualization, Y.L.; methodology, Y.L.; formal analysis, Y.L.; investigation, Y.L., X.L. and Q.J.; resources, Q.Z.; data curation, Q.Z.; writing—original draft preparation, Y.L.; writing—review and editing, Y.L.; visualization, Y.L. and Q.J.; supervision, Q.Z.; project administration, Q.J.; funding acquisition, Q.J. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the National Natural Science Foundation of China (No. 51778123).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Fontana, M. *Matteo Ricci: A Jesuit in the Ming Court*; Rowman & Littlefield Publishers: Washington, DC, USA, 2011.
2. Young, E.P. *Ecclesiastical Colony: China's Catholic Church and the French Religious Protectorate*; Oxford University Press: Oxford, UK, 2013.
3. Song, Z.; Zhou, J. Institutional Construction for Preservation of Modern Architectural Heritage. *Archit. J.* **2005**, *7*, 5–7.
4. Corbusier, L.; Anthony, E. *The Athens Charter*; Grossman Publishers: New York, NY, USA, 1973.
5. Jokilehto, J. The context of the Venice Charter. *Conserv. Manag. Archaeol. Sites* **1998**, *2*, 229–233. [CrossRef]
6. Stovel, H. Origins and influence of the Nara document on authenticity. *APT Bull.* **2008**, *39*, 9–17.
7. Starn, R. Authenticity and historic preservation: Towards an authentic history. *Hist. Hum. Sci.* **2002**, *15*, 1–16. [CrossRef]
8. Newell, P. The PRC's Law for the Protection of Cultural Relics. *Art Antiq. L* **2008**, *13*, 1.
9. Chai, R.; Hao, L. A Study on Legislation for Protection of Cultural Relics in China: Origin, Content and Model. *Chin. Stud.* **2019**, *8*, 132–147. [CrossRef]
10. Zhu, Y. Authenticity and heritage conservation in China: Translation, interpretation, practices. In *Authenticity in Architectural Heritage Conservation*; Springer: Cham, Switzerland, 2017; pp. 187–200.
11. Chung, S.-J. East Asian values in historic conservation. *J. Archit. Conserv.* **2005**, *11*, 55–70. [CrossRef]

12. Agnew, N.; Demas, M.; Sullivan, S.; Altenburg, K. The begetting of charters: Genesis of the China Principles. *Hist. Environ.* **2004**, *18*, 40–45.
13. Zhang, F. Study and preservation of Chinese modern architecture. In Proceedings of the Anthology of 2006 Conference on Modern History of Chinese Architecture, Beihai, China, 1 July 2006.
14. Zhang, S. *An Introduction Integrated Conservation—A Way for the protection of Culture Heritage and Historic Environment*; Shanghai Scientific & Technical Publishers: Shanghai, China, 2001.
15. Lovell, J. *The Opium War: Drugs, Dreams, and the Making of Modern China*; Abrams: New York, NY, USA, 2015.
16. Roberts, P.M. Nanjing, Treaty of (August 1842). In *China at War: An Encyclopedia*; 2012; Volume 298.
17. Ch'en, J. *China and the West: Society and culture, 1815–1937*; Routledge: Milton, UK, 2018; Volume 2.
18. Évariste, H.U.C. "L'empire chinois." Imprimerie des Lazaristes, Pékin. Réédition (1992).628–633. *L'empire chinois*. Available online: https://scholar.google.com.hk/scholar?hl=zh-CN&as_sdt=0%2C5&q=18.%09%C3%89variste%2C+H.+L%E2%80%99Empire+chinois%2C+chapitre+2%2C+1854%2C+r%C3%A9%C3%A9dition+Omnibus+2001%3B+pp.+628%E2%80%93633.&btnG= (accessed on 1 April 2021).
19. Strong, D. Jesuits in China from 1842 to 1954. *La Civiltà Cattol. Engl. Ed.* **2018**, *2*, 28–37.
20. Ward, M. Moses or Meddler? CMS Missionary JR Wolfe in Post-Tianjin Treaty Fujian. *Mission Stud.* **2019**, *36*, 458–483. [CrossRef]
21. Chen, C. The Dispute between the Holy See and France over the Protectorate in China at the End of the 1920s-A Discussion Centered on the Apostolic Delegate Celso Costantini. *J. Inst. Mod. Hist.* **2009**, *65*, 51–79.
22. Marthaler, B.L. *New Catholic Encyclopedia*; Thomson Gale: Farmington Hills, MI, USA, 2003.
23. Taxation Department of Jinling Pass. *Ten Years Report of Jinling Pass*; Nanjing Press: Nanjing, China, 2014.
24. Sun, J. The beginning and end of the opening of Nanjing Trade Port. *Arch. Constr.* **1999**, *8*, 24–26.
25. Kessler, L.D. *The Jiangyin Mission Station: An American Missionary Community in China, 1895–1951*; UNC Press Books: Chapel Hill, NC, USA, 1996; Volume 61.
26. Qiang, W.; Liu, Y. Analysis for the Characteristic and Rehabilitation of Industrial Architecture Heritages in the Site of Jinling Machinery Bureau. *Archit. Cult.* **2011**, *9*, 104–106.
27. Liu, X.; Yang, W. The role of architectural technology in the development of modern architecture in Nanjing. *Archit. J.* **1996**, *11*, 40–42.
28. Chu, C. *The Catholic Church in China: 1978 to the Present*; Springer: Berlin/Heidelberg, Germany, 2012.
29. Bao, M.; Nobuhiro, M. Fundamental Issues in the Study of Modern Chinese Architectural Technology History: Enlightenment and Reflection from the Study of Modern Japanese Architectural Technology History. 2008 International Conference on China's Industrial Architectural Heritage, Fuzhou, China, 13 December 2008; pp. 192–205. Available online: https://d.wanfangdata.com.cn/conference/7821412 (accessed on 1 April 2021).
30. Cuerva, E.; Judith, U.; Còssima, C. Recovering industrial heritage: Restoration of the wine cellar cooperative in Falset (Catalonia, Spain). *Buildings* **2019**, *9*, 243. [CrossRef]