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Lessons from the Conservation Practices Following the Notre-Dame Cathedral Fire: A Case Study of the Former Site of the Henan Preparatory School for Students Studying in Europe and America

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Abstract: As a world-famous cultural heritage site, Notre Dame de Paris has developed a systematic approach to post-disaster emergency response, scientific restoration, and preventive protection. This paper takes the protection practice of Notre Dame Cathedral in Paris after the fire as the research object, discusses the protection and utilization path of modern architectural heritage in response to disaster risk, combines the protection needs of the old site of Henan European and American preparatory schools after the fire, and analyzes the relevant experience of Notre Dame Cathedral in Paris. Lessons for Heritage Preservation. This article offers recommendations for establishing collaborative preservation mechanisms, adhering to scientific restoration principles, and strengthening preventive conservation to guide post-disaster preservation and the long-term management of China's modern and contemporary architectural heritage.

Keywords: Post-disaster preservation; Notre-Dame de Paris; Modern architectural heritage; Henan Preparatory School for Study in Europe and the United States

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1. Introduction

Historic buildings are not merely remnants of physical spaces; they also embody the historical information and cultural values of particular periods. Conserving them requires attention not only to the buildings themselves but also to preserving their historical significance, authenticity, and surrounding environment [1]. In recent years, emergency response, scientific restoration, and the long-term preservation of historic buildings after fires have attracted widespread attention. The preservation practices implemented at Notre-Dame Cathedral after the 2019 fire have provided systematic insights into on-site emergency response,

professional coordination, architectural restoration, and risk prevention. In May 2024, a fire broke out in the auditorium of the former Henan Preparatory School for Students Studying in Europe and America during renovation work, highlighting the practical challenges facing historic buildings in construction safety management, fire emergency response, and subsequent conservation [2].

Although there are differences in architectural types, heritage identification, and management systems between the two heritage sites, the protection practice adopted by Notre Dame Cathedral in Paris provides a valuable reference for the post-disaster protection work of "Henan Preparatory School Site for Studying in Europe and the United States." This paper comprehensively uses literature research, case analysis, and comparative research methods to explore the applicability of relevant practical experience from the three dimensions of post-disaster emergency response, scientific restoration, and preventive protection, aiming to provide a reference for the protection and adaptive utilization of the site.

2. Overview of the former Henan Preparatory School for students studying in Europe and America

2.1. Overview of the Historic Site

The former site of the Henan Preparatory School for Students Studying in Europe and America is located on the Minglun Campus of Henan University in Kaifeng, Henan Province. Its surviving historic buildings include the South Gate, Building No. 6, Building No. 7, the twelve dormitory buildings in the east and west wings, and the auditorium. Together, these structures largely preserve the spatial layout and architectural character of a modern-era campus. In 2000, the Modern Architectural Complex of Henan University was designated as a provincial-level key cultural relic protection site, becoming the third batch of such sites in Henan Province [3]. In 2006, the State Council of the People's Republic of China designated the former site of the Henan Preparatory School for Students Studying in Europe and America as a Major Historical and Cultural Site Protected at the National Level, as part of the Sixth Batch of National Key Cultural Relics Protection Units [4]. In 2018, the former site of the Henan Preparatory School for Students Studying in Europe and America in Kaifeng was included in the third batch of China's 20th-Century Architectural Heritage List [5].

The Grand Auditorium (Figure 1), located at the intersection of the north-south and east-west axes on the Minglun Campus, is an integral part of the historic site's architectural complex. In May 2024, a fire broke out at the Grand Auditorium during renovation work, damaging the building itself. This fire expanded the scope of conservation efforts for the historic site of the Henan Preparatory School for Study in Europe and the United States from routine maintenance to post-disaster response and restoration safety, and it also provides a concrete case study for examining the post-disaster conservation of modern and contemporary architectural heritage.



Figure 1. Auditorium on the Minglun Campus of Henan University (Source: Official Website of Henan University)

2.2. Post-fire conservation status and key issues

2.2.1. Post-fire conservation status

On May 2, 2024, a fire broke out in the Grand Auditorium at the former site of the Henan Preparatory School for Study in Europe and the United States on Henan University's Minglun Campus. The fire affected about 3,410 square meters, causing significant damage to the building, but there were no casualties. After the fire, the Henan Provincial Fire Safety Committee established a joint investigation team comprising representatives from the fire rescue, public security, emergency management, education, and cultural relics departments to investigate the cause and determine relevant responsibilities. The investigation determined that the fire originated at the junction of the ridge cap and the eaves on the northern side of the roof east of the Grand Auditorium's entrance hall. The direct cause was the improper use of a liquefied petroleum gas torch during the waterproofing phase of the roof renovation project; the high-temperature flame used to heat the waterproofing membrane caused the wooden roof structure to smolder and ignite [6].

The Grand Hall is now in the post-disaster restoration phase, and the restoration plan must fully account for the extent of the building's damage, its historical value, and its original architectural features. In 2025, the relevant restoration design received approval in principle from the National Cultural Heritage Administration, which emphasized "minimal intervention" and documenting the entire process.

2.2.2. Issues in conservation and utilization

The continuous use of historical buildings must be balanced with the protection of cultural relics. Some of the buildings on the site are still used for teaching, research, and administrative work. However, the original spatial layout and materials of these buildings may not fully meet modern needs. If protection requirements are not fully considered when installing new facilities or adjusting building functions, problems may arise; such changes will not only alter the original spatial pattern but may also damage the integrity of the historical information carried by the building.

Second, routine fire safety management and risk prevention at the historic site still have shortcomings. In 2022, a fire safety assessment of Henan University's modern architectural complex identified several issues in the auditorium, including substantial combustible materials, partially aging fire protection facilities, problems with certain firefighting equipment, and inadequate management procedures for key fire-risk areas [7]. The 2024 fire investigation further revealed that the automatic fire alarm system had been deactivated during the renovation work and that no dedicated fire suppression and emergency evacuation plan had been

developed. As a result, the fire could not be effectively controlled in its initial stages.

Finally, restoration work itself may introduce new risks. The fire was linked to the unauthorized use of a liquefied petroleum gas blowtorch, and the investigation also found that supervisory personnel had failed to conduct on-site supervision as required. This indicates that while restoration is essential to conserving historic buildings, it is also a critical stage for risk management. Heritage conservation requirements, construction safety, and on-site supervision must therefore be addressed together.

3. Conservation practices at Notre-Dame Cathedral in Paris

On April 15, 2019, a major fire broke out at Notre-Dame Cathedral in Paris (Figure 2), damaging important architectural elements, including the roof and spire. In the aftermath, France gradually developed a conservation approach encompassing emergency response, scientific restoration, and long-term risk prevention.



Figure 2. Main Façade of Notre-Dame Cathedral in Paris (Source: Ren Jun, An Interpretation of Architectural Monumentality, 2004)

3.1. Establishing a rapid and scientific post-disaster emergency response mechanism

On July 29, 2019, France passed the "Law on the Protection and Restoration of Notre-Dame de Paris and the Establishment of a National Fundraising Campaign," which created a national administrative public institution under the supervision of the French Ministry of Culture. This institution is responsible for organizing, coordinating, and implementing research and engineering projects related to the protection and restoration of Notre-Dame de Paris. On November 28 of the same year, the public institution was formally established by decree to provide specialized organizational support for the ongoing post-disaster restoration efforts.

In its post-fire response to the Notre-Dame de Paris disaster, France placed a strong emphasis on preserving information regarding the architectural remains. After the fire, relevant departments used technologies such as drones and robots to quickly assess the extent of damage and collect visual data, which formed the basis for restoration plans. During the on-site cleanup, teams sorted, numbered, preserved, and analyzed burned timber, stone, and metal components, and treated some damaged components as archaeological remains.

3.2. Following scientific restoration practices under the principle of authenticity

Cultural heritage conservation follows the principle of authenticity. Restoration projects should prioritize safeguarding the historical information and cultural values embedded in heritage sites. With a full site investigation, research, and heritage value assessment as the foundation, restoration respects the building's original form, materials, craft, and historical context. It should not simply substitute original heritage fabric with newly built parts.

The final restoration plan for the spire of Notre-Dame Cathedral reconstructed the spire to recover its original shape. This ensures the cathedral's overall appearance matches its historical architectural identity.

When selecting materials and construction methods, the restoration retained traditional timber frameworks and building skills. Modern technologies were also introduced to fulfill safety requirements. As early as 2015, art historian Andrew Tallon collected data on Notre-Dame Cathedral using three-dimensional laser scanning. The data provided important records for subsequent restoration. These cases indicate that traditional craftsmanship and modern technology can be combined in heritage conservation guided by authenticity.

3.3. Establishing a long-term preventive conservation system

Preventive conservation reorients cultural heritage protection away from emergency repair after disasters and toward daily risk control. Staff carry out regular checks, long-term monitoring, danger screening, and upkeep work to spot and handle hidden threats early, which lowers the chance of severe harm to heritage sites.

After the Notre-Dame fire, updating fire alarm and fire-extinguishing equipment became a core conservation task. Projects including better fire surveillance, risk screening, and equipment upkeep improved the building's ability to avoid and respond to hazards. Besides, donations from the public covered restoration costs. Meanwhile, official websites and other platforms shared real-time repair updates with citizens, letting more people take part in heritage protection work. All these actions prove that protecting Notre-Dame does not only involve repairing damage after fires, but also daily risk control and public involvement.

4. Implications of Notre-Dame Cathedral's conservation practices for the former site of the Henan Preparatory School for Students Studying in Europe and America

The conservation practices adopted at Notre-Dame Cathedral cannot be directly replicated at the former site of the Henan Preparatory School for Students Studying in Europe and America. However, its approaches to post-disaster emergency response, scientific restoration, and preventive conservation offer valuable lessons for protecting the historic site.

4.1. Establishing a coordinated conservation mechanism to strengthen emergency response capacity

For Notre-Dame Cathedral, a specialized agency was set up to organize all heritage conservation work. Teams from different professional fields worked together to coordinate emergency site treatment, building condition evaluation, and later reconstruction projects. Many different parties take part in managing the former Henan Preparatory School for Students Studying in Europe and America, including school administrators, heritage protection departments, fire safety agencies, and design, construction, and inspection groups. The university can adjust its current management system to make clear each stakeholder's duties and combine heritage protection standards with daily construction safety management.

In daily management, the university should carry out regular building checks and standardize procedures to report hidden risks. Promptly refer issues involving the building fabric, structural safety, or historic components to cultural heritage authorities and relevant professionals for assessment. In the event of a fire or other emergency, prioritize protecting human life and controlling on-site risks, then conduct professional investigations based on the extent of the damage. For damaged components of historical value, documentation, classification, and preservation should be carried out as far as possible, provided safety requirements are met, to provide reliable evidence for subsequent restoration.

4.2. Adopting a scientific restoration approach based on the principle of authenticity

During the post-fire restoration of Notre-Dame Cathedral, historical records, architectural surveys, and digital technologies provided key evidence to determine the building's original form and assess the fire damage. For architectural heritage, restoration involves more than addressing structural safety concerns; it also requires an accurate understanding of the original spatial layout, materials, construction methods, and historical information to avoid compromising authenticity due to insufficient documentation.

The former site of the Henan Preparatory School for Students Studying in Europe and America has a long history, and its buildings were constructed in different periods, have undergone prolonged use, and have undergone multiple rounds of renovation. Future conservation work should adhere to the principle of "minimum intervention." For important buildings such as the auditorium, historical photographs, architectural archives, survey records, and investigations of existing conditions should be examined together to assess the original architectural form, spatial layout, and materials of building components. Other buildings should also be investigated according to their respective conservation conditions.

By combining historical records with surveys of existing buildings, it becomes possible to distinguish original historic fabric from later alterations, providing a sound basis for determining the scope and methods of restoration. Particular attention should be paid to the auditorium, which was damaged by fire. Comparing pre-fire documentation with the building's post-fire condition can help prevent the loss of historical information during reconstruction.

4.3. Strengthening preventive conservation and shifting from post-disaster restoration to routine maintenance

First, upgrade file management for historic building conservation. Using available records of past protection, repair, and monitoring work, the university should create separate archives for each building. Staff need to keep updating files that record the buildings' historical evolution, present conditions, earlier renovation projects, deterioration trends, disaster handling processes, and later upkeep work. The auditorium suffered a

fire and was repaired afterward, so managers should especially keep full records of fire damage conditions, investigation results, renovation blueprints, and construction records. All these files should be connected to the building's original historical materials. Tracking building damage and its long-term development can lay solid groundwork for future repair and daily upkeep. This practice also lowers the chance of losing historical data when construction projects finish, or management staff rotate positions.

Second, protection plans need to match each building's heritage significance, structural state, and present functions. The auditorium sustained fire damage and is undergoing reconstruction, so its structural safety, original historic parts, and fire hazards need regular close surveillance. For Building 6, Building 7, the South Gate, and the east and west dormitory blocks, daily repairs and damage inspections should fit their unique physical states. This targeted management does not mean treating each building separately. Instead, it lets managers distribute resources based on actual demands, while keeping consistent protection standards for the whole historic compound.

Third, risk monitoring should become an integral part of daily building use. Regular inspections should cover roof leakage, wall cracks, damaged components, and the operational condition of fire protection facilities, with identified problems documented and addressed promptly. Buildings such as the auditorium that have experienced major disasters or restoration work require closer post-restoration inspection. Other buildings should also receive maintenance according to their condition and intensity of use. These measures can gradually replace the passive practice of undertaking major repairs only after problems emerge with a more proactive approach to routine conservation.

Lastly, risk control should cover all stages of restoration projects. Construction crews need to assess all hidden risks stemming from high-risk operations—hot work, waterproofing, and temporary power wiring—prior to starting work.

5. Conclusion

The conservation of Notre-Dame Cathedral after the fire shows that protecting historic buildings requires a coordinated approach to emergency response, scientific restoration, and preventive conservation. The fire at the auditorium of the former Henan Preparatory School for Students Studying in Europe and America exposed problems in fire safety and construction management. To address these issues, conservation efforts at the site should strengthen emergency response, building surveys, restoration management, and routine risk prevention. These measures should preserve historical information and architectural character while linking post-disaster restoration with regular maintenance.

The two heritage sites vary in building categories, protection grading, and management frameworks. For this reason, the targeted measures used for Notre-Dame Cathedral cannot be copied straight to the former campus site. Even so, its complete set of heritage protection workflows provides valuable references. Future protection plans must match the site's actual physical condition and daily usage patterns. Teams should also upgrade risk tracking, daily upkeep management, and emergency handling mechanisms. Completing these work items step by step will build a unified protection framework covering daily risk prevention, on-site emergency response, and post-fire reconstruction.

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