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## CASE STUDY

# The protection project of Hanyuan Hall and Linde Hall of the Daming Palace

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Received 6 September 2011; accepted 18 October 2011

**KEYWORDS**

Hanyuan Hall;  
Linde Hall;  
The site of rammed earth;  
Protection of bases by surrounding them with bricks and stones or rammed earth;  
The site of kiln;  
Museum

**Abstract**

This paper expounds the consideration to the design of protection and exhibition of Hanyuan Hall and Linde Hall of the Daming Palace. Based on in-depth study on their existing conditions after archeological excavation, and in combination with comprehensive considerations in terms of the protection of the main body of sites, the restoration research of existing bases and superstructures, the requirement of site open exhibition, etc., it proposes the design to restore the rammed earth bases by surrounding them with bricks and stones or rammed earth. Besides the protection and exhibition of the site of Hanyuan Hall bases, it also integrates the features of landform there to design the protection and exhibition of brick and tile kiln of Tang Dynasty within the relic area. Under the condition at that time, a semi-underground small exhibition center is designed by taking advantage of the height difference of base side slopes, satisfying the requirement of exhibition, and meanwhile preserving the overall landscape of the site. The integration of the design of protection project with archeology as well as the science and technology of heritage preservation is a brand-new probe into site protection design.

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## 1. Introduction

Located in the new urban area of the city of Xi'an, the site of the Daming Palace of the Tang Dynasty is a key unit of cultural remains under national protection (G06-17). Hanyuan Hall and the Linde Hall are important parts of it.

The city of Chang'an (Xi'an) in the Tang Dynasty was not only the political, economic and cultural center of the dynasty at that time, but also an international metropolis enjoying a high reputation worldwide. As an important palatial architectural complex built in the Tang Dynasty on the foundation of the city Daxing of the Sui Dynasty, the Daming Palace was famous for its large-scale and

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magnificent halls. It served as both the venue for court meetings and a symbol of the prosperous Tang Dynasty.

Hanyuan Hall was built in the third year of the Longshuo Period (663 AD) as the first main hall in Daming Palace. It served as a venue for holding high court meetings on the days of the Spring Festival and winter solstice.

Built on the highland on the southern slope of Dragon Head Tableland, Hanyuan Hall was not only high and spacious, but also commanded an open and wide view. Due to its large altitude difference, its superstructure was built on three large platforms. The hall has 11 rooms, each of which is 5.35 m wide and 28.1 m deep, with a pillar diameter of about 0.7 m. In addition, Qifeng Pavilion and Xiangluan Pavilion were built 30 m to the east and the west of the main hall respectively. The hall and the pavilions were connected by a zigzagging veranda with buildings built around the corners. In addition, an eastern court and western court were built in the southeast and southwest of Yuanxia Hall. Officials had to go to court meetings by following the Dragon Tail Path in front of the hall.

More than 220 years after its completion, Hanyuan Hall was destroyed in the war that broke out at the end of the Tang Dynasty. As proven by relevant archeological data, this hall was partially repaired in these 220 years, but there is no record of reconstruction.

Built approximately in the Linde Period during the reign of Emperor Gaozong of the Tang Dynasty, Linde Hall was located on the highland to the west of Taiye Pond in the north of the Daming Palace. It was also called “a three-part hall” because it consisted of Linde Hall, Jingyun Pavilion and Zhangri Pavilion. It served as a venue for emperors to hold banquets or receive foreign envoys and guests.

## 2. Project background

Relevant investigation and preliminary preparation for the Hanyuan Hall Protection Project began in 1993. In 1995, UNESCO and the Japanese government established the Hanyuan Hall Cooperative Protection Project with the Chinese government. This project lasted for 10 years until its completion in 2003. Thereafter, Japan’s voluntary cultural assistance project commenced in May of 2003 and finished in March of 2004. During this time, the design of the small exhibition center to the north of Hanyuan Hall and the protection of the kiln site to the northeast of Hanyuan Hall were consecutively completed.

In 2004, the Protection Project of Linde Hall of the Daming Palace went into operation. Its protected and exhibited items included the Linde Hall platform (including Linde Hall, the Jingyun Pavilion and the Zhangri Pavilion) and the platforms of the Jielin Building, Yuyi Building, as well as two pavilions (the eastern and western ones). This project was completed in 2006.

Entrusted by the State Administration of Cultural Heritage, the Archeological Research Institute of the Chinese Academy of Social Sciences presided over the archeological exploration, measurement and excavation of the sites of Hanyuan Hall and Linde Hall. Entrusted by the Cultural Heritage Administration of Shannxi Province, the Cultural Heritage and Parks Bureau of Xi’an City presided over the implementation of this project. The Ancient Buildings

Design and Research Institute of Shannxi Province undertook the design of the project for protecting these two sites.

## 3. The status quo of surroundings before site protection

(1) The remains of the site of Hanyuan Hall include the base site of the main hall, Qifeng Pavilion and Xiangluan Pavilion. Its superstructure was destroyed at the end of the Tang Dynasty, and substantial parts of it have been gone for a long time. Remnants chiefly include the platform of rammed earth, parts of brick pavement, a brick apron, bricks encircling the platform walls, pillar foundations of stone, balustrades, lishou (a decorative part of buildings shaped like the head of Chi, a legendary dragon), etc. Most of them are damaged. Due to many years of wind and rain corrosion, the platform of rammed earth has become mutilated and is continuously shrinking.

To the north of this site is farmland, and further north is the original base site of Taiye Pond. To the south of the hall is the residential area of the Xi’an Railway Bureau. To the east and the west of this hall are also residential areas, and to their north is cultivated land. The present site of Hanyuan Hall is 230 m from east to west and 250 m from south to north. It is encircled by a wall.

The remnants of Linde Hall chiefly include the rammed earth platforms of Linde Hall, Yuyi Building, Jielin Building and the two pavilions. In 1986, protective maintenance was performed on the platform of Linde Hall. The outcropped vertical wall of the front hall and the surface of the first layer of the platform were surrounded by bricks and stones. The outcropped part of the second layer of the platform was covered with 300 cm of earth for protection. The rear half of the outcropped part was simply refilled, with an insufficiently distinct boundary. The hall base of rammed earth which was not surrounded by bricks had been seriously damaged and weathered, with the hall surface covered with a thin layer of earth. As a result, the turf and root system had injured the remains, and the problems of water seepage and freeze thawing have not yet been solved. On the bottom of the other platforms of rammed earth, there are traces of surrounding bricks. At some places they reach a height of 1.8 m, from which their contracture and curve arc can be seen.

(2) The influence of climate and rainwater on the site: Located at the center of Guanzhong Basin, Xi’an is adjacent to the Weihe River and Bashui River to its north and east respectively. Its terrain inclines from southeast to northwest with an altitude of around 400 m. Located in a warm temperate zone, Xi’an has an annual average temperature of 13.3 °C, a minimum temperature of −20.61 °C, maximum temperature of 45.2 °C (at the extremes), and an annual rainfall of 604 mm which is mostly concentrated in the months from July to September. The site suffers from scouring by rainstorms in the summer and long-term immersion in rain during the autumn. Especially, the winter thaw brings about the rapid weathering and peeling of the surface of rammed earth. Therefore, it is very necessary to cover the site to prevent it from being destroyed by natural rainfall.

#### 4. Soil mechanics and protection of the site

An engineering geological survey and laboratory analysis have been made on the rammed earth of existing remains. The hall base of rammed earth consists of plain filling earth, rammed earth and ancient soil. The plain filling earth is about 1.5 m thick. The loess and rammed earth refilled after surface weathering and archeological excavation came from the original artificially rammed hall base. With a thickness of 4 m, it is a key object of protection. Below the rammed earth is sedimentary soil and ancient soil.

According to the geological report, the rammed loess has very good strength and bearing capacity, no collapsibility due to saturation, and very good stability. However, the weathered portion is loose and tends to crack. Therefore, the rammed earth of the hall base should be covered. According to the principle of the adaptability between tradition and the ancient site, the method of covering the rammed earth with rammed loess was chosen to make up for the loss of the original loess, without producing influence due to a large difference between material performance. In order to increase the density and intensity of loess ramming, we chose to add lime powder to the loess at the upper layers. This practice and the material not only conform to traditional craftsmanship, but also are part of the newly growing technology.

In order to increase the stability of the earthen body, prevent cave-ins, and restore the original look of the base of Hanyuan Hall, a protective retaining wall (with a thickness of 720-1080 mm) was built while protecting various layers of rammed earth by covering them with earth. Surrounded by black bricks, this retaining wall can safely prevent the platform of rammed earth from caving in again. In order to add waterproof properties to the surface of rammed earth, the upper part of lime earth was rammed and a floor layer of square bricks was laid according to the original method used on the hall base, thus further protecting the remnants of rammed earth.

#### 5. Methods of protection

For the protection and exhibition of earthen sites, such protective means as earth-covering, brickwork-enclosing, shed-covering and simulative restoration are often applied for exhibition purposes. During the Protection Project of Hanyuan Hall, the exhibition methods of brickwork-enclosing, earth-covering of the hall surface, shed-building (for part of the site), and installation of protective windows were applied. Based on this experience, similar means of protection and exhibition were applied to the Protection Project of Linde Hall, which was carried out subsequently.

In order to prevent water immersion, the rammed-earth layer and the waterproof layer was added to all rammed-earth hall bases and other areas of the site, so that rainwater could not directly reach the site's earthen surface. Specifically, a layer of fine sand was laid on the surface of the original site to achieve a difference between the original rammed earth and the new rammed earth. Then, the same soil with a thickness of no less than 50 cm was laid on it and rammed compactly. This served as a protective layer. Then, it was covered with a waterproof

layer of lime earth according to its thickness and location. Based on experimental data, compactly rammed 3:7 lime earth can effectively prevent the passage of surface water. Finally, part of the lime earth was covered with a surface layer of cyan earthen bricks.

#### 6. Design of the site protection project

##### 6.1. Design principles

- 1) respect archeological data, and take it as the first standard;
- 2) refer to various types of documents and historical records, and study the original state of various parts;
- 3) appropriately plan the peripheral part of the site according to the current surroundings;
- 4) keep the original site complete and safe by combining the application of science and technology with tradition;
- 5) restore the scale and form of the steps and base of Hanyuan Hall to their original state;
- 6) make the protection work reversible so that later generations can study the site conveniently.

##### 6.2. Major methods of site protection

- 1) *Protection of the site's rammed earth surface*: As to the surface of the Tang Dynasty site that had previously been archeologically excavated, after cleaning it, 5-10 cm of fine sand were laid on it. It was then covered with 45 cm of earth. Therefore, a protective layer for the site surface over 50 cm in total came into being. The principle was to achieve a difference between the site surface and the protective structure without destroying the site surface.
- 2) *Supportive reinforcement*: Many crevices, cracks and cave-ins have been left behind at the site after more than 1000 years of natural and artificial destruction, which have brought hidden risks to the stability of the site. Accordingly, these parts were reinforced or rammed using original raw materials and craftsmanship, and surrounded with bricks and stones, e.g. filling caves; reinforcing side slopes; filling cracks.
- 3) *Limited restoration of the site base*: If there was sufficient evidence from textual research proving that the site could be accurately restored, it was restored using original raw materials and craftsmanship, e.g. we surrounded various layers of large platforms with bricks and stones according to the original practices of the site, thus having not only protected the site, but also achieved the purpose of restoration.  
If there was insufficient archeological evidence and the site needed to be supported or repaired, it was protected with bricks and stones, thus making its surface different from that of the original ancient buildings.
- 4) *Limited partial exhibition*: There are remnants that can be exhibited to visitors in some parts of this site, including intact layers of rammed earth, brick apron pavement, and stone foundations under pillars. They were exhibited by setting up observation windows or observation wells in the protective layer, so that visitors could have a realistic feeling (Figs. 1 and 2).



Fig. 1 The site of Hanyuan Hall unveiled by archeology.



Fig. 2 The site of Hanyuan Hall after the protection project.

## 7. Design of the Hanyuan Hall protection project

### 7.1. The main body of Hanyuan Hall

The main body of the hall is located on the highland at the top of Dragon Head Tableland. Its four-sided boundary is clearly discernable. The location of pillars and walls on the hall base can be archeologically confirmed. There are brick-paved apron remains around the walls of the hall base. Therefore, both its scale and height can be confirmed.

*The protection plan:* fine sand was laid on the layer of rammed earth on the main body of the hall as an insulation layer. Then, a 45-cm-thick protective layer was made on it, the edges were protected with a brick-wall, the platform floor was laid with earthen bricks, and stone foundations were

restored at each pillar location. Both lining bricks and floor bricks were copied according to the form and dimensions determined by archeological excavations while striving to reflect traditional craftsmanship and offer a certain feeling of the original site. Where there were remnants of rammed earth on the hall base, a 0.8-m-high low wall was built using traditional ramming craftsmanship with a mixture of loess, yellow sand and rubber powder. From a planar viewpoint, the project of protection and restoration displays the original plane and pillar grid setup of the main body of Hanyuan Hall.

### 7.2. Repair of the main steps

The main body of Hanyuan Hall is located on a pedestal of three flights of steps, rising layer by layer from south to north.

Height differences of the pedestal are based on the intrinsic slope of Dragon Head Tableland. Archeological excavation confirmed the location and height of the first layer of the platform (the lowest layer). It also has been confirmed that the third layer is the pedestal under the main body of the hall. The specific location of the second layer has not yet been found due to the serious destruction of the site. In order to prevent the existing site from being destroyed further and to exhibit the form of the flights of steps, a 5-cm-thick layer of fine sand was laid on the foundation of the original site of archeological excavation, and then was covered with 45-cm-thick loess, thus forming the intrinsic protective layer for the site remains. Its flights of steps were supported by a brick retaining wall. To achieve waterproofing, lime was added to the upper 10-cm-thick rammed earth on the surface, thus forming a waterproof layer of lime earth. In addition, the flights of steps of the pedestal were covered with a brick floor. The brick retaining wall was made according to traditional practices and earth-lining stones and rectangular stone slabs were used for its lower and upper parts respectively. However, for the sake of safety, the foundation of the retaining wall was specially designed.

### 7.3. Dragon Tail Path

Dragon Tail Path was designed for people to mount the hall from the south. It is called Dragon Tail because the zigzagging slope left in historical records is just like the tail of a dragon. During this archeological excavation, no evidence was found of the zigzagging Dragon Tail path. However, traces of a ramp were found at the intersection between the two pavilions (eastern and western) and the flights of steps of the hall. Therefore, the Dragon Tail Path was located on the inner side of the two pavilions, as affirmed by archeological data. During these repairs, a ramp was set up for mounting the main body of the hall. Since there is no evidence of a zigzag, a gently sloping ramp was used for directly mounting the main body of the hall on the inner side of pavilions. As for the specific method, the site was first covered with a protective layer of earth before covering the surface of the ramp with gray earthen bricks modeled after those unearthed in Hanyuan Hall of the Daming Palace (both plain surface and lotus-patterned bricks).

### 7.4. Large platform and eastern platform of the two pavilions

The Xiangluan Pavilion and Qifeng Pavilion are on both sides (eastern and western sides) of the hall. Located on platforms of rammed earth, the two pavilions consist of three watchtowers. Although these two pavilions have been seriously damaged, the location of the apron bricks of their body still can be seen. However, the pavilion platforms under them have been seriously damaged or disabled, so it is very difficult to find their edges. In addition, the body of the pavilions has little of the original rammed earth left behind. Therefore, in order to restore the height of the pavilions, it is necessary to further study the original. Therefore, this part of the project included the protection of the remaining parts of the watchtower platforms and the restoration of the

pavilion platforms. Due to more than 1000 years of transformations, the original topography of Dragon Head Tableland has also been destroyed. Therefore, before repairing and restoring the pavilion platforms and the watchtower platforms, it was necessary to first restore the destroyed landform. Before building pavilion platforms on it, the land was refilled, ground and rammed compactly with pure loess. As to the specific method, a platform was first rammed up to the designed height with pure loess before building up a brick retaining wall around it, so as to ensure the stability of the platforms rammed up with loess. After ramming them up to the level of the remains of the watchtowers, the remnants were first insulated with fine sand before being covered with a 45-cm-thick protective layer of loess and finally being laid with brick. According to archeological excavation and research data, both Xiangluan Pavilion and Qifeng Pavilion consisted of three watchtowers, and a layer-by-layer decline occurred between the subsidiary and the main watchtowers. Although the original height could not be restored during these repairs, a take-in and decline was worked out on the remaining watchtowers while protecting the rammed earth of the watchtower platforms, so as to reveal their original form. The pavilion platform and the surrounding bricks of the pavilion platform were elaborately fired according to archeological reports and site remains and laid using traditional craftsmanship, so as to maintain the original look of the Tang Dynasty. Windows were also made in the north of the three watchtowers of Qifeng Palace to display part of its rammed earth.

### 7.5. Eastern and western veranda

There exists the base site of a building between the main body of the hall and the two pavilions, which is located on the high platform slightly lower than the main body of the hall, called Qiantong Gate.

Guanxiang Gate. There also exists the base sites of buildings to the east and west of the gate, which should be the annexed buildings of this hall, but there are no historical records about it. This site has been poorly preserved. Protection was still initiated on this part according to the archeological findings at the site. The western part of Guanxiang Gate had been completely mutilated, so it was restored by referring to the form of Tongqian Gate. After protecting the site surface by covering it with earth, the floor was paved with earthen bricks.

### 7.6. The square in front of the hall

Between Hanyuan Hall and Danfeng Gate is the main square of the architectural complex of Daming Palace, used as a venue for inspection, court meetings and grand ceremonies in the Tang Dynasty. Due to pressure from modern buildings, this square has become incomplete. The existing land within the scope of the office for the protection project is 250 m from south to north and 280 m from east to west and is basically rectangular. Inclining from north to south, this square has a large grade. Through archeological investigation, it has been confirmed to be the floor of the square in the Tang Dynasty, but it has been seriously destroyed. Most prominently, there is a ditch dug up in the 1940s near the

site of the first layer of the platform on the north side of this square, and a ditch to the east of the hall, both of which have destroyed the floor of the square. The project design adopted the method of refilling and ramming to restore the remaining part of the original look of the floor at the place of the square. As for the specific method, the floor of the square was covered with pure loess before being leveled with machines. Since such remains as the remaining platforms have all been raised by 50 cm, the square has also been raised accordingly.

No trace of brick pavement has been discovered on the original lawn of the square. Therefore, it was guessed that the square had been filled or rammed evenly with loess. Considering that the environmental effect would become very bad if the loess was still exposed after Hanyuan Hall was open to the public, partitioned turf was planted on most of the surface of the square, but no trees were planted in case the remains under the square would be destroyed.

### 7.7. The project of protecting the kiln site to the northeast of Hanyuan Hall

The kiln site to the northeast of the steps of the hall used for firing earthen bricks in the Tang Dynasty was archeologically excavated together with the site of Hanyuan Hall. By taking advantage of the highland of Dragon Head Tableland, workers dug an underground tunnel and fired bricks and tiles for the construction of Hanyuan Hall using local materials. Each kiln furnace discovered on the spot has a total of four holes, and the kiln chamber, chimney flue, inner passage, etc. are relatively intact. Several kiln furnaces are arranged around the central passage. The burned kiln wall is hard, compact, and dark-red in color. The entire system can very well reflect the technology of firing bricks and tiles in the Tang Dynasty. Since there generally are no protective measures for abandoned kiln sites, excavated kiln bodies usually face various kinds of dangers. First, due to the open-air exposure of the site, direct rainwater erosion and weathering have brought about such damages as cracking, instability and collapse of the side slopes of the kiln body, and the weathering and peeling of broiled earth on the surface of the kiln. Next, the area of the kiln site is within the scope of the northern base of Hanyuan Hall. Since the main body of the landscape is the site of Hanyuan Hall, the image of any other building and structure will have a certain degree of effect on the overall landscape of the hall.

Based on these facts, protective measures should be considered in two categories: the landscape and the kiln site. In terms of landscape, the kiln site is the only annexed part of Hanyuan Hall. Therefore, the influence upon the main body of the site in such aspects as volume and form should be reduced. Measures of landscape protection in this aspect are to maintain the present height of Hanyuan Hall. The existing side-slope height difference was taken as the space for the protective construction of the kiln site, adopting the proposal of protecting the kiln site according to its original height and volume by taking advantage of its original location under the northern base of Hanyuan Hall.

The means of protection was to build a covering structure on the top of the kiln site to prevent direct corrosion from

rainwater. According to the existing preserved space, the other buildings were divided into exhibitions of the ante chamber and kiln site. The ante chamber is to serve as a waiting room and space for organizing visitors. The exhibition center at the back of the kiln site is designed to accurately and completely protect and exhibit the kiln site. Due to the necessity of management and protection, the kiln site is also to be exhibited in a closed manner. After the completion of the project, it looks like an exhibition hall from the north but like an underground building from the upper part of the hall base. In this way, not only have the general requirements of an exhibition building been met, but also the influence of excessive construction on the whole site has been avoided.

The protection of the main body of the kiln site was divided into two stages. The first stage: carrying out a complete pre-reinforcement before commencing the protection project.

First, a chemical reinforcement to the surface of the areas of broiled earth on the inner wall of the kiln site that showed signs of weathering was carried out. The treated surface of the kiln site was covered with Japanese paper (equivalent to good-quality long-fiber Chinese Xuan paper).

Next, in order to guarantee the stability of kiln earth during construction, the kiln wall was filled with sandbags for support. Since the wall surface of the kiln site is an irregular arc, in order to ensure even and complete contact between the filler and the wall surface, polystyrene foam was poured into it. In order to ensure the stability of the earth around the kiln site, and to prevent collapse or the rapid occurrence of cracks, sodium silicate was poured over it to reinforce it. All these measures have ensured the safety of the earth body and kiln surface during the protection project.

For the top structure of the kiln site, a steel color plate roof with a foundation of manually bored reinforced concrete was adopted, convenient for installation and disassembly. As for roof treatment measures, waterproofing was considered and grass was planted in hollowed bricks for its outer appearance, so as to keep it in harmony with its surroundings. After the completion of the construction work, the sand bags used for filling the kiln site and other annexes were removed. Project inspection has proved that this way of pre-reinforcement filling can effectively protect the safety of these kinds of cultural remains.

The second stage: after the kiln-site construction was completed, the floor and kiln wall of the kiln site were formally reinforced, a process which was divided into two parts:

First, by means of physical support, an arch center was produced and installed along the kiln wall using square steel, thus effectively solving the safety problem of the top of the kiln.

Second, by means of chemical reinforcement, the broiled earth surface on the inner side of the kiln wall was sealed and protectively reinforced.

In terms of utilization and exhibition, in order to bring as little interruption as possible to the cultural remains, and to avoid the influence of trampling upon the original loess floor, a wooden plank road was used for the entire indoor passage, thus not only creating desirable conditions for

aesthetic enjoyment, but also avoiding direct contact between the viewers and the site itself.

Of course, this project is yet to be perfected, especially in such aspects as adjusting the microclimate environment, preventing condensed water from occasionally occurring indoors, and improving ventilation.

### 7.8. The design of a small exhibition center to the north of Hanyuan Hall

The Hanyuan site is a site in its pure form, and it is impossible to set up an onsite exhibition space. However, there is no place at the site of Hanyuan Hall that can serve as an auxiliary site for displaying and exhibiting unearthed cultural relics. Many research results also show that there is no space for exhibition. According to these demands, a small building for research and exhibition was planned at the site of Hanyuan Hall.

The first problem is its location. Within the scope of Hanyuan Hall, so far, no places other than the site itself have been archeologically explored in detail. Moreover, in terms of the overall layout of the site of Daming Hall, there is no land around the site of Hanyuan Hall for carrying out construction without influencing the environment. It is very necessary to design an exhibition center which is very close to the site of Hanyuan Hall for exhibiting research results and cultural relics unearthed in the hall.

At last, we planned to build this exhibition center below the northern base of Hanyuan Hall. There are earthen cliffs which emerged throughout history from the destruction left by earth-borrowing. The earthen cliffs are about 4.5 m high. Due to its location at the highest spot of Dragon Head Mountain, the former site of Hanyuan Hall should have been a continuous slope. The form of these earthen cliffs does not conform to the true original site of Hanyuan Hall. Moreover, these earthen cliffs face the danger of cracking and collapse. The solution was to restore the topography of rammed earth to the north of the hall, and restore the form of the original slope with loess alone. Or a protective slope for the safety of the north of the hall base could be built. Considering these two factors and the area of the exhibition center, we built a small building for research and exhibition by taking advantage of the height difference between the earthen cliffs. This is very beneficial for perfecting the overall exhibition system of Hanyuan Hall while taking advantage of the topography. Moreover, this building also can play the role of supporting the earthen cliffs on the northern slope. It also can form a complete exhibition space to the north of Hanyuan Hall by echoing the kiln site to its east.

The exhibition building of Hanyuan Hall is divided into two parts: the eastern part is an independent exhibition hall; the western part is office houses used for the management of the site of Hanyuan Hall; the part between them is used for management and transportation. The overall building has only one story, with the same height as the original side-slope. The treatment of the roof of the building aims to make it a part of the steps to the north of Hanyuan Hall. This building has a structure of reinforced concrete. Its roof is covered with hollowed bricks and planted with turf to integrate it with the environment of the hall site. The outer

facade of this building is treated as simply as possible without any whitewashing. In terms of color and molding, visual interruption was prevented to a maximum. Traditional exhibition models including showcases and booths were adopted in the exhibition hall. With cultural relics unearthed in Hanyuan Hall and research results in recent years as its main exhibition contents, it has made up for the following deficiency of the site of Hanyuan Hall: conveying insufficient information.

## 8. Protective design of Linde Hall

During the design of the project of protecting Linde Hall, we adopted the same means of protective exhibition and the same technique of design as that of Hanyuan Hall. They are slightly different only in the aspect of partial site exhibition.

- 1) The surface layer of Hanyuan Hall is covered with cyan square bricks, while the surface layer of Linde Hall is covered with loosely paved bluestones, because there is some evidence of this practice in layered remains found during archeological excavation. According to these results, due to the alternating of dynasties and additional repairs, the surface layer includes both bricks and stones with different specifications. To meet the requirements of visitors, and exhibit some original remains, we loosely laid some stones on the surface of the hall to convey the feeling of the surface layer of the hall.
- 2) Shed-cover protection and display window: shed-covers were built in the form of an apron for protective exhibition of the partially intact brick walls. For pillar-foundation stones and gate-pier stones on the surface of the hall, special protective windows and observation wells were built so that viewers can have a better perceptive understanding of the building materials and practices of the Tang Dynasty (Figs. 3 and 4).

## 9. Conclusions

- 1) The implementation of the project of protecting the site of Hanyuan Hall acts as a model for the protection of other large-scale sites around Xi'an. It has accumulated much design and construction experience for the protection of large sites in the future.
- 2) During the project, if no explicit answer had been found in such aspects as archeological data, documentary data and scientific research, vague techniques were adopted so as to leave room for future archeological investigation and research.
- 3) It is very important to determine the overall protective idea and layout plan of the site before designing the project of protecting the site.
- 4) Closed protection of brickwork: this is a means of engineered protection under which the base of rammed earth left behind was surrounded with bricks, stones or rammed earth, and loess was added between the newly built wall and the base of rammed earth, and on the base of rammed earth, so that the site can lie in a state of closed isolation. This method applies to sites at which a high base of rammed earth has been left behind on the



Fig. 3 Rendering of the Protection of Linde Hall Site.



Fig. 4 Recent picture of display window at the Qifeng Palace Site after the protection project.

ground. It is also a realistic portrayal of the high-platform buildings in the Tang Dynasty surrounded with black bricks, and one of the important methods adopted for the protection and exhibition of the site of Daming Palace.

- 5) Remains which are kept in a good condition and are of some aesthetic value should be exhibited to the maximum if conditions of protection and engineering technology permit. Exhibition of a site is in itself a means of protection.
- 6) Due to the particularity of the project of protecting the site, the conflict between design plan and the size of the protected site often occurred during the process of

construction. Therefore, design work basically ran through the entire process of construction.

The Protection Project of Hanyuan Hall and Linde Hall is a kind of exploration into the means of protecting and exhibiting large sites, which up to the present has been very successful. With the development of science and technology and the renewal of human concepts, methods that suit the preservation and protection of sites and can further exhibit the historical information of sites will certainly emerge. We should proceed with our research and exploration.