46 Reconstruction of the 8th–century Imperial Palace of the Heijo capital at Nara in Japan

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46.1 NABUNKEN (NARA NATIONAL CULTURAL PROPERTIES RESEARCH INSTITUTE) AND THE SITE OF THE HEIJO CAPITAL

Nabunken is the short, informal name for the Nara Kokuritsu Bunkazai Kenkyujo, officially translated as the Nara National Cultural Properties Research Institute. The only national research organisation for archaeological sites and historic buildings and gardens in Japan, it is located adjacent to the site of the Imperial Palace of the ancient Heijo capital (710–784 AD).

One section of the Institute, the Heijo Palace Site Investigations Division, began a systematic excavation of the Heijo Imperial Palace in 1955. Work has continued ever since then. The policy has been to divide the palace into areas. Half of each area is excavated and half left undisturbed for the benefit of future research. In this way about 30 per cent of the palace area has been examined during the past 35 years.

46.1.1 Location of the Heijo capital

The Heijo capital (*Heijo kyo*) is located in the northern part of the Nara Basin, very approximately in the centre of the country. The site is within the boundaries of the present–day city of Nara, to the east of Osaka, Japan's second city.

The Imperial Palace, temples, and aristocrats' mansions of the capital were symmetrically located within a grid system of a form adopted from China. The capital was 4.8 km from north to south, and 4.3 km from east to west. There was an extended section on the east side. It is thought that the city had a population of more than 100,000 people and was one of the largest cities of the whole 8th–century world.

46.1.2 Location of the Imperial Palace

The Heijo Palace (*Heijo kyu*) was situated at the centre of the northern end of the city. It covered an area of about 1,200,000 square meters, and it was surrounded by an earthen wall surmounted by a roof (*tsuiji*).

46.1.3 The first imperial audience hall (Daigokuden)

The Heijo Palace was divided into several areas. These were the First Imperial Audience Hall Area, the Second Imperial Audience Hall Area, the Eastern Residence Area and various other sections where governmental offices and bureaus were located. Structures found behind the Suzaku Gate (the main entrance to the Imperial Palace) are thought to be the first sections of the Imperial Audience Hall and the Government Office compound. We think that the Second Imperial Audience Hall compound was built in 745, during the reign of Emperor Shomu. After that time, the area behind the Suzaku Gate became an imperial residence.

The First Imperial Audience Hall compound area measures 180 meters east to west, and 300 meters north to south.

46.2 POST–EXCAVATION LANDSCAPING TECHNIQUES AND REPLICATION OF ANCIENT BUILDINGS

After excavations are finished, the sites are turned into new sections of a museum–park. The excavation area is first landscaped and then turned over to the museum.

We use several different landscaping techniques. For example, we indicate ancient ditches

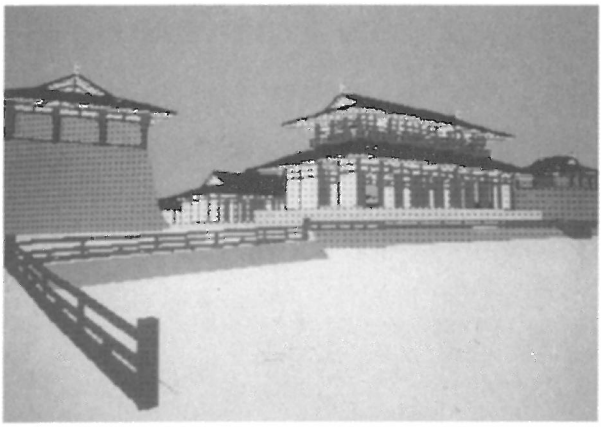

Figure 46.1: Computer graphics reconstruction of the first imperial audience hall area during the early Nara period.

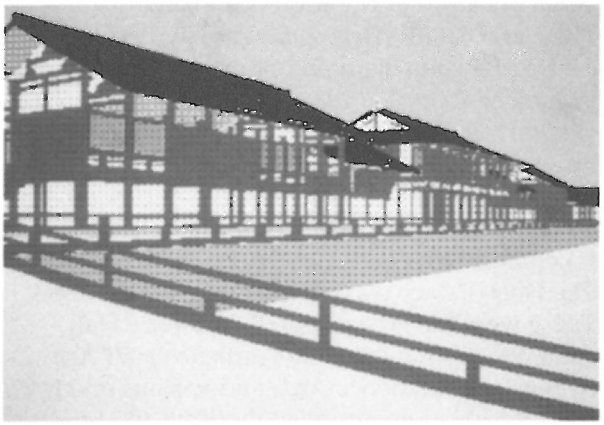

Figure 46.2: Computer graphics reconstruction of the first imperial hall area during the later part of the Nara period.

or water areas by laying down color–coded gravel or we may plant bushes to indicate the positions of former post holes, etc. Another method is to construct earthen platforms over architectural features that have been discovered. Sometimes we are able to make a full–scale reconstruction of an important building.

Such work has its limitations. Data is often limited, especially if the site has been disturbed or partially destroyed. We may be obstructed by present–day features such as roads or ditches, moreover ancient features nearly always lie on top of or cut into each other. Almost all the buildings had pillars embedded directly in the ground. Distinguishing the superimposed post holes of different buildings constructed on the same sites can often be complicated. In some places more than 7 buildings have been found constructed in the same position.

We must choose suitable buildings for replication, and indeed chosen the best methods for creating our historical museum–park. In the case of the First Imperial Audience Hall area, we plan to reconstruct a full–scale model of the buildings, but this will take more than 10 years and require more than US $ 250,000,000.

Before the real reconstruction work begins we must do computer graphic simulations to test the soundness of the designs. We actually have a few examples of Nara period buildings still extant. Several temple buildings have survived for more than 1200 years. From these examples, we can make detailed drawings of the probable superstructures of palace buildings, and before full–scale reconstruction is attempted, we can make small–size models. A small scale model of the whole of one area and a large–scale model of one building is also necessary. However making models is expensive and requires a lot of time, and remaking physical models is troublesome if our ideas change, especially if the model is highly detailed, so computer graphics simulations are used.

46.3 USING DYNAPERS3 AND LAPLAS

One of the authors of this paper, Makoto Motonaka started using two computer systems in 1989. One is for architectural designs and is called DYNAPERS3 (Dynaware Corporation), the other is for making topographical perspectives and is called LAPLAS (Kozo Keikaku Engineering Incorporated).

46.3.1 DYNAPERS3

DYNAPERS3 is a relatively small–scale application for use with a personal computer, in this case the inexpensive NEC MS–DOS computer PC–9801, which is popular in Japan (though not fully compatible with the IBM–PC). It takes up to a month to input one batch of data using this machine because all the data has to be entered from the keyboard. Much time is required to calculate three–dimensional sketches. For example it takes about two hours to do one complex drawing.

Illustrated here is an example (Figure 46.1), the First Imperial Audience Hall during the early Nara period. Another drawing (Figure 46.2) shows the same area during the later part of the Nara period. The originals are in 8 colours, then we can express red pillars, white plaster walls, and green roof–tiles. Colour printing also poses problems of time and money. If low resolution output is used, image quality obviously deteriorates.

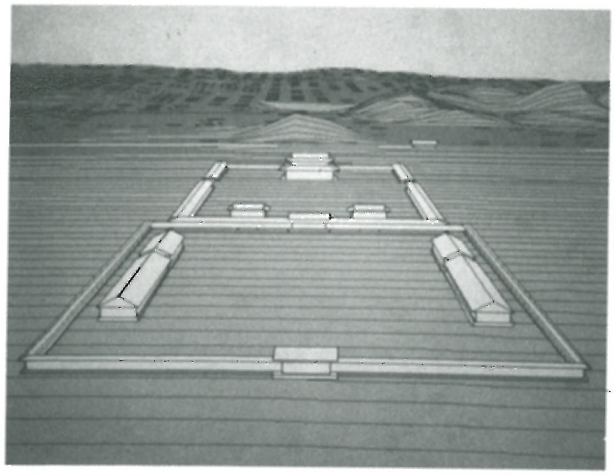

Figure 46.3: Computer graphics reconstruction of 3D perspective of the first imperial audience hall area.

46.3.2 LAPLAS

In order to make topographic models of whole areas, the second software application called LAPLAS (Version 5.4) is used on a UNIX work station, in this particular case, a Data–General AV–301C.

The work is done in two steps. First the contours are traced with a digitiser using the program on a PC–9801, as it is essential that we make a contour map based on three–dimensional topographical data.

Because direct connection between the AV–301C and the AC–1(Analytic Drawing Machine) is impossible, the output contour map of the AC–1 has to be traced to obtain the LAPLAS perspective from the AC–1 data. (Tracing is laborious, so the authors intend to write the necessary bridging software).

Some text file filtering is done on the personal computer, PC–9801. Data is transferred from the PC–9801 to the AV–301C by ftp on the Ethernet.

The LAPLAS CAD system uses grid data. Some data filtering is also necessary before we can use the main LAPLAS 5.4 program.

LAPLAS is used to draw the three–dimensional perspective, after the text data has been reformed and combined with grid data. As an example Figure 46.3 shows a plan of the area of the First Imperial Audience Hall.

LAPLAS is useful for large–scale topographic simulations, but one cannot make a detailed construction within the topographical landscape. The realisation of superstructure is pretty limited. So now we are trying to combine the two systems, one being used for the building detail and one for the large–scale topographical modelling.

After a few months work, we are thus able to make three–dimensional drawings of structures in their topographical settings, and we can evaluate our planned reconstructions before they are begun. This is an indispensable stage in the creation of our palace site museum park.

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