

A DESIGN RESEARCH OF RAILWAY STRUCTURES AND ARCHITECTURES *

鉄道構造物と駅の景観シミュレーション

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1. Introduction

Urban structural design in our country has focused primarily on function, economy, and safety. However, recently there has been renewed interest in the aesthetic design of urban structures and public spaces such as railway structures. The aesthetic values implies harmonization of all structures in a public area. Some special works could be found, for example, Kyoto, Asahikawa, Shinminamata station. However, the concept harmonization has not been generally applied to the design and construction of the structures and plazas.

These principles were applied in an attempt to create a new aesthetic design for the imaginary railway structures and architecture including the railway viaducts, station architecture and surrounding plaza of a railway station in a traditional town as a case study.

2. A Case Study of Aesthetic Design

The present case study considered the station area shown in Fig.1. This diagram represents the main gateway of a typical historic town surrounded by mountains such as Nara station.

In the present study, the design of railway viaducts, station architecture and surrounding plaza was considered.

The area consists of new plaza and pedestrian decks in front of the main gate. These are linked to the grand floor and second floor of the station by pedestrian walkways. The design allows the front and back of the station to remain connected.

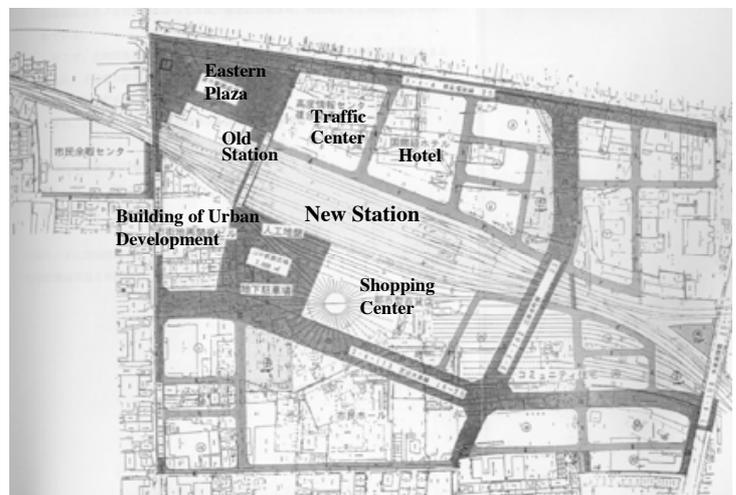


Figure 1 : Site Plan in this Simulation of Design

3. Investigation of Natural and Historical Features

The landscape of a city such as Nara was investigated and the role it plays was examined in order to create the appropriate design. The elements of the landscape considered in the present study consisted of both natural features, such as mountains and rivers and historic features, such as temples and shrines. For example, Nara is famous as the ancient capital of Japan and tourism is the main source of revenue. Even today, many temples and beautiful mountain scenery have been preserved.

At the beginning of the study, the natural features, cultural assets, recent land use in the area as well as building location were investigated. Thus,

we believed that the new railway structures should not break from the traditional and natural atmosphere. However, the new structures should also offer a contrasting

aesthetic quality to the traditional atmosphere. This aesthetic relationship is considered in the next chapter.



Figure 2 : Natural Features and Tiled Roofs

*Keywords: landscape design, railway structures, railway station, plaza

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4. Examination of Form and Function of Structures

(1) Station Architecture and Surrounding Plaza

About 40,000 people, for example, use Nara train station everyday. To ensure effective use of space, the station was designed to consist of two floors. The first floor would house restaurants and shops while the second floor would contain the main platform and concourse. Two plazas were planned for the Eastern and Western gates in order to provide access to the main platform from both the first and second levels as well as provide a rest area for passengers. The European style old station would be moved to the new plaza as a monument. People can also use it as a bower.

(2) Railway Viaducts

Ridged frame viaducts are generally used in Japan in consideration of cost and safety. However, such a design can be detrimental to the aesthetics of the area. Piers of consisting ridge frame viaducts generally lend a heavy impression because pier tends to be shorter than the pier of highway structures. In an attempt to solve these problems, all the hunches attached to the vertical beams could be removed and the drain pipe could be buried within the pier. Furthermore, a wall style pier could be constructed in order to reduce the number of piers and beams.

5. A Design Simulation of Railway Viaducts

We are attempting to create a new aesthetic balance by emphasizing the contrast between the ancient aspects and modern aspects of the city. The many large old temples leave a somewhat heavy and gray impression of the city. Therefore, we want to incorporate light and clear images into the new railway structures and architecture. This was investigated using a 1/500 scale model of the city and landscape.

Several concepts have also been proposed for the design of well-balanced railway viaducts.

However, the principle of public design of structures must dissociated from the personality of the designer. Instead, the natural and cultural features should be emphasized. Large long railway viaducts tend to strongly

influence the surrounding landscape. Such structures also include many additional confounding components such as piers, girders and walls. Reducing these components can greatly enhance the aesthetic qualities of the structure. Thus, we considered the aesthetic design of viaducts with respect to its impact on the surrounding landscape.

(1) The type of design using straight lines

- Removing hunches of girders; The beams could be constructed with straight lines by removing all the hunches.
- Hiding the drainpipes; Furthermore, burying the drainpipes in the posts would provide a much cleaner profile.
- Emphasizing the horizontal outline; The horizontal outline can be emphasized and simplified by making the thickness of the girder and pier equal.
- Creating many slits; Finally, carving many slits on the back of the girder would reduce the perceived size of the structure.

The perspective of the proposed design was drawn using computer simulation. (See Fig.3)

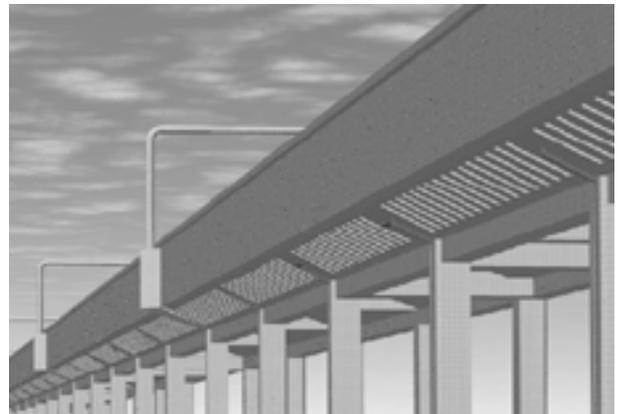


Figure 3 : “Straight Line“ Type

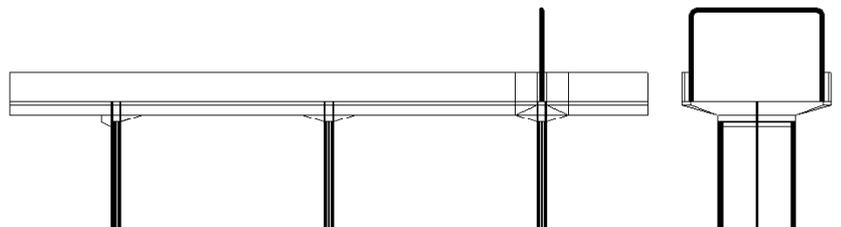


Figure 4 : Section of “Wall Pier” Type

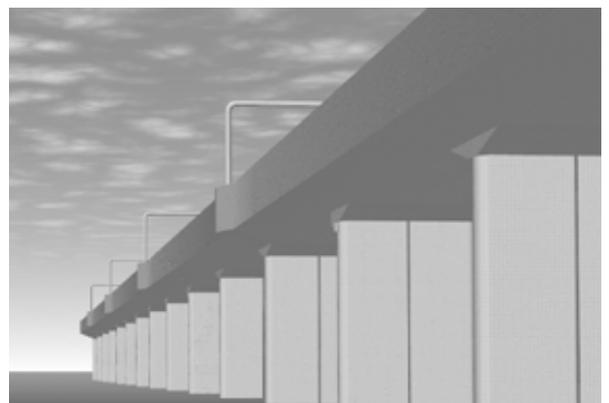


Figure 5 : Section of “Wall Pier” Type

(2) The type of design using wall piers

● Wall Piers; Complicated vertical outlines could be reduced by using wall piers.

● Harmonious Whole;

A pier with wires and wall balustrade form a harmonious whole.

● Hiding the drainpipes

The perspective of the proposed design was drawn using computer simulation. (See Fig.4 and Fig.5)

6. Conceptual Design of Station Architecture and Surrounding Plaza

We proposed the use of a long span between piers and a huge roof to create a new image for the station. The roof including all the platforms was designed to unify human activity in one large spectacular space as well as create a new urban landscape within the surrounding landscape. The urban area can be viewed from the platform. In addition, we considered a link between the station and the plaza to be essential to allow a continuity to exist between the internal and external spaces and to allow people to walk and relax.

6-1 Conceptual Design of Station Architecture

(1) "Clouds" ; Image of natural landscape

Several concepts have been proposed for the design of a light clear station and plaza. One such proposal is called "Clouds". This proposal calls for the roof of the platform to have a curved surface to resemble clouds. It gives a light and floating impression. It could be considered to use penetrating skin of Teflon and collected wooden materials as the construction material. The town scenery can be viewed from the platform as a result of the long slender piers. The curved roof also gives a gentle and soft impression to people. The perspective of the proposed design was drawn using computer simulation. (See Fig. 6)

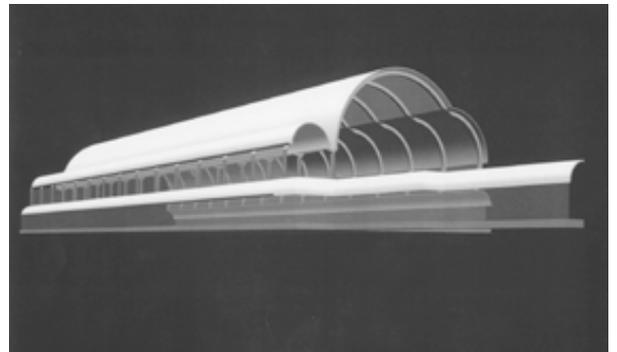


Figure 6 : "Clouds" ; Image of Design

(2) "Tile Roof"; Image of traditional architecture

The large traditional tile roofs of temples and shrines comprise the main component of the surrounding scenery of Japanese historic towns. Thus, we propose a second concept that considers the shape of the tiles.

The internal space of the station consists of compound roofs that are folded and piled up to represent the shapes of the traditional tiles. Polycarbonate boards prevent the rain from entering the platform area.

Roofs of a fine texture that is in harmony with the natural features of the surrounding landscape as well as a balance between light and shadow enhance the atmosphere of the structure. In addition, environmental aging of the materials can play a significant role in achieving an aesthetic balance with the surrounding landscape.

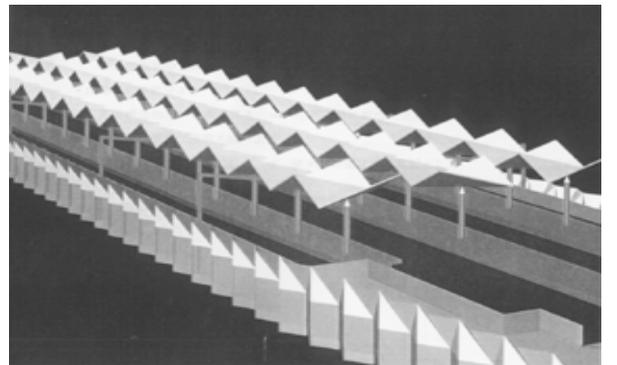


Figure 7: "Tile Roof" ; Image of Design

Such considerations allow a continuity to be developed between the station and the plaza consisting of restaurants and rest area.

The perspective of the proposed design was drawn using computer simulation. (See Fig.7)

6-2 Conceptual Design of the Plaza

The former traditional station would be moved to the center of this plaza as a monument. The overall surface of the plaza would be constructed with a gentle slope. The plaza would be linked to the station to allow visitors to walk directly from the platform to the plaza. (Fig.8 and Fig.9)

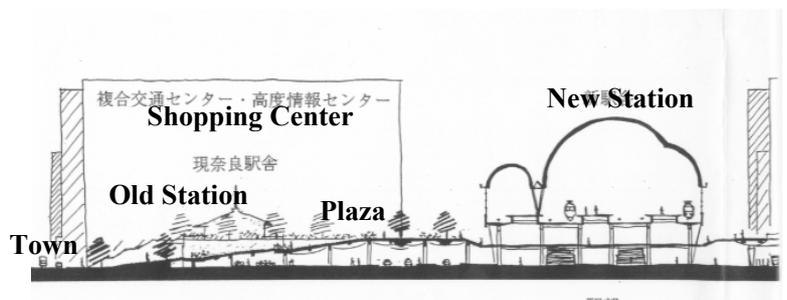
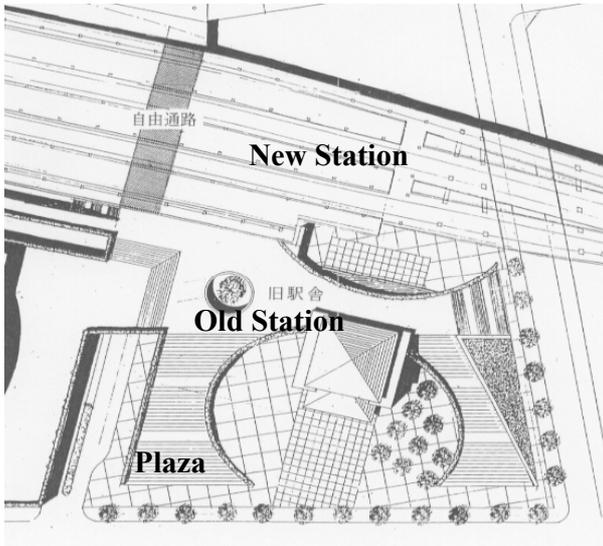


Fig.9 Section of the Plaza

Figure 8 : Plan of the Plaza

7. Proposed Design using Presentation of the new design using Computer Simulation

The final proposed design will be analyzed from the perspective of pedestrians and drivers using computer simulation.

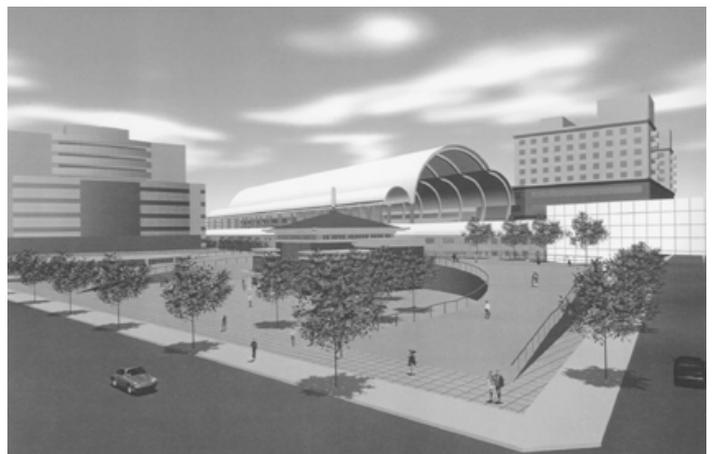
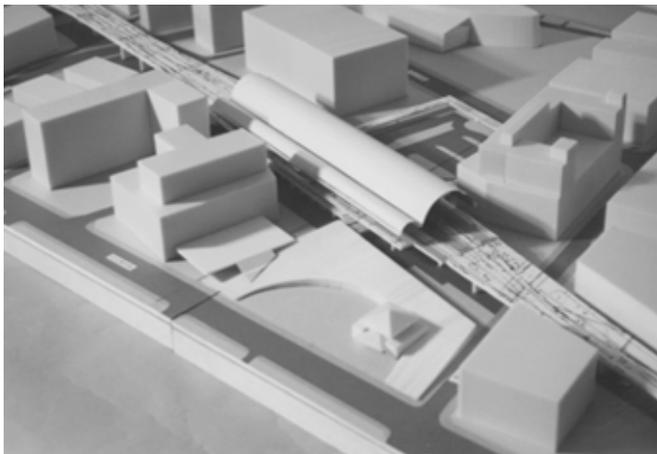


Figure 9 : Perspective 1 ("Clouds")

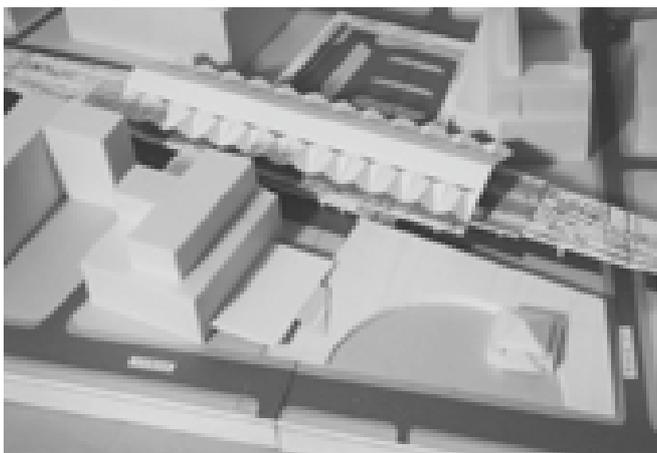


Figure 10 : Perspective 2 ("Tile Roof")

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