



Devised to efficiently implement a variety of space
Tianjin library

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Summary

This architecture possessed the internal space have the various size and shape planned according to the various functions as the library. This architecture formed from our structure system requested from architect could arrange planned various space efficiently. In this paper, we introduce the ingenuity and design process that was employed to efficiently achieve a large building having a variety of spatial elements.

Keywords: Elegant Structures, Aesthetic Design, New Structural Form

1. Introduction

Tianjin Library in the vast park of 90ha as part of the new urban development of Tianjin, China, was built at the same time as the construction plan as a shopping mall, Museum, Art Museum, Theatres. This library that total floor area has a number of books collection 6 million books of scale beyond the 58,000m² is the largest scale of library in China (table.1). This plan have inner space having a variety of size and shape. We had to make propose structural systems which can efficiently place. (Fig 1, 2).

Table 1: outline of architecture

Name	Tianjin Library		Plan Location:	Tianjin, China	
Owner	Tianjin, China		Function	Library	
Design and supervision					
Architect		Riken Yamamoto & FIELDSHOP + Tianjin Urban Planning Design & Research Institute			
Structure (Basic design)		Structural Design Office Plus One, co., Ltd.+ Tianjin Urban Planning Design & Research Institute			
Site area	37,800m ²	Building area	13,700m ²	Total floor area	55,000m ²
Number of floors		1 basement , ground floor 5			
Floor height :		about 3.8m, about 6.4m max height : 30m			
Structure		Steel + Reinforced Concrete			



Fig.1: Appearance

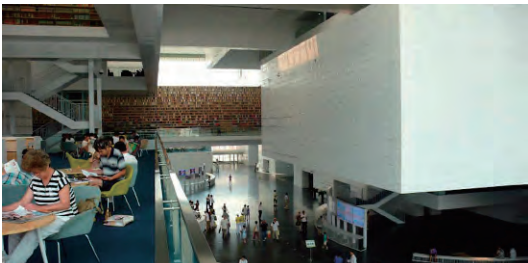


Fig.2: Introspection



2. Structure of the bookshelf

This plan have large atrium and long span (40m). To not appear structure, we took wall girder in the book shelf. The book shelf with wall-girder which also serves as a communication passage, could realize the brightness of the atrium space. (fig.3)

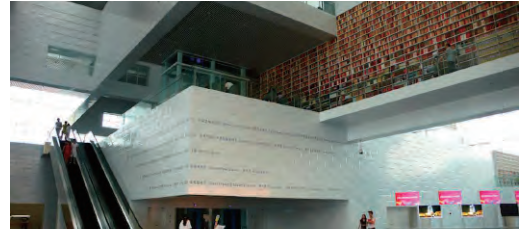


Fig.3 bookshelf with wall-girder

3. Cross grid structure system

In order to organize the huge building, we adopted the rules of 'cross grid'. The cross grid is overlaid on the grid shifted by a half worth of each layer of the framework square grid of 20.4m x 20.4m.

Structure system that was born this way, it was effective method to organize theoretically of architecture and structure. (Fig.4)

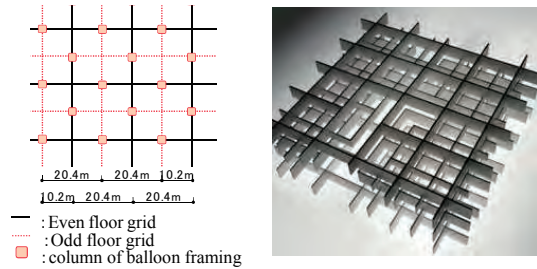


Fig.4 Concept of cross grid system

4. The large rack structure by wall girders and seismic core

The wall girders that assembled in a grid pattern is taking a brace of that layer. Thus, by simply placing the appropriate wall girders, structure frame will have a sufficient resistance to the horizontal seismic forces.

We took the seismic core system as a way of more clarity to resisting to the earthquake. The seismic core were placed on the four corners of the plan.

Seismic core was connected Wall girder in the braced frames. The entire skeleton was a huge Frame composed of the seismic core and the wall girder. (Fig.5, 6)

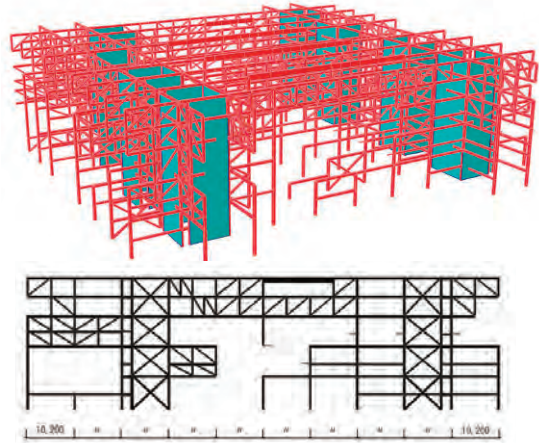


Fig.5 Flame model

5. Conclusion

The huge building with complex spatial element in the design of the building we clarified the system with certain rules.

Then, it made being a reasonable form good consistency with the design plan and the structural plan Frames.



Fig.6 At the construction