High Performance Office Building with Precast and Prestressed Concrete — Calsonic Kansei Research and Development Center, Headquarters —

プレキャスト・プレストレストコンクリートを用いた高性能な事務所建築 — カルソニックカンセイ研究開発センター・本社 —



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Synopsis

Calsonic Kansei Research and Development Center, Headquarters consist of the main building with 7 Stories (**Fig.1**) and the east building with 3 stories. The main building has base isolation system to attain high seismic performance. Also, structural frames with precast and prestressed concrete are adopted to achieve high construction quality of structure and short construction period. The east building is designed to be a normal structure. In this report, the precast and prestressed concrete structure of the main building is mainly introduced.

Structural Data

Location: Saitama Prefecture, Japan
Structural Type: RC(Reinforced Concrete),S(Steel) +PCaPC [only Main Building])
Number of Stories: Main Building 7 stories, East Building 3 stories
Building use : Research institute, Office
Floor Area: Main Building 6,266.88m^2, East Building 3,761.39m^2
Total Floor Area: Main Building 37,930.17m^2, East Building 9,540.70m^2
Design: Nikken Sekkei, Taisei Corporation
Construction: Taisei Corporation
Construction Period: Jan. 2007 – Mar. 2008

Fig.1 Overview (Main building)

1. Introduction

Calsonic Kansei Research and Development Center, Headquarters consist of the main building with 7 stories and the east building with 3 stories (**Fig.2**). The plan of the main building is 110m x 60m and that of the east building is 80m x 30m, and these buildings are connected by a bridge at the level of the second floor. Base isolation system is adopted to attain high seismic performance for the main building. For the 16.8m span of the office space in the main building, hybrid composite beams are designed. Also, for the sake of high construction quality of structure and short construction period, structural frames with precast and prestressed concrete is adopted

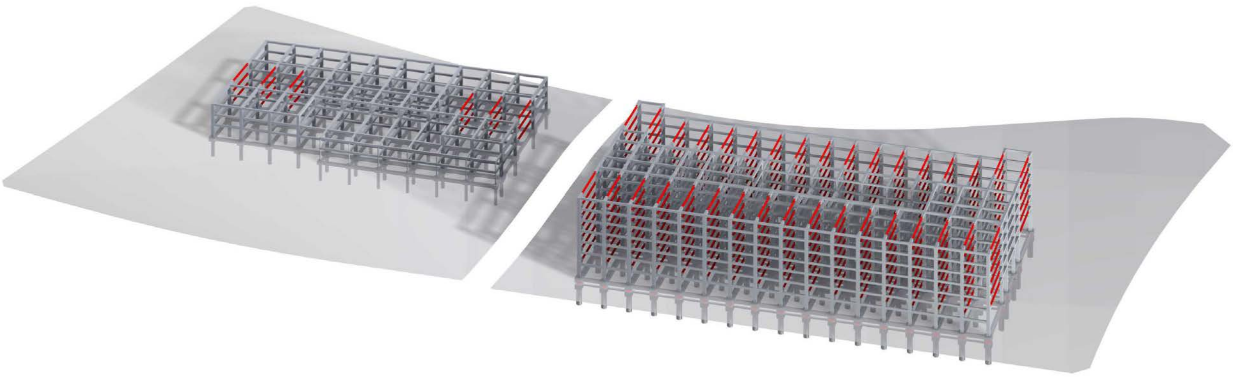

Fig.2 Structural frame of main building and east building

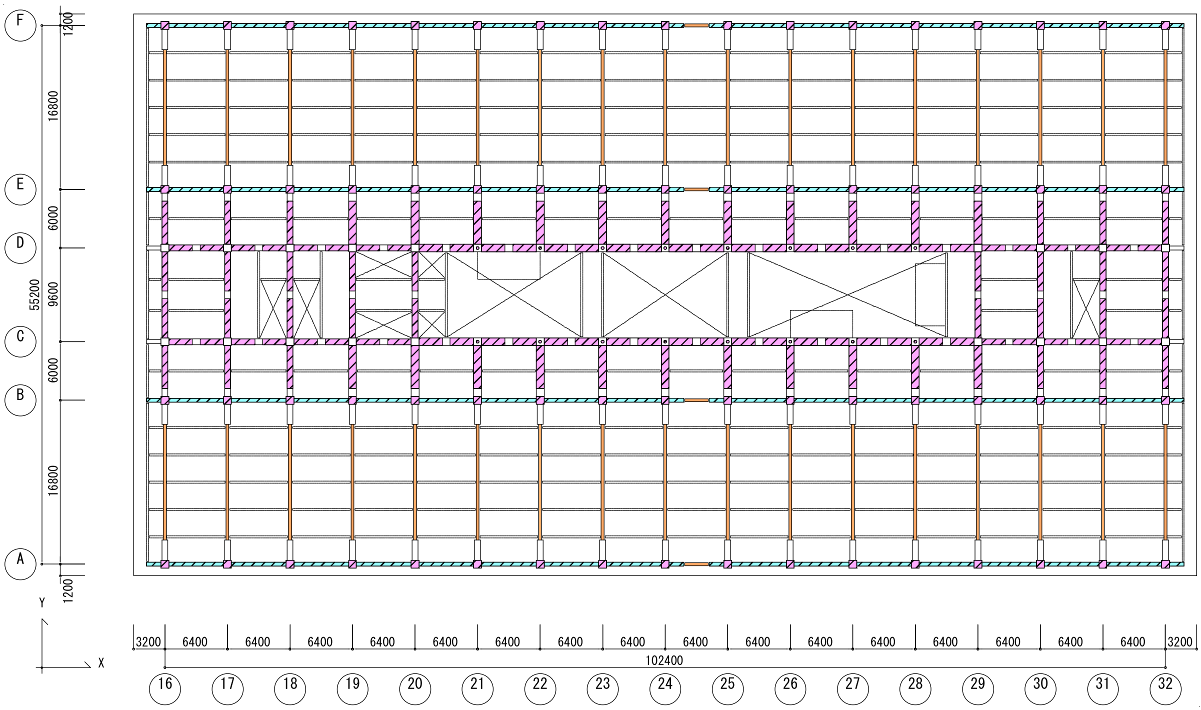

Fig.3 Structural plan of typical floor of main building

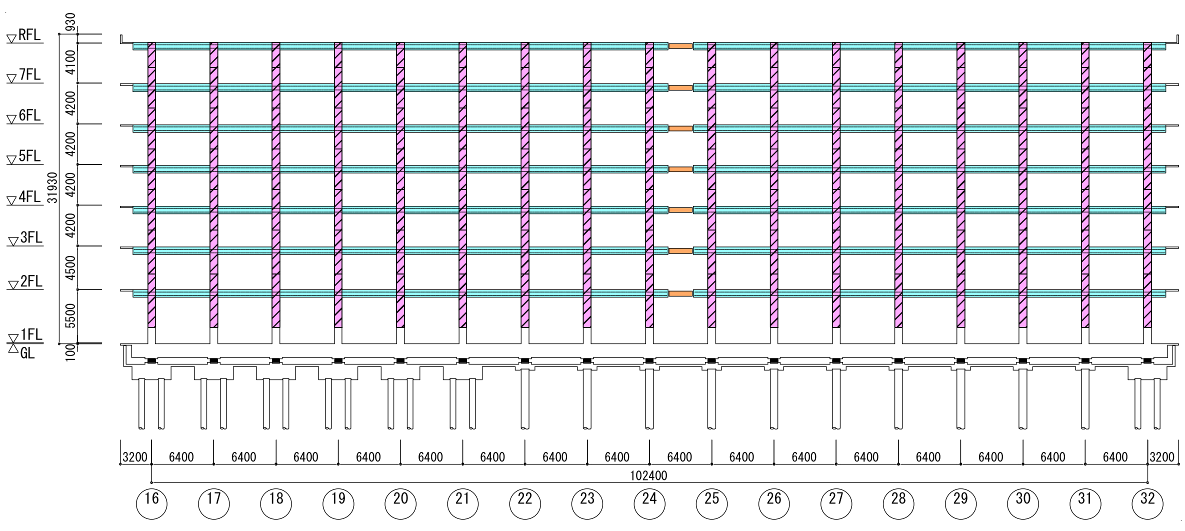

Fig.4 Structural elevation of main building

2. Structural Design and Construction

(1) Structural System

Fig.3 and **Fig.4** show the structural plan of the typical floor and the structural elevation of the main building, respectively. Below the first floor, isolation devices are installed on the isolation floor. Precast concrete piles under the isolation floor support the main building.

In the longitudinal direction (X direction), structural frames with precast and prestressed concrete are adopted. In the transverse direction (Y direction), hybrid composite beams are used for 16.8m span of the office space.

(2) Base Isolation System

Rubber bearings and elastic sliding bearings are installed under the columns as isolation devices. Rubber bearings function as springs and elastic sliding bearings absorb seismic energy as a damper during large earthquakes. By adopting the base isolation system, high seismic performance can be achieved and flexible open space of the office can be designed.

(3) Precast Prestressed Concrete

Fig.5 shows the detail of the frame of the precast prestressed concrete. The joints of the full precast columns are located at the middle height of the upper and lower floors. Steel sleeve joints of the longitudinal reinforcements of the columns are used and high strength mortar is filled in the sleeves and the seam gap between the precast columns.

The precast beams are set at the designed position between the columns, and the gap of the beam-column contact surface is filled with grout. About 50m straight tendons inside the beams through several spans are used to unify the columns and the beams as the rigid frame simultaneously. By adopting this prestressing system, the reinforcement of the beam-column intersections can be simplified and the dimensions of the beams can be designed to be small.

(4) Hybrid Composite Beam

For the long spans (16.8m) of the office space, hybrid composite beams are used. This beam is the composite of steel of the middle and reinforced concrete of the both ends. By using steel beams and deck form, the weight of the structure can be light and the RC of the beam ends enhances the rigidity of the frame, economically. **Fig.6** shows the hybrid structural beam under construction.

(5) Slender Precast Column

Communication void is designed in the middle of the main building from the second to seventh floor. Around the communication void, the slender precast columns with Fc60 concrete are designed. Using precast system, the diameter of the column can be small (286mm) and the slender columns are realized. **Fig.7** shows the slender precast column under construction.

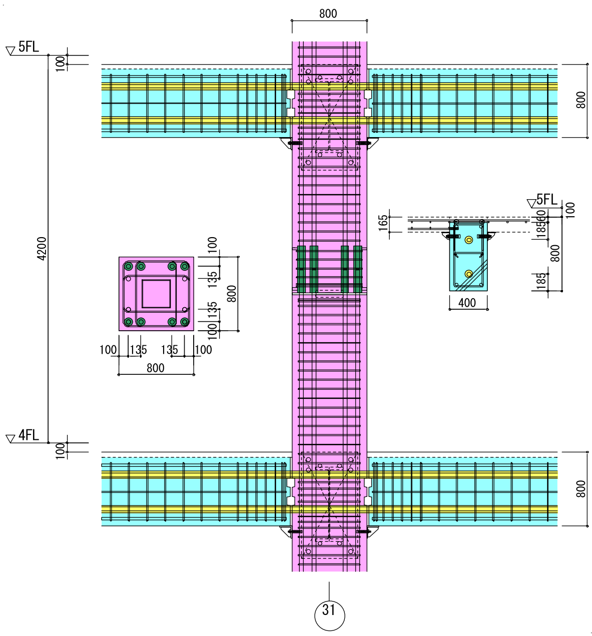

Fig.5 Detail of frame of precast prestressed concrete

Fig.6 Hybrid composite beam (under construction)

Fig.7 Slender precast column (under construction)

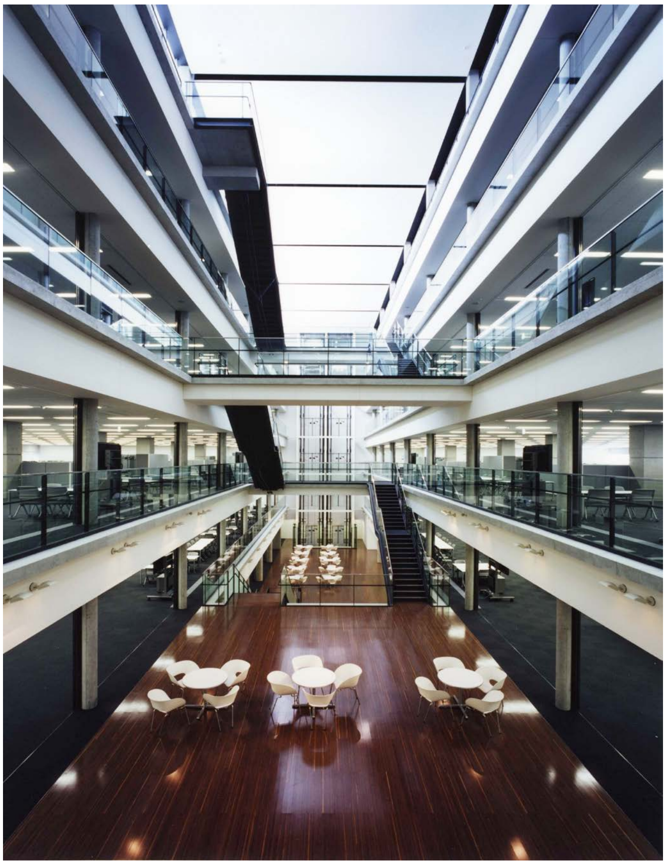

Fig.8 Communication void

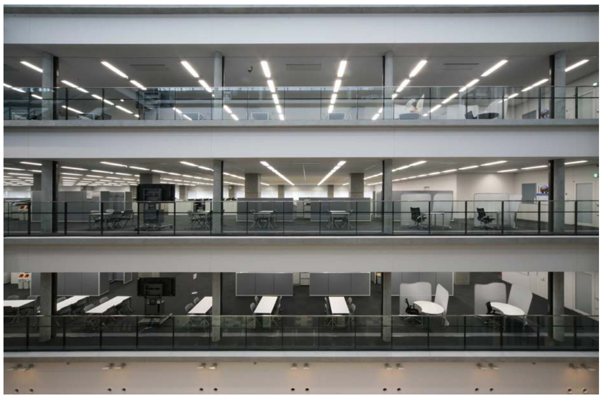

Fig.9 Communication void

Fig.10 Office space

3. Conclusions

Fig.8 and **Fig.9** show the communication void of the main building. By using the slender precast columns, open and comfortable communication space is realized.
Fig. 10 shows the office space. Large office space is realized by using the hybrid composite beams economically.
Precast prestressed concrete system can make construction term short as 14.5 months, as well as attain the high construction quality of the structure.
Base isolation system makes seismic performance high and flexibility of the space high.

Photos of Fig.1, Fig8, Fig9, Fig10
by Shinozawa Architecture Photo Office

概　要

カルソニックカンセイ研究開発センター・本社の本館は，高い耐震性を持ち，大地震時にも本社機能を維持することができるように，免震構造を採用した。免震構造を採用することにより，耐震性能の向上とともに，プランに対する自由度も向上させることができた。事務所空間の長スパンの梁には，端部 RC 造・中央を S 造とする複合構造梁を用い，大きな空間を軽量な構造で実現した。建物長辺方向の柱および梁には，プレキャスト部材を用いたプレストレストコンクリート構造とした。プレキャスト・プレストレストコンクリート部材と複合構造梁を 1 層づつ建方し，緊張・グラウト工事および床スラブを現場で打設することで，7 階建て免震鉄筋コンクリート造の施工を，施工品質を保持して，14.5カ月という短工期で実現した。また，コミュニケーションボイド（吹き抜け）周りにプレキャストの細柱を使用することで，開放的な空間が実現できた。