Training Facility with Latticed-Pattern Facade
— NTT Central Training Institute / The New 5th Building —

格子状のファサードを有する研修施設
— NTT 中央研修センタ 新 5 号館 —




* Akinori NAKAGAWA: NTT Facilities, Inc.
中川　明徳：株式会社 NTT ファシリティーズ
** Kazunobu YOKOTA, P.E.Jp: NTT Facilities, Inc.
横田　和伸，技術士（建設部門）：株式会社 NTT ファシリティーズ
*** Kazuhiro GOTO, P.E.Jp: NTT Facilities, Inc.
後藤　和弘：技術士（建設部門）：株式会社 NTT ファシリティーズ
**** Hirokazu TANIZAWA, P.E.Jp: NTT Facilities, Inc.
谷沢　弘容，技術士（建設部門）：株式会社 NTT ファシリティーズ
Contact: nakaga55@ntt-f.co.jp
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Synopsis
NTT Central Training Institute which started in 1949, surrounded by rich nature, consists of several historic buildings which succeeded to Ministry of Communication, Nippon Telegraph and Telephone Public Corporation and NTT. The New 5th Building was built in the NTT Central Training Institute, as a new training base of the NTT Group after an interval of 25 years (**Fig.1**).
The Precast Prestressed Concrete Structure was adopted to resolve some issues most reasonably such as restriction for the maximum height of buildings, the large training room with no columns, well-matching with the existing buildings, and so on. Furthermore, it has contributed also to global environment consideration.

Structural Data
Location: Irimacho, Chofu (city) Tokyo, Japan
Use: training facility
Scale: 6 floors above ground
Building Area: 1,613.34m^2
Total Floor Area: 9,532.30m^2
Building Height: 24.950m
Structure: Precast Prestressed Concrete Structure, partly Reinforced Concrete Structure
Maximum Span: 16.8m
Height of Story: 4.1m
Designer: NTT Facilities, Inc.
Contractor: Toda Corporation
Prestressed Concrete Work: P.S. Mitsubishi Construction Co., Ltd.
Construction Period : Oct. 2009 - Nov. 2010

Fig.1 NTT Central Training Institute

Fig.2 Latticed-pattern facade of the New 5th Building

1. Design

(1) Precast Prestressed Concrete Structure

The Precast Presstressed Concrete (PCaPC) Structure was adopted to resolve the following issues most reasonably.

1) Flexible training environment was required, which could hold training for both a large number (more than 300) of trainees and a small number (about 40) of trainees.
   Therefore, precast composite slab called Single T slab (ST slab) was adopted for the slab structure of training rooms, and made them the large ones (32.0m x 16.8m) with no columns (**Fig.3**).
   The ST slabs were arranged at the intervals of 2.0m. Then, the depth of ST slabs was 950mm including the topping concrete (**Fig.4**).
2) It was required that the building scale was 6 floors above ground and the training rooms had ceiling height more than 3m. However, there was a regulation that the maximum height of buildings should be less than 25m.
   Therefore, the following details were adopted and it became possible that the ceiling height was 3.14m (**Fig.4, Fig.6**).
   - The bottom of ST slabs consisted of the architectural ceiling design.

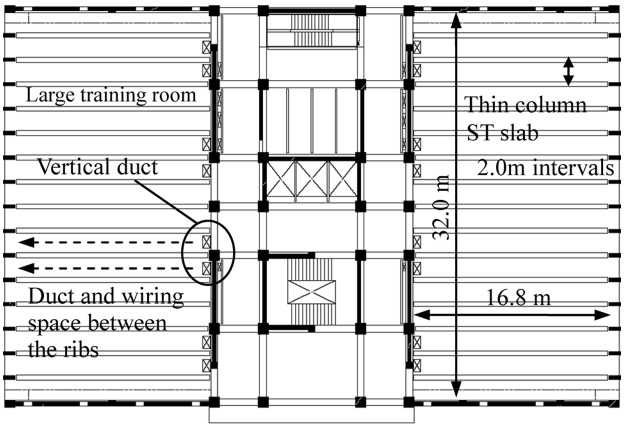

Fig.3 Planning of the training rooms

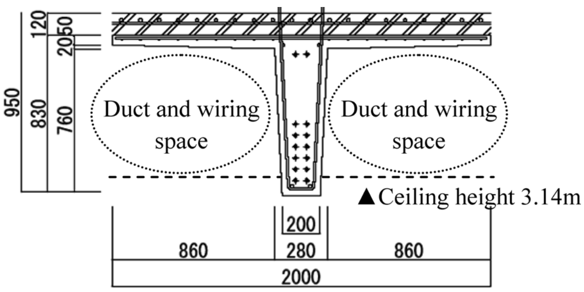

Fig.4 Precast composite slab (ST slab)

- The portions between the ribs of ST slabs were used as duct and wiring space.

3) The new 5th building needed to well-match with the existing buildings which were reinforced concrete structure.
Therefore, the facade and interior design directly consisted of the precast skeleton structure without using extra interior and exterior materials.
    - At the front of the building, the latticed pattern facade consisted of the thin columns, ST slabs and light shelves of PCaPC structure (**Fig.2**). Each ST slabs and each light shelves were unified by the PC strands (**Fig.5**).
    - At the side of the building, the vertical ribs of Precast Concrete Form (PCF) became the motif of facade (**Fig.7**).

(2) Seismic Design

The most important concept of seismic design was to reduce the lateral deformation of the thin columns in the seismic condition. Therefore, enough amount of bearing walls were planned at the core portion and the side of the building (**Fig.3**). It was determined that the thickness of the topping concrete was 120mm to transfer the lateral force of the training room portion to the bearing walls (**Fig.4**).

2. Global Environment Consideration

The design of the new 5th building adopted the design concept taking the global environment into consideration as a main theme. As the specific feature of the design, the building was designed in consideration of the reduction of CO_2 emission generated not only in the operation phase of the building but in the construction phase of the building and the design effectiveness for the reduction of CO_2 emission was evaluated quantitatively.

The method of evaluation is as follows.

1) The CO_2 emission was calculated based on the LCA Guidelines of Buildings[1]
2) About the construction work of skeleton above ground, the CO_2 emission was calculated for the cases such as (a) the model building of cast-in-place reinforced concrete structure, (b) the design building of PCaPC structure (the evaluation in the design phase), (c) the design building of PCaPC structure (the evaluation in the construction phase) (**Fig.8**).

The conclusion is as follows.

1) The CO_2 emission was reduced by 15.6%, because the application of PCaPC structure made it possible to reduce the materials to use, the commuter's cars to the site and the frequency of using cranes at the site, even if the CO_2 emission for the transportation of precast members was taken into consideration.
2) It was established that it was possible to estimate the CO_2 emission in the design phase, because the CO_2 emission in the construction phase would be mainly generated by manufacturing materials to use.

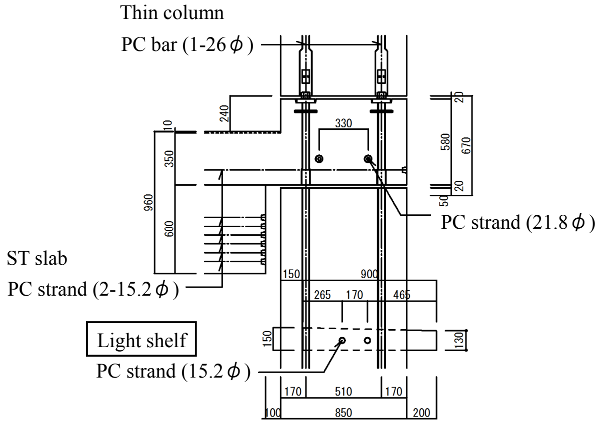

Fig.5 Detail of latticed pattern facade

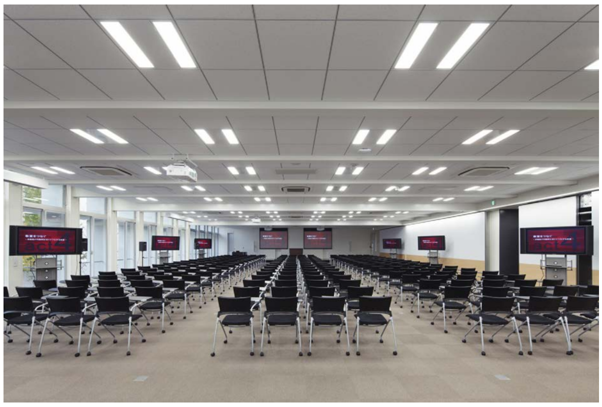

Fig.6 Large training room with no columns

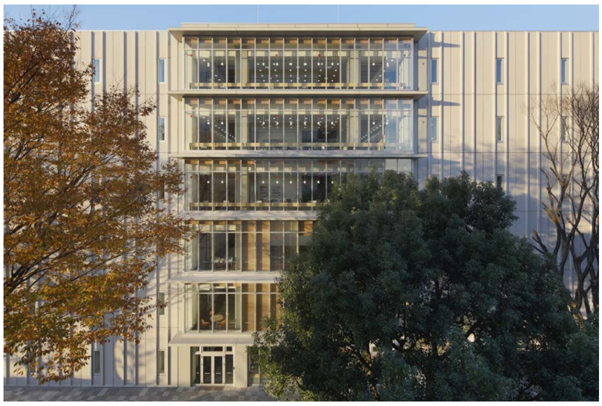

Fig.7 Precast concrete form facade

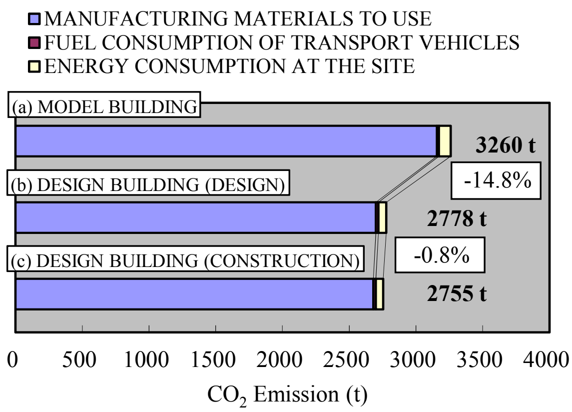

Fig.8 Comparison of CO_2 emission

3. Construction

(1) Construction Period

The total period of construction was 13 months, and it took 4 months for the election and integration of Precast Prestressed Concrete structure above ground.

(2) Construction method

The construction method was planned as follows.

1) The core portion was built before the election of the training room portion (**Fig.9**).
2) The ST slabs were too long to transport during the daytime. Therefore, they were transported between midnight and early morning (**Fig.10**).
3) After the election of the thin columns, the ST slabs were built on them (**Fig.11**).
4) The reinforcing bars of bearing walls at the core portion were arranged after the election of the girders above them (**Fig.12**). Then, the high fluidity concrete was placed for the bearing walls, after the introduction of prestress into the girders.

As mentioned above, it was important to determine the procedure for the election of members, the introduction of prestress and concrete placing.

References

[1] Architectural Institute of Japan: *LCA Guidelines of Buildings - The Evaluation Tools for Global Warming, Resource Consumption, Waste and Recycling Affaires-*, 2006 (in Japanese)

Fig.9 Election of the core portion

Fig.11 Election of the training room portion

Fig.10 Transportation of ST slabs

Fig.12 Reinforcing bar arrangement of bearing walls

概　要

1949年に発足したNTT中央研修センタは，豊かな自然環境に囲まれ，逓信省，電電公社，NTTと引き継がれた歴史ある建物が並ぶ。センタ内で25年ぶりの新築となる新5号館は，NTTグループの新たな研修拠点として計画された。

本建物の設計では，絶対高さ制限25mのもと，1～6階のすべてに無柱大研修室を計画し，その天井高を3m以上とすることが求められた。そこで，研修室部を徹底的にモジュール化することでPCaPC造を採用し，16.8mスパンを支持するプレキャスト合成床版（ST床版）のリブを天井デザインとして見せる納まりにすることで，意匠・構造・設備が融合した合理的な建築計画とした。また，建物正面はST床版とそれを支持するPCaPC細柱，ライトシェルフで格子状ファサードを構成し，RC造の既存建物群と調和させた。さらに，PCaPC造で計画したことは地球環境配慮にも寄与しており，本設計ではその効果を定量的に評価した。