10. Structural Performance of Precast Concrete Shell R/C Columns using F_c=70N/mm² class concrete, and Evaluation of Deformability of Precast Concrete Shell R/C Columns

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Loading tests were carried out on specimens of precast concrete shell R/C columns under high axial load using (F_c=) 70 N/mm² class concrete and (σ_y=) 785 N/mm² class lateral reinforcement. Structural performances were examined. The relationships of the amount of the lateral reinforcement and the deformation capacities were found and evaluation equations of deformation capacities were presented for specimens of loading experiments that were carried out by our company as well as other research laboratories. Applicability of the evaluation equation was examined for R/C columns of conventional construction method.

The results can be summarized as follows:

(1) If the amount of lateral reinforcement corresponds to dimensionless quantity of amount $p_w \sigma_{wy}/\sigma_0 > 0.22$ is arranged in R/C columns using (F_c=) 70N/mm², (σ_y=) 490 N/mm² class main reinforcement, (σ_{wy}=) 785 N/mm² class lateral reinforcement, then the restoring force characteristic ($Q - R$ relationship) has abundant ductility and the deformation capacity R_u can be secured 1/50 rad or more.

(2) Cracking did not expand in connected parts of two pieces of precast concrete shell to R=1/33 rad under the reinforcement arranged for in this paper, R/C columns using precast concrete shell had enough structural performance.

(3) In the area of concrete strength (F_c=) 70 N/mm² class, the calculated values of flexural ultimate strength by the ACI equation estimate the experimental strength values to the safety side. The calculated values by the NZ equation under estimate more than the experimental strength values.

(4) A strong correlation was found between the deformation capacity R_u and the dimensionless quantity of amount of lateral reinforcement $p_w \sigma_{wy}/\sigma_0$.

(5) The central value of deformation capacity R_u of R/C columns using precast concrete shell can be estimated by equation (2) and equation (3), and the lower bound value can be estimated by equation (4) and equation (5).

Key words : reinforced concrete, R/C column using precast concrete shell, structural performance, evaluation of deformability