

For the Effective Use of the Stock of Reinforced-Concrete Apartment Buildings --The Development of a Method of Sophisticating the Durability Evaluation and Technology to Enlarge Space--

Building Department

The transition to old towns due to the aging of buildings and residents has been advancing with the apartment building complexes developed in suburban areas during and after the rapid economic growth period. We have been conducting the development of technology to efficiently use reinforced-concrete apartment building stock and to realize the regeneration of eco-friendly housing complexes.

Social Background and Problems

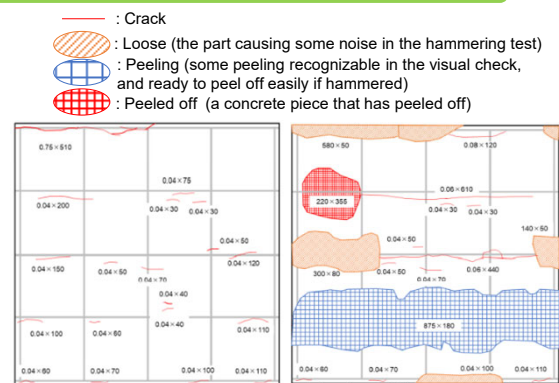
- For the regeneration of eco-friendly suburban housing complexes, the reinforced-concrete apartment building stock needs to have longevity and needs to be used effectively.
- For the stock to have longevity, our task is to sophisticate the evaluation of durability and to select rational countermeasures in consideration of the local risk of cracking, water contents, and so forth, as well as carbonation.
- For the effective use of stock and to try to activate the housing complexes by encouraging child-rearing households to move in, our task is to establish the technology to realize, in consideration to the safety of the structure, the expansion of small housing spaces (to form an opening in structural walls between apartments).

Description of the Research

For the Longevity of the Stock of Reinforced-Concrete Apartment Buildings

We have been examining methods of sophisticating the evaluation of durability and measures for enhancing the durability, to improve the longevity of the reinforced-concrete apartment building stock. We examine documents, investigate real buildings, and conduct experiments to examine and propose ① a method of evaluating the current status of degradation, including cracks, exposure of reinforcing bars, and so forth, ② a method of evaluating the resistance to degradation and the environmental degradation factor using the indices such as carbonation and water contents, and ③ a method of comprehensively evaluating the durability performance of existing reinforced-concrete parts. In addition, we also have been examining ④ a method of the rational selection of longevity countermeasures in response to the results of the evaluation of durability performance.

Description of the drawing on the right. The degradation of RC wall member was accelerated with an electrical method. As a result, we confirmed that the degradation was seen in the order of the crack in the longitudinal direction of the iron bar → the loose surface and the peeling → the peeling off. This result was reflected in the current method used to evaluate the degradation status.



Initial stage of accelerated degradation → late stage of the accelerated degradation

An example of an RC wall member in the accelerated degradation experiment

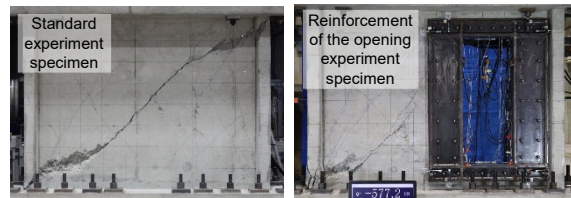
Effective Use of the Stock of Reinforced-Concrete Apartment Buildings

In order to realize the expansion of the space between apartments for the effective use of RC apartment buildings in consideration of the safety of the structure, we need to propose an evaluation method to grasp the influence from the formation of an opening over the seismic performance of the architecture, the rules to arrange the openings to minimize the degradation of the seismic performance caused by the formation of openings, and the technology to reinforcement for the recovery of the seismic performance. To solve these problems, we have been conducting analyses using the finite element method, and experiments using model specimens.

Description of the photo on the right. A new opening was formed in the RC experiment specimen simulating a structural wall between two apartments (scale reduced to two thirds). The steel skeleton was used to reinforce the surrounding part, and the horizontal load was applied for simulating seismic loading condition. In this experiment, the experiment specimen with its opening reinforced sufficiently was proved to exercise the lateral load carrying capacity equivalent to, or more than, the standard experiment specimen, which simulated the status before the new opening was formed.



A view of the loading test



Verifying the seismic performance of the experiment specimen With a reinforced opening by the loading test

Promoting the longevity of apartment building stock and effective use by expanding space to contribute to the regeneration of the eco-friendly apartment complexes for the realization of the green society