An examination into the durability evaluation standards of existing concrete structures based on research data of actual buildings

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(Keywords) Concrete, carbonation , durability, corrosion of steel bar probability

1. Foreword

In order to appropriately evaluate the effect of deterioration prediction and deterioration measures of concrete structures, it is essential to examine it from the data of an actual building built under different conditions, such as location environments.

The purpose of this research is to collect the actual building data regarding deterioration like the carbonation depth from the concrete structures surface to the inside etc. based on the investigation diagnosis report into earthquake-resistance and planned maintenance of condominium apartments, and examining the evaluating method/standards of concrete structures using the corrosion of steel bar probability according to the measured carbonation value and age of a building, for the sake of arranging an index of deterioration progress predictions of concrete structures. Here we will report our findings.

2. The collected actual building data

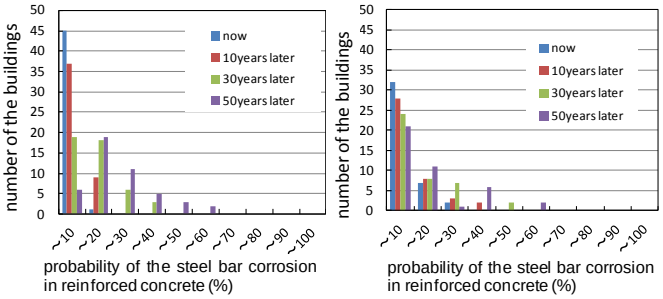
The collected data was acquired from the seismic diagnosis report, as well as the report for the investigation of planned maintenance, and the report of the renewal construction. The collected data items were basic items required for deterioration evaluations like carbonation depth, age of the building, as well as construction site, a type of finishing materials and its thickness etc. Here, the collected data was the seismic diagnosis report for roughly 900, the planned maintenance reports for roughly 160, and the data from the reports of renewal constructions for roughly 3000. Regarding the seismic diagnosis report, the data measurements included the carbonation depth etc. on the parts of various places in one building. Furthermore, the collected data used data from completed surveys and therefore, collecting of test specimens was not conducted for the research.

3. Results and discussion

The corrosion of steel bar probability, the index of durability for concrete structures, which takes into account the constant unevenness of material quality and construction accuracy, was calculated. Using data from the seismic diagnosis report, an example (carbonation measurement points) of the results from the carbonation suppression examination into various finishing materials, is shown in the figure. The number of data collected varies depending on the type of finishing materials, however, in the case of mortar + thin finishing materials, the current corrosion of steel bar probability in most 30-40 year-old buildings is less than 10%, and less than 10% for 80% of buildings with thin finishing materials . According to the calculations, roughly half of the buildings with thin finishing materials had a corrosion of steel bar probability less than 10%, even 50 years later compared to those coated with mortar. We are scheduled to examine this point in more detail along with the collection position etc. of the test specimens .

As well, after evaluating the unevenness of the carbonation speed coefficient based on the analysis of the seismic diagnosis report, gathering evidence from the test specimens of multiple points per building, it was found that it tends to become smaller in points where the finishing is of mortar types. As well, in exposed concrete points indoors, not only was the carbonation speed coefficient large, but the possibility that unevenness at every collecting point of test specimens grows, was

suggested from the prominent effects of environmental conditions. It was therefore confirmed that evaluations including the collection position etc. of the test specimens is required for more accurate deterioration evaluations.



(a) finishing materials ; mortar+lyshin (b) finishing materials ; lyshin

Figure: probability of the steel bar corrosion in reinforced concrete (actual building 30-40 years after construction)

4. Conclusion

The results of this research will become the backbone data for the validation of durability evaluation standards of concrete skeletons in existing buildings, and are scheduled to be reflected in the basic standards in the future.