

【Grant-in-Aid for Scientific Research (S)】

Science and Engineering (Engineering)



Title of Project : Development of Preservation/Renovation Techniques for Seismic Performance Improvement and Authenticity of Historical Buildings

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Research Project Number : 16H06363 Researcher Number : 10202467

Research Area : Architecture, Building structures/Materials, Architectural history/environment

Keyword : Historical buildings, authenticity, seismic performance, Preservation/Renovation technique

【Purpose and Background of the Research】

Large-scale earthquakes occur frequently, and many historical buildings including the cultural heritages were severely damaged. Although repair and reinforcement become an urgent need, effective methods have not been established, and these have to be conducted individually. This research program is to develop novel techniques for diagnosis, repair and reinforcement of historical buildings by verifying the integrated knowledge developed in the world. In addition, this research aims to present guidelines for the preservation of cultural and modernization heritages, and to develop techniques to enhance their earthquake resistance capacity and durability in consideration of the authenticity.



Airship hangar (1917)



Handa red brick (1898)

【Research Methods】

- 1) Extract the problems from the existing examples of investigation, diagnosis, repair and reinforcement conducted to historical buildings.
- 2) Clarify the problems related to investigation, diagnosis, repair and reinforcement methods from the investigation studies on historical buildings.
- 3) Based on 1) and 2), evaluate the durability improvement and reinforcement technique from the viewpoint of reinforcing effect, construction precision, landscape, durability, extent of injury, authenticity, reversibility, economics and so on.
- 4) Evaluate effectiveness and scope of non-, minor and destructive testing methods such as optical measurement, drilling, flat jack, microtremor measurement and monitoring and so on.
- 5) Clarify material deterioration especially caused by salt deposition from measurement of environment, moisture state, and analysis of salt.

- 6) Clarify degradation mechanisms and prediction of materials, and propose an effective repair method based on the exposure test and accelerated weathering test, using deterioration suppressing materials and surface protection measure.
- 7) Verify the repair and reinforcement effect by monitoring.
- 8) Based on the above investigations, develop repair material and reinforcement method, and present the guidelines.

【Expected Research Achievements and Scientific Significance】

Preservation/renovation techniques developed in this research will be a useful guide in the maintenance and repair of historical buildings to preserve them for future generation. In addition, research results are applicable to RC infrastructure and building stock. Furthermore, the evaluation of PML (probable maximum loss) and development of BCP (Business Continuity Plan) expect an incentive toward “preventive maintenance” measures from “ex-post measures” technique of historical buildings.

【Publications Relevant to the Project】

- D. Sabia, T. Aoki, R. Cosentini, R. Lancellotta, Model Updating to Forecast the Dynamic Behavior of the Ghirlandina Tower in Modena, Italy, Journal of Earthquake Engineering, Vol.19, Issue 1, pp.1-24, 2015.
- T. Aoki, N. Yuasa, H. Hamasaki, Y. Nakano, N. Takahashi, Y. Tanigawa, T. Komiyama, et al, Safety Assessment of the Sanctuary of Vicoforte, Italy, Journal of Materials and Structural Integrity, Vol.5, No.2/3, pp.215-240, 2011.

【Term of Project】 FY2016-2020

【Budget Allocation】 136,300 Thousand Yen

【Homepage Address and Other Contact Information】

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