

Summary

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Mechanical Behavior and Soundness Assessment for Sustainable Utilization of Suspended Lath and Plaster Ceilings

In Japan, suspended ceilings have long been considered as "non-load bearing members", but recent earthquakes have revealed its vulnerability, and safety guidelines for earthquake resistance of the ceilings have been established. Although renovations have been carried out in accordance with these guidelines, such renovations have been limited to dry construction ceilings. Plaster ceilings that remain in many historical buildings exhibit significant variations due to differences in buildings and periods, and there is a lack of sufficient evaluation for their earthquake resistance. In this study, I examine historical evolution, mechanical properties, and damage mechanisms of suspended plaster ceilings using the "lath and plaster technique", and propose soundness diagnosis methods with view to effective utilization of exist ceilings.

The results of plaster strength tests showed no significant differences between actual ceiling members taken from a historical building (approximately 80years old) and their simulated specimens (16weeks old). This means that it is possible to reproduce mechanical properties using the specimens simulating the actual members, and there is a possibility that soundness of historical ceiling members can be evaluated without damaging them. Furthermore, the surface hardness distribution obtained through rebound testing demonstrated a possibility to assess the adhesion condition of both the plaster and the lath. This enables visualization of "possibility areas of delamination".

Based on these results, I proposed a regression equation to calculate the bearing capacity of lath and plaster ceilings. Also, I conducted vibration tests on the ceiling specimens to confirm the consistency of all test results and destruction situations. The results showed that under ideal conditions, the plaster has a high bearing capacity because the plaster required a considerable acceleration (10000-30000 gal) to fall. Therefore, recent peeling phenomena in plaster ceilings are caused by deterioration factors that exceed the bearing capacity of the ceilings, and the scope of investigation should be expanded to improve a certainty of the soundness evaluation.