Penilaian Kondisi Struktur Kayu Bangunan Aula Timur ITB Menggunakan Metode Non-Destructive Test (NDT) Sebagai Upaya Mitigasi Risiko Keruntuhan Bangunan Bersejarah

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Abstract

Building has a limited life cycle due to the degradation of building materials, especially wooden structures that are susceptible to biological decay and structural fatigue. The East Hall at the Bandung Institute of Technology (ITB), built in 1918, is now 108 years old and exceeds the general design life of buildings (50–100 years). Despite its high historical value as a cultural heritage, studies on the building's structural performance are still very limited compared to the architectural aspects of the building. This study aims to evaluate the performance condition of the wooden structural components in the East Hall of ITB with a focus on evaluating internal damage and the material stiffness value (Young's Modulus). Considering this building's significant historical significance in ITB and the city of Bandung, the evaluation was conducted using the Non-Destructive Test (NDT) method with simulation using Finite Element Analysis (FEA). The results of this study are expected to provide a diagnostic roadmap for conservation strategies, mitigate collapse risks, and strengthen international academic collaboration in the field of wood engineering and preservation of historic buildings.

Keyword: ITB East Hall, historic building, wooden structure, structural integrity, finite element analysis

Introduction

The East Hall of the Bandung Institute of Technology are designed by Henry Meclaine Pont, have even been nominated as a cultural heritage site due to their historical and architectural value, their continued existence as active old buildings, and their role as identity and cultural values for the city of Bandung and Indonesia (Hafizh, 2025). The older a building is, the greater its vulnerability to structural failure. When a building reaches its wear-out phase, the integrity of the material becomes vulnerable and reaches its elastic limit, significantly increasing the risk of catastrophic failure. Evaluating the structural performance of historic buildings requires an investigative method that maintains the existing structure. Non-Destructive Testing (NDT) methods at critical points of the building can enable this evaluation process to be carried out without the need to dissemble or damage the original character of the building. This method is used to detect anomalies or discontinuities in materials without damaging the components which is suitable to historical building such as East Hall ITB.

Research Method

The research methods used in this study include secondary data collection and testing of wooden components in the East Hall, ITB. This secondary data collection is necessary to determine the initial design of the building, the planned design age, size, and shape of the East Hall when it was first constructed.

The results of this secondary data will then be compared with the testing of wooden components in the East Hall. This component testing is planned to take several points from the main structure of the East Hall to be tested using NDT equipment and compared to FEA simulation.

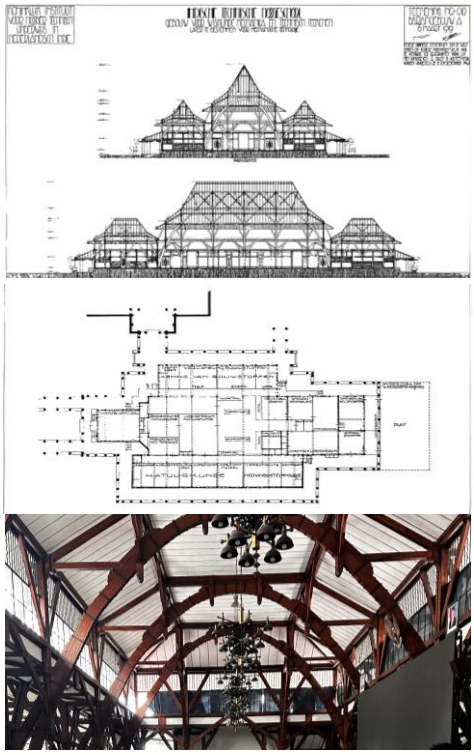


Fig 1. The East Hall Plan and Structural Existing

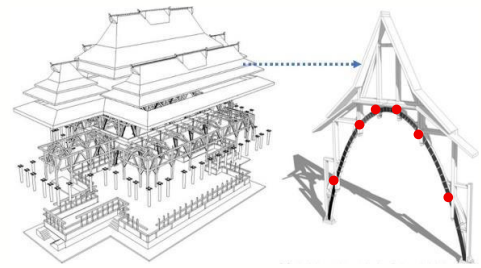


Fig 2. Testing Point Plan

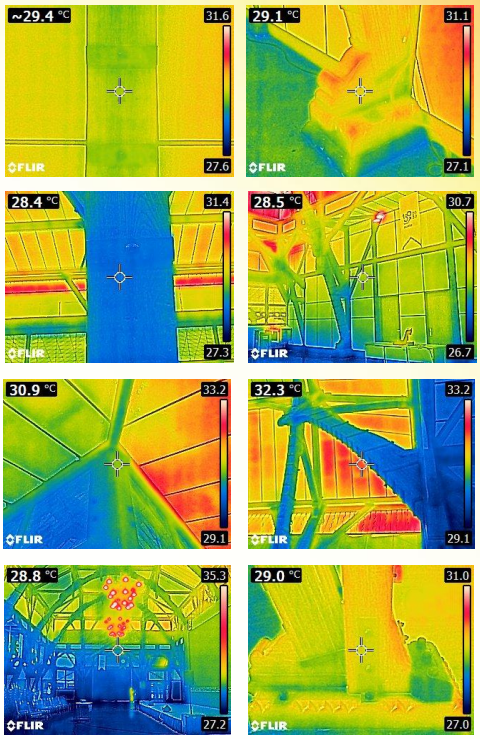


Fig 3. Thermal Camera Testing

Discussion & Result

This research has progressed through a preliminary survey and trials of Non-Destructive Testing (NDT) equipment at Universiti Teknologi MARA (UiTM), Malaysia, to identify suitable testing methods for assessing the structural condition of the East Hall. Initial thermal camera testing was conducted on the East Hall building. The result using thermal camera shows the impact of environment temperature to the structure. Cracks and gap were not sufficiently clear to provide an accurate assessment. Therefore, structural simulation is considered necessary to identify critical points before conducting further NDT measurements, allowing the testing process to be more targeted and efficient. The research also identified technical challenges in accessing the upper parts of the timber structure, which require scaffolding and additional safety equipment for operators.

Conclusion

The preliminary steps has been done toward evaluating the structural condition of the historic East Hall ITB using NDT methods as an effort to mitigate the risk of structural failure and support the preservation of historical buildings. Initial investigations have demonstrated the potential application of NDT equipment and thermal imaging, although further refinement is required to obtain reliable assessment results. Structural simulation using the Finite Element Method (FEM), preliminary Ultrasonic Pulse Velocity (UPV) testing, and comparative testing on new timber with similar strength characteristics are planned as the next research steps.