Deterioration Evaluation of Reinforced Concrete Materials in Highway Bridges

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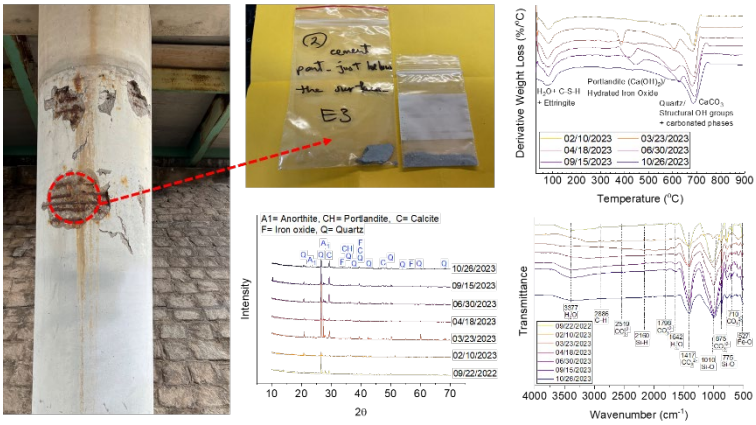
Abstract

This study investigates the deterioration behavior of concrete in highway bridges in New England, focusing on characterizations of field-collected samples and laboratory accelerated aging tests. The primary objective is to facilitate condition assessment of existing infrastructure through a thorough analysis of material properties and changes.

To this end, four strategic locations spanning three reinforced concrete piers of the I-495 bridge in Chelmsford, Massachusetts were selected for monthly sample collection. To understand and address the deterioration behavior of concrete in these critical structures, the development of reaction products and chemical bonds in aged concrete materials were characterized through X-ray Diffraction (XRD), Thermogravimetric Analysis (TGA) and Fourier Transform Infrared (FT-IR) spectroscopy.

The XRD results revealed that the dominant crystalline components of the collected samples consist of quartz and calcite, with a noticeable gradual increase in calcite and iron oxide content over time. These findings provide valuable insights into the evolution of concrete components. TGA and FT-IR results highlighted notable increases in Calcium Silicate Hydrate (C-S-H) and carbonation products in the aged concrete materials. This observation is critical for understanding the chemical transformations occurring within the concrete and contributes to the assessment of its condition. Furthermore, the FT-IR data exhibited a progressive increase in rust content, as evidenced by the rising intensity of the Fe-O bond over time. This information is essential for monitoring the structural integrity of concrete over its lifespan.



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References

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