Three-Point Bending Test

A **bending test** is crucial for evaluating how materials respond to flexural loads. **Three-point bending testing** is one of the most widely used methods for this analysis, providing engineers with essential insights into material **stiffness, strength, and failure characteristics**. The test produces a **flexural stress-strain response**, similar to tensile stress-strain curves, with an **elastic region** defined by the **bending modulus (or flexural modulus)**.

Objective

The purpose of this case study was to analyze the **strain and displacement fields** on the specimen surface and measure the **curvature upon failure** using **Digital Image Correlation (DIC)**.

Description of the Case Study

A **concrete brick specimen** (140 x 18 x 18 mm) was subjected to **three-point bending** to evaluate its **flexural properties**. The test setup included:

- **Camera:** Single **Basler 2.3 MP camera**
- **Frame Rate: 150 fps**
- **Lighting:** Single **strong halogen light**

During testing, the **DIC method** was used to track **full-field displacement and strain**, allowing precise measurement of how the material deformed under load.

The **image** below captures the **three stages of bending**, showing the specimen's deformation as force was applied.

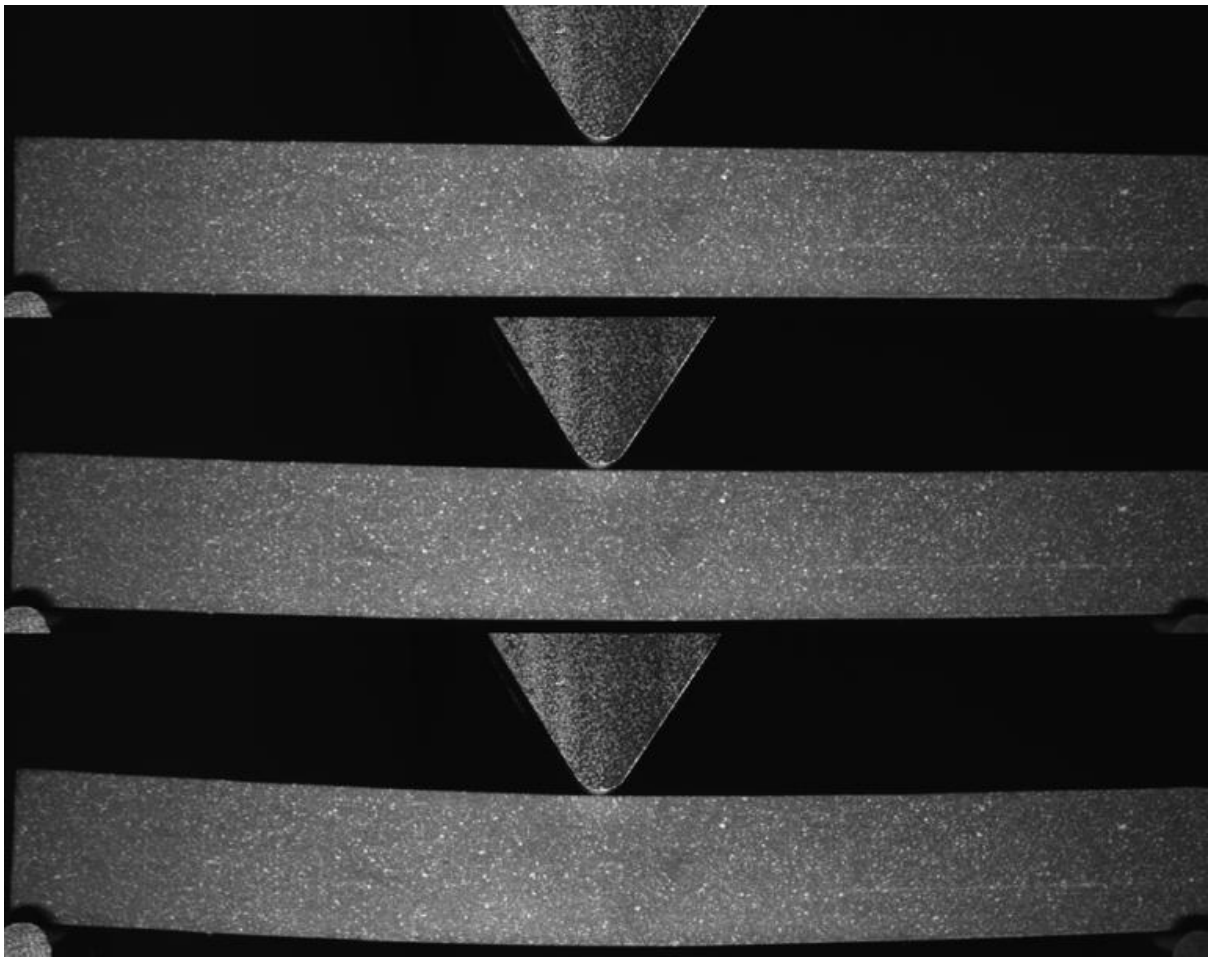

Fig 1: Three-point bending test of concrete brick

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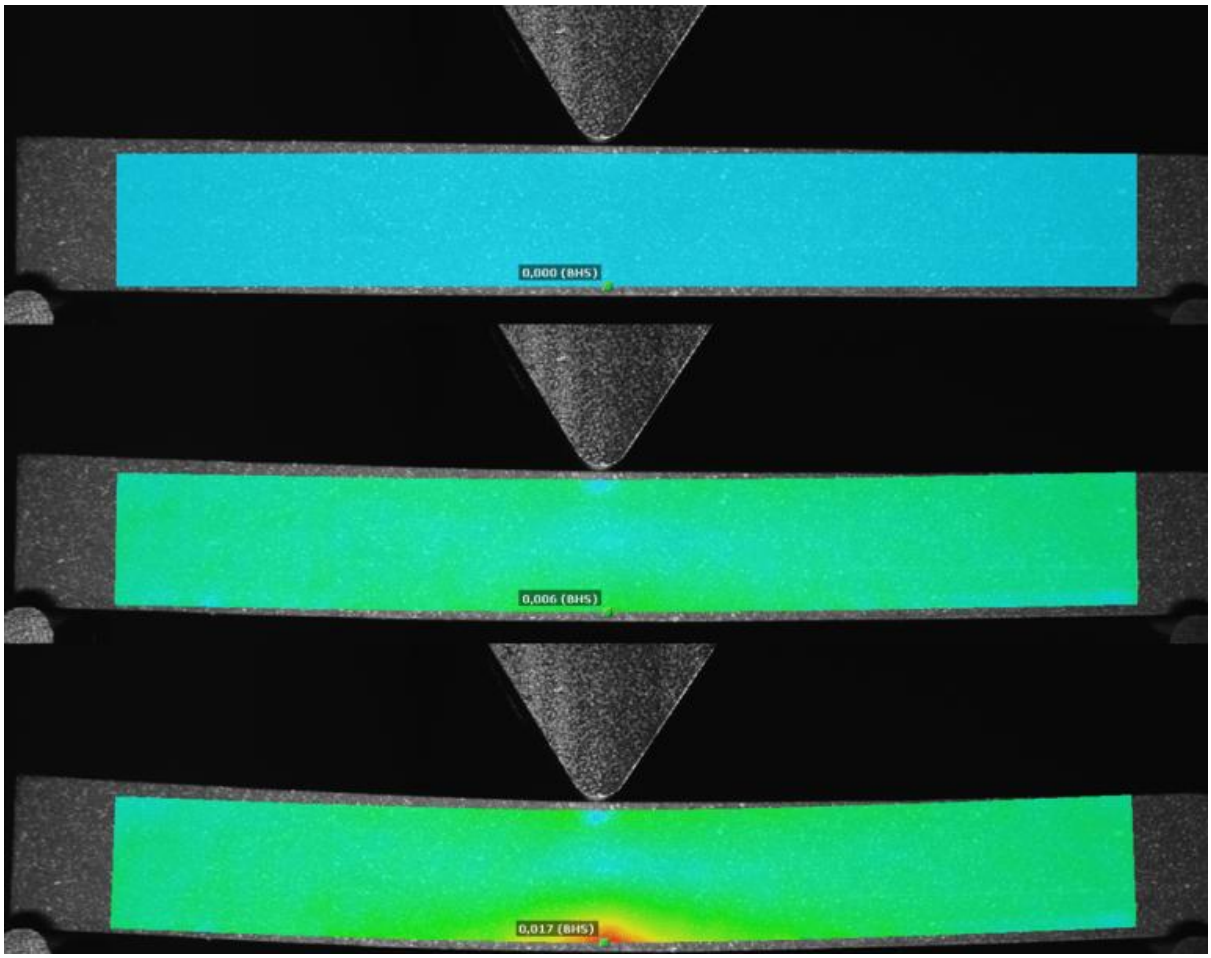
Visual Results

❖ **Failure Displacement:** At the moment of failure, the **maximum displacement** of the specimen reached **2.29 mm**.

❖ **Curvature Measurement:** The test recorded a curvature of **4.38°** at failure.

❖ **Strain Distribution:** Full-field DIC analysis provided a **detailed strain map**, helping visualize stress concentration points before failure.



Advantages of Using DIC in Bending Tests

❖ **Non-contact, full-field strain measurement** for precise deformation analysis.

❖ **Real-time tracking of displacement** to detect failure points accurately.

❖ **Quantitative curvature assessment,** helping engineers optimize material performance.

❖ **High accuracy in detecting stress concentration areas** before structural failure.

❖ **Post-processing capabilities,** allowing detailed review and comparison with simulations.