XSIGHT

APPLICATION REPORT

OPTICAL MEASUREMENT OF A REINFORCING STEEL BAR

APPLICATION SPECIFICATION

Reinforcing steel bars with a diameter of 12 mm were measured with X-Sight-4105-D optical extensometer.

In combination with the ITT module, this system is specifically designed to measure reinforced steel, rebars, strand wires, and other construction materials for civil engineering applications. The system accommodates two industrial cameras covering a field of view of 550 mm × 100 mm and complies with the accuracy class 1 according to the ISO 9513 standard. The housing is dustproof, and the lens is covered with glass so the system can be used safely in industrial environments.

Initially, the X-Sight-4105-D extensometer was positioned in front of the sample at the correct distance and calibrated using a corresponding calibration grid. Reinforcing bars have a visible and detectable natural pattern, so no additional surface markings were necessary to secure optimal measuring conditions.

The test was performed according to EN ISO 527-1, ASTM E8, and EN ISO 15630-1. The designated grade of the tested reinforcing steel specimen is B500B.

Tensile test set-up for reinforcing steel bars with the ROD measuring system

KEYWORDS

- Reinforcing steel bar
- Tensile test
- Standard: EN ISO 6892-1
- Standard: ASTM E8
- Standard: EN ISO 15630-1

TEST SETUP

- X-Sight-4105-D video extensometer
- Alpha DIC® modules:
  - Axial Strain - AX
  - Line Value Distribution - LVD
  - Intelligent Tensile Test - ITT
  - Post Process - PP
- Measuring tools:
  - ROD Line probe
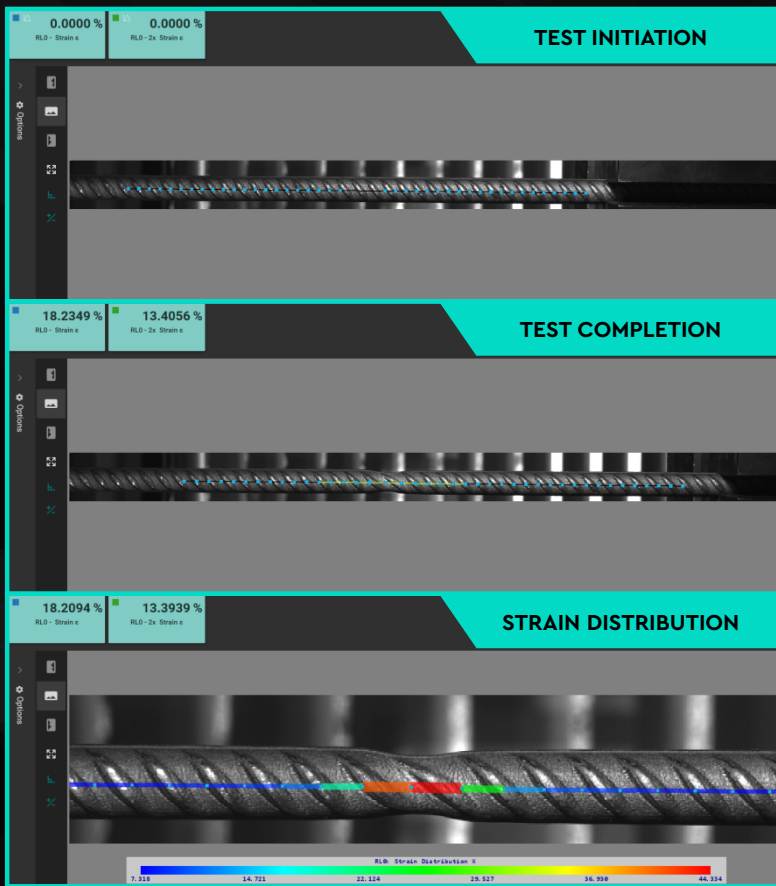- Rebar ø 12 mm; B500B

OUTPUT

- Stress-strain curve
- Young's modulus
- A5 & A10 elongation-at-fracture parameters
- Elongation

WHY CHOOSE X-SIGHT?

- Colorful strain visualization for real-time measurement
- Able to measure rebars with a layer of mill scaling or rust
- A wide range of available outputs
- Automatic neck detection
- Simultaneous evaluation of A5 and A10
- Real-time and post-process measurements

MEASUREMENT PROCESS AND TOOLS

TEST INITIATION
0.0000 % RL0 - Strain ε
0.0000 % RL0 - 2x Strain ε

TEST COMPLETION
18.2349 % RL0 - Strain ε
13.4056 % RL0 - 2x Strain ε

STRAIN DISTRIBUTION
18.2094 % RL0 - Strain ε
13.3939 % RL0 - 2x Strain ε

ROD LINE PROBE

The ROD Line enhances the standard Line probe by adding the axial neck detection feature.

This probe's name refers to the measurement of **R**ebars (with) **O**xide layer **D**eformations. The Intelligent Tensile Testing feature allows the measurement of specimens with a layer of oxide or mill scaling, which falls off during testing due to sample stretching causing failures of point tracking and invalidity of output values. This factor makes standard video extensometers unusable. It is possible to measure the A5 and A10 values simultaneously, as shown in the graphs.

LINE STRAIN DISTRIBUTION

Provides a colorful strain visualization during real-time measurement. Users can quickly identify the position and value of maximum deformation. With multiple LSD tools placed across the width of the sample, the bending behavior of the sample can also be easily determined and quantified.

MEASUREMENT EVALUATION

The measured force and calculated strain data were evaluated to obtain the Stress-Strain curve and determine Young's modulus. The green curve in the graph below relates to the A5 gauge length and the blue relates to the A10 gauge length. ROD functionality allows to measure both values simultaneously. The Young's modulus result value is: **E = 206.6 GPa**

Stress-Strain Curve

Strain (120 mm) A10 value — Strain(60 mm) A5 value