

NC STATE UNIVERSITY

## Constructed Facilities Laboratory Department of Civil, Construction, and Environmental Engineering

Test Report  
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### TENSILE TESTING OF HARDWIRE BAR.

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# TEST REPORT

## ASTM D 3039

### STANDARD TEST FOR TENSILE PROPERTIES OF POLYMER MATRIX COMPOSITE MATERIALS

#### Description of Material

An ASTM D 3039 tensile test was performed on a Hardwire™ composite bar provided by Structural Preservation Systems, Inc. The approximate dimensions of the bar cross section are provided in Figure 1. Using these dimensions the area of the bar was calculated to be  $0.236 \text{ in}^2$ . The bar provided was approximately 30" long.

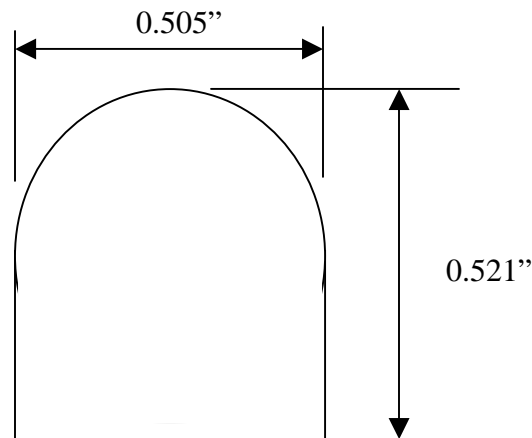


Figure 1 – Specimen Dimensions

#### Test Specimens

Test specimen was prepared by placing each end of the bar in a 10 in. piece of steel tubing. The tubing was then filled with an expansive grout to provide a suitable mechanism for gripping as well as transferring load into the bars. A longitudinal strain gage was placed on each bar to measure the strain under load.

#### Test Setup

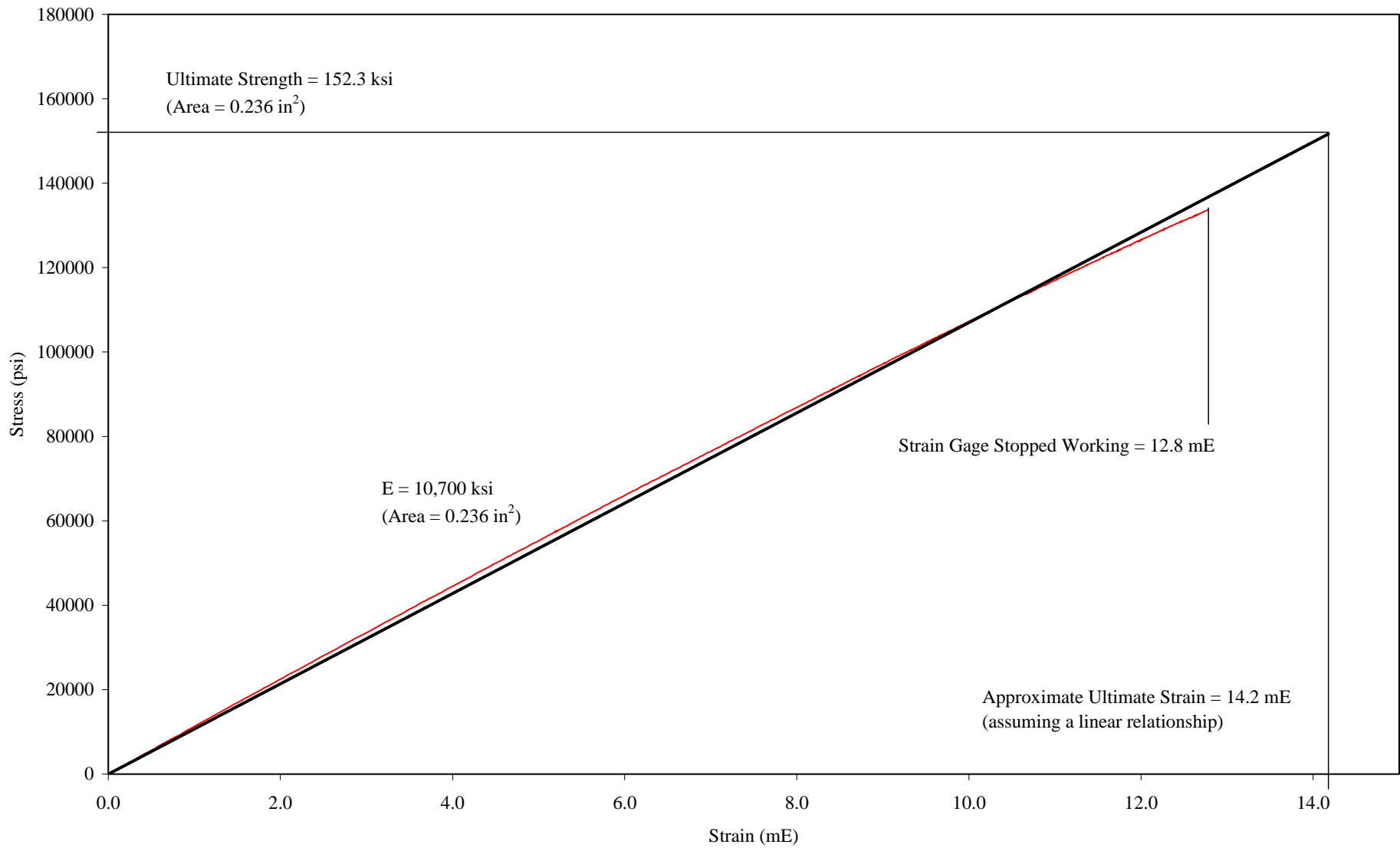
The specimens were gripped in a 220 kip MTS hydraulic wedge-grip machine. Load and stroke from the machine as well as the strain in the bar were recorded using an electronic data acquisition system at a rate of 1 point per second. Specimens were loaded using displacement control at a rate of 0.05 in/min. An extensometer was used to verify the initial readings of the strain gage but was removed prior to failure. Figure 1 shows the test setup.



**Figure 1 – Test Setup**

## **Results**

The stress strain diagram for the specimens is shown in Figure 2. Figures 3 and 4 show the failed specimen. The failure was due to fracture of most of the Hardwire™ material at a single location. Approximately 25 wires in the center of the cross section did not fracture at the same location as the rest of the wires but did fracture elsewhere in the bar. The modulus was approximated to be 10,700 ksi. The ultimate strength was measured to be 152.3 ksi. The strain gage stopped reading at a value of 12.8 mE so an ultimate strain value was not determined. The ultimate strain was approximated to be 14.2 mE by assuming a linear stress-strain relationship.



**Figure 2 – Stress-Strain Relationship**



**Figure 3 – Failed Specimen**



**Figure 4 – Failed Specimen**