I. Motivation

- The need to repair and retrofit rapidly deteriorating infrastructure has led to research in fiber-reinforced composites.
- Successful applications using concrete fiber-reinforced polymer (CFRP) matrix composites in the construction industry.
- Confined concrete has higher strength than unconfined. FRP does not corrode and can be used as a form and reinforcement.

II. Objectives

- To understand the long-term behavior of CFRP composites subjected to hygrothermal exposure.
- Evaluate long-term performance of CFRP and concrete elements subjected to compressive axial loads.
- Analyze results at 2500+ days and compare to previous research results taken at 0, 10, 30, 100, 300, and 500 days.

III. Specimen Preparation

- Concrete preparation:
  - 5 specimens
  - Sand surface and place epoxy
  - Mount strain gauges
- CFRP preparation
  - 5 specimens
  - Sand top/bottom of specimen
  - Rub acetone on FRP surface
  - Place epoxy and mount strain gauges
- Strain gauges
  - 4 axial gauges for concrete samples
  - 6 gauges for CFRP samples (3 axial, 3 hoop)

IV. Testing Procedures

- Compression Testing & Data Gathering
  - Testing done at a universal compression machine.
  - Excel and LabView programs were used to gather and process data for both concrete and CFRP.
- Fracture conditions
  - Concrete fracturing
  - All 5 CFRP specimens had a spiral fracture from top to bottom.

V. Concrete Results

- Graph displays stress–strain values registered at 30, 100, 300, and 500 days.
- Stress-strain response in concrete is almost bilinear which resembles that of the CFRP composite results (not including results beyond the unconfined peak strength).

VI. CFRP Results & Combined Results

- Compressive Strength for 0 & 30 days
- Compressive Strength for 100 & 300 days
- Compressive Strength for 500 & 2500+ days

- Concrete & CFRP comparison @ 2500+ days

**Neon blue line are results from testing done @2500+ days**

The CFRP composite demonstrated higher strain and strength than unconfined concrete.

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