Mechanical Properties of Seawater Glass Fiber Reinforced Concrete

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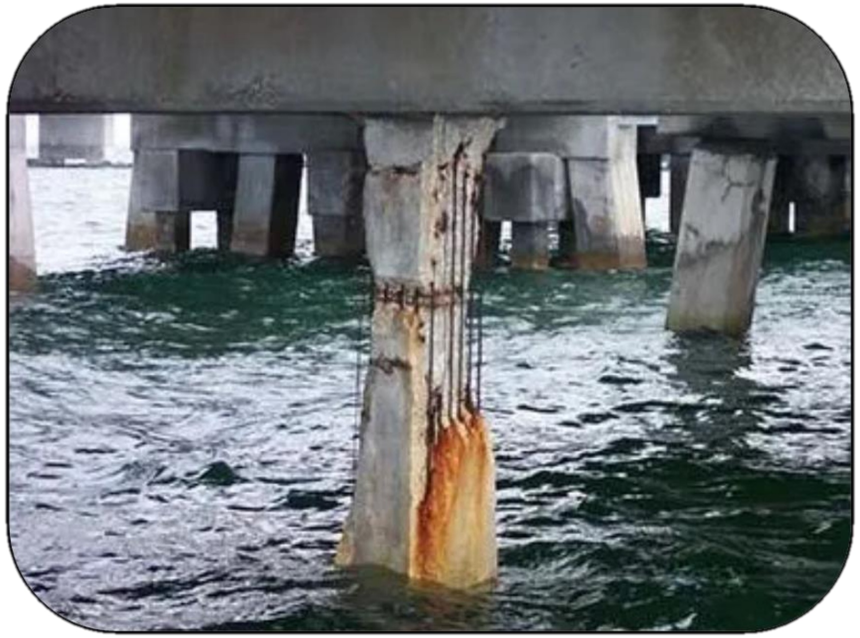
Introduction

- In coastal construction, sea water is often used due to its economic efficiency. However, due to contaminants and the nature of seawater, the structural integrity of sea concrete degrades rapidly from crystallization and corrosion.

- Glass Fiber Reinforced Polymer Reinforcement (GFRP) offers a promising solution due to its anti-corrosive properties.

- We are researching and comparing the use of GFRP in normal and sea concrete with the main goal of analyzing its performance under seismic conditions.



Hypothesis

Experimental Results

The concrete reinforced with Glass Fiber Reinforced Polymer (GFRP) will exhibit greater structural capacity under marine and seismic conditions compared to traditional steel-reinforced concrete, particularly when subjected to the corrosive effects of seawater.

Implications

This research anticipates that GFRP's inherent corrosion-resistant properties and its ability to withstand tensile stresses will result in enhanced performance in coastal construction environments where exposure to both seawater and seismic events is prevalent.

Project Overview

Project Overview

- Small Scale Comparative Testing
- Large Scale Model with GFRP
- Seawater Integration and Testing

Project Overview

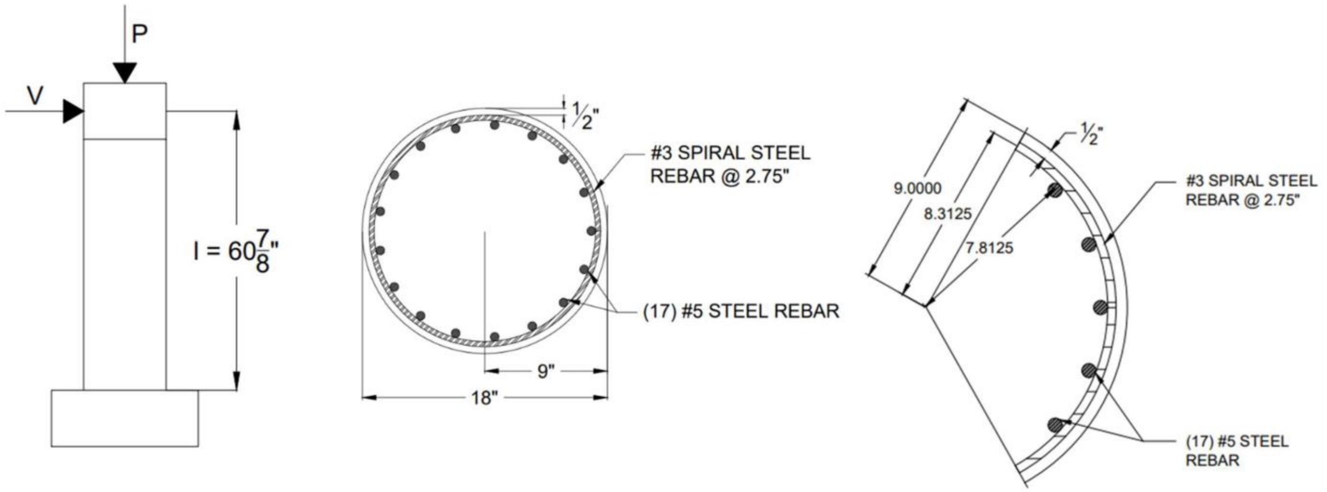
Phase One: Small-Scale Comparative Testing

- Assess concrete performance using seawater and freshwater, reinforced with steel or glass fiber.
- Method: Use 24x48 inch cylinders for testing over 3, 7, 28, and 90 days.
- Tests: Compressive strength (compression machines), tensile strength (split cylinder test), visual crack analysis. Source: Water from Scripps Center, tested for pH, sulfate, organic content

Project Overview

Phase 2 & Phase 3: Large Scale Model with GFRP Reinforcement & Seawater Integration

- Objective: Examine concrete behavior under real-world conditions. Method: Construct large concrete cylinder with 18 GFRP bars, subject to shear and compressive load. Focusing on an in-depth analysis of structural behavior.
- : Transfer Phase 2 with sea water concrete and GFRP bars for Phase 3



Results

- The strength of seawater concrete was lower than that of freshwater concrete. However, adding steel mesh increased the strength of freshwater concrete but decreased it in seawater concrete due to compositional weakening.

- The seawater concrete reinforced with glass fiber reinforced polymer (GFRP) showed significantly lower strength compared to other samples, likely due to the use of GFRP as an additive. Further research will be done to address this

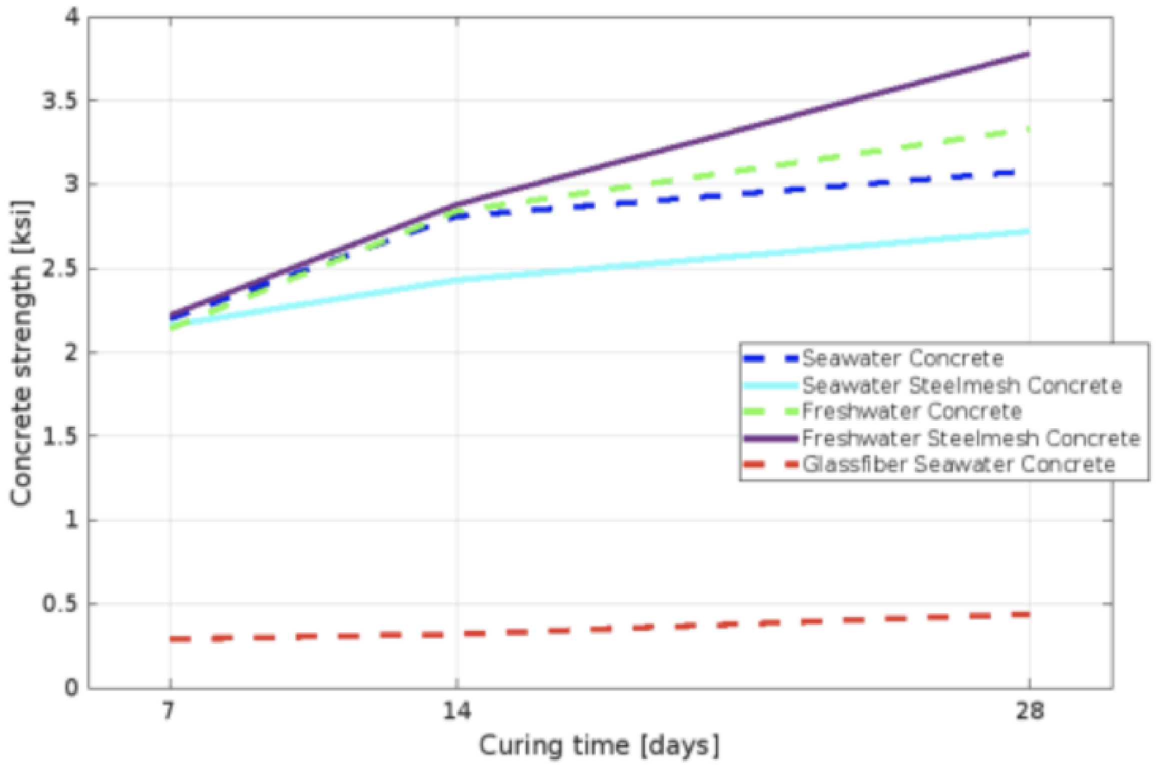


Figure 3: Concrete Strength (ksi) vs. Curing Time (days) Graph

Conclusion & Future Direction

Conclusion

Preliminary experimental data from Phase 1 show that seawater has a deleterious effect on the strength of concrete and that GFRP as an add in significantly decreases strength.

Future Direction

Additional experiments are underway to collect more data points from Phase 1 and inform the development of the two subsequent phases.

Beginning another project revolving the use of polyurethane waste from Surfboard Company in concrete.

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Questions

Thank You!

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