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A REVIEW PAPER ON PRESTRESSED CONCRETE

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ABSTRACT

This literature review focuses on six major research articles that delve into prestressed concrete structures. This research is centered around developments in prestress methods, nondestructive testing techniques, and material advancements. An examination of the previous methodologies, results, and hypotheses seem to point to the future of structural health monitoring systems in the distant future will likely include embedded sensing, thermal compensation, and finite-element modeling. Well, this research just proves the obvious, but at the same time sheds some light to further research in prestressed concrete.

Keywords- Prestressed concrete, post tensioned concrete, fiber bragg grating (fbg) sensors, long term prestress loss, finite element analysis, thermal compensation.

1. INTRODUCTION

Prestressed concrete (PC) sure has changed structural engineering, now almost anything can support so much more weight and for a lot longer period of time. And then there is the problem of prestress loss, and material compatibility and structural integrity monitoring, all of which have been worked out in the last hundred years, through technology. Six key papers relevant to the developments of Fiber Bragg Grating (FBG) sensors, computational modeling, and experimental proof for the optimalization of PC systems are considered in this paper. But again according to the literature the real break throughs are in thermal calibration, relaxation testing, and long-term performance verification.

2. LITERATURE REVIEW

1. Study on FBG Sensor-Embedded PC Strands Researchers: Kim Sung-Tae, Park Young-Soo, Yoo Chul-Hwan, Shin Soobong, Park Young-Hwan. Highlights: Highlights: Developed PC strands with embedded FBG sensors using carbon-fiber-reinforced polymer (CFRP). Creep and relaxation tests on smart strands vs normal strands for over 1000 hours. Tracked prestress loss for 1,600 days with high accuracy, definitively proving finite-element models. Conclusion: Add the FBG sensors however, and real time monitoring becomes very accurate, and could actually develop into real time structural diagnostics.

2. Thermal Expansion and Prestress Force Compensation Researchers: Hyunjong Seong et al., Jianping He et al. Highlights: Highlights: Explored the influence of temperature on prestress force variation. Calculated cte's of composite and non-composite pc samples. Demonstrated the necessity of thermal calibration for long-term monitoring. Conclusion: Temperature compensation (TC) must be included to maintain a high degree of accuracy over long-term prestress force.

3. Finite-Element Analysis of Long-Term Prestress Loss Researchers: Not explicitly stated; utilized MIDAS CIVIL 2020 software. Highlights: Highlights: Fictional creep loss over time, ACI, KS, and CEB-FIP. Did some time-history creep and shrinkage analysis on a few different composite and non-composite specimens. Established benchmarks for computational accuracy in PC performance prediction. Conclusion: Finite-element modeling will eliminate structural degradation through foresight and proactivity.

4. Relaxation Testing on Low-Relaxation Strands Researchers: Various authors contributing to Korean standards (KS D 7002). Highlights: Highlights: Performed relaxation tests maintaining displacement constant over 1,000 hours. Compared load reductions between standard and sensor-integrated strands. Identified minor deviations, affirming compliance with low-relaxation strand standards.

Conclusion: Sensor strands work as good or even better than the old PC strands.

5. Experimental Verification Using Beam Specimens Researchers: Sung-Tae Kim and team. Highlights: Highlights: Fabricated beams with dimensions suitable for composite/non-composite comparison. Tracked seasonal fluctuations for 1,600 plus days and found that prestress force is directly related to temperature. Verified that optical fiber sensors work in the field.

Conclusion: Shows how it is possible to incorporate high tech sensors for realistic pc tracking.

6. Case Studies on Structural Failures Researchers: Compiled from industry reports. Highlights: Highlights: Documented failures, including corrosion-induced bridge collapses. Emphasized the importance of prestress force in older structures.

Conclusion: Emphasizes proactive monitoring to prevent catastrophic failures.

3. CONCLUSION

The reviewed studies underscore the importance of integrating advanced sensor technology and computational tools in prestressed concrete systems. This research, involving prestress loss, temperature effects, structural health monitoring, etcetera, offers revolutionary steps towards enhancing the durability and reliability of PC structures in the long run. A lot more research will be needed to perfect these methods to make them more industrially applicable and also to make them stable under various environmental conditions.

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