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Recent Advances in Computational Design and Analysis of Unbonded Post-Tensioned Concrete Structures

* Thomas Kang[1),2)]

[1)] *Department of Architecture & Architectural Engineering, Seoul National University, Seoul 08826, Korea*
[2)] *Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, IL 71801, USA*
[1)] *tkang@snu.ac.kr*

ABSTRACT

Post-tensioned (PT) concrete systems are extensively used for a wide array of applications today such as high-rise multi-story buildings, long-span bridge structures and nuclear containment structures. The systems are made valuable by fully utilizing concrete compressive strength and very high-strength steel, and through proper design, by controlling cracking, deflection and confinement. Currently, PT concrete remains one of the most challenging areas in computational modeling; particularly unbonded PT concrete systems. This is due to the complexity of the transfer of unbonded PT tension force in steel to concrete, sliding and friction behavior at the tendon/sheathing interface and shear-flexure interactive behavior in 3D slab-column connections with unbonded tendons. As such, the structural mechanism is difficult to understand, often leaving some uncertainty in design. In order to keep improving the structural design of unbonded PT concrete structures, the writer's research team has put a lot of efforts in developing relevant computational methods. In this keynote speech paper, this development process is presented. With the help of newer computational techniques, previous experimental programs can be reevaluated, and many other areas where experimental assessment is usually very difficult can be researched. Here, the techniques of using a general purpose finite element package and using a nonlinear finite element formulation are both adopted. The computational design of unbonded PT concrete structures will be developed and evolved further by practitioners and practicing scholars.

[1)] Associate Professor
[2)] Adjunct Associate Professor