

pti *Technical Notes*

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Exclusion of Post-Tensioned Residential Slabs-on-Ground from ACI 318

It is the official position of PTI that post-tensioned (PT) slabs-on-ground foundations were never intended to fall under the requirements of ACI 318 and that the PTI consensus-based document, “Design of Post-Tensioned Slabs-on-Ground (DC10.1-08),”¹ listed in the Commentary of ACI 318 is the controlling document for the design and construction of post-tensioned slabs-on-ground.

The current language of ACI 318-14,² Sections 1.4.7 and R1.4.7 needs clarification. The Code appears to address one structure type, whereas the Commentary expands to two different types.

EXCERPT FROM ACI 318-14:

1.4.7 This Code does not apply to design and construction of slabs-on-ground, unless the slab transmits vertical loads or lateral forces from other portions of the structure to the soil.

R1.4.7 Detailed recommendations for design and construction of slabs-on-ground and floors that do not transmit vertical loads or lateral forces from other portions of the structure to the soil, and residential post-tensioned slabs-on-ground, are given in the following publications:

- **ACI 360R** presents information on the design of slabs-on-ground, primarily industrial floors and the slabs adjacent to them. The report addresses the planning, design, and detailing of the slabs. Background information on the design theories is followed by discussion of the soil support system, loadings, and types of slabs. Design methods are given for structural plain concrete, reinforced concrete, shrinkage-compensating concrete, and post-tensioned concrete slabs.
- The Post-Tensioning Institute (**DC 10.5-12**) provides standard requirements for post-tensioned slab-on-ground foundations, soil investigation, design, and analysis of post-tensioned residential and light commercial slabs on expansive soils.

The Code states that it does not apply to slabs-on-ground unless they transmit vertical loads or lateral forces from other portions of the structure to the soil.

The Commentary refers to ACI 360R-10³ for slabs-on-ground and floors that do not transmit vertical loads or lateral forces from other portions of the structure to the soil.

The Commentary refers to PTI DC10.5-12⁴ for residential post-tensioned slabs-on-ground.

The above noted variation between the code section and commentary section has been misinterpreted and misused by some in the legal profession, and results in hardship to builders and the concrete construction industry.

This Technical Note is to clarify that the post-tensioned residential slabs-on-ground were never intended to be governed by the ACI 318 Building Code.

1—BACKGROUND OF THE CURRENT CODE LANGUAGE

A provision was added in ACI 318-05,⁵ Section R1.1.6 regarding applicability of residential and light commercial post-tensioned slabs-on-ground to the 318 Building Code. This provision remained essentially unchanged in ACI 318-08⁶ (Section number changed to R1.1.7) and ACI 318-11⁷ (same section) and was moved to R1.4.7 in ACI 318-14 as part of the reformatting.

The reason for not having the exclusion of post-tensioned slabs-on-ground on expansive soils added to the code side was simply to allow for the case of a “structural ground supported slab” that would require design by ACI 318. At the time of the code change (before 2005), there was discussion about adding a definition for post-tensioned concrete slabs on expansive soils. This never materialized in the subsequent code cycles to the detriment of the concrete construction industry. Some in the legal profession claim that all post-tensioned concrete slabs constructed on expansive soil are governed by ACI 318, as they transmit loads through the slab to the soil.

2—WHAT SLABS ARE EXCLUDED FROM ACI 318?

A definition should clarify which type of post-tensioned residential and light commercial slabs-on-ground is intended to be excluded from the ACI 318 Building Code:

Residential and light commercial post-tensioned concrete shallow foundations on expansive soils are ribbed or uniform-thickness post-tensioned foundations built on expansive soils.

Several decades ago (1980), PTI developed a detailed self-contained, standalone design guideline (based on extensive parametric studies) for such foundations. These design guidelines were ultimately adopted by the model building codes and have been used on millions of residential foundations since 1980.

Standard practice over many decades, supported by the IBC, CBC, ACI 360, etc., and the Commentary R1.4.7 all recognize that residential post-tensioned foundations on expansive soil are not governed by ACI 318.

3—INFORMATION ILLUSTRATING THE EXCLUSION OF THESE SLABS FROM ACI 318

UBC, IBC, and CBC have always specified PTI Standards for the design of shallow post-tensioned foundations on expansive soils; they were never intended to be governed by ACI 318. There has never been a path to ACI 318.

- International Building Code (IBC 2015⁸), Chapter 18, Soils and Foundations, 1808.6.2 Slab-on-ground foundations: Excerpt from IBC 2015, Chapter 18 – Soils and Foundations:-
“...nonprestressed slab-on-ground, mat, or raft foundations on expansive soils shall be designed in accordance with WRI/CRSI “Design of Slab-on-Ground Foundations” and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with PTI DC 10.5.”
- California Building Code (CBC 2016⁹) also requires design of post-tensioned slab-on-ground, mat, or raft foundations on expansive soils to be in accordance with PTI DC 10.5 (current edition 2012).
- ACI 360R-10, Chapter 10, Section 10.2.4 Post-Tensioning Institute method: It describes the PTI method of design for ribbed and uniform thickness foundations.
- The PTI DC10.5-12, “Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive Soils,” and its predecessors, is a stand-alone standard directly referenced by the Model Codes.

Millions of residential post-tensioned foundations have been built over the past several decades throughout the United States. None of them were designed in accordance with ACI 318; the designers followed the implied exclusion from 318 and designed these foundations in accordance with the International Building Code, California Building Code, etc.

4—ENCAPSULATED TENDONS

PTI published an Addendum #3¹⁰ to the PTI M10.2-00, “Specification for Unbonded Single Strand Tendons,” 2nd Edition in December 2011.¹¹ This addendum stated:

Specification:

“Tendons used in all applications governed by ACI 318 shall be encapsulated in conformance with the requirements of 2.2.6.”

Commentary:

“The intent of this requirement is to maximize the durability of post-tensioning tendons used in all applications governed by ACI 318, regardless of environmental classification. Encapsulated tendons provide additional protection of the prestressing steel regardless of location of the structure or exposure to moisture intrusion from any source.”

This Addendum was specifically linked to applications governed by ACI 318 Building Code; it was never intended to apply to post-tensioned residential slabs-on-ground, as they are governed by PTI DC10.5 and its predecessors since 1980, as discussed under Item 2.

5—REFERENCES

1. PTI Committee DC-10, “Design of Post-Tensioned Slabs-on-Ground (PTI DC10.1-08),” third edition with 2008 Supplement, Post-Tensioning Institute, Farmington Hills, MI, 2008, 156 pp.
2. ACI Committee 318, “Building Code and Commentary (ACI 318-14) and Commentary (ACI 318R-14),” American Concrete Institute, Farmington Hills, MI, 2014, 519 pp.
3. ACI Committee 360, “Guide to Design of Slabs-on-Ground (ACI 360R-10),” American Concrete Institute, Farmington Hills, MI, 2014, 72 pp.
4. PTI Committee DC-10, “Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive Soils (PTI DC10.5-12),” Post-Tensioning Institute, Farmington Hills, MI, 2012, 46 pp.
5. ACI Committee 318, “Building Code and Commentary (ACI 318-05) and Commentary,” American Concrete Institute, Farmington Hills, MI, 2005, 430 pp.
6. ACI Committee 318, “Building Code and Commentary (ACI 318-08) and Commentary,” American Concrete Institute, Farmington Hills, MI, 2008, 473 pp.
7. ACI Committee 318, “Building Code and Commentary (ACI 318-11) and Commentary,” American Concrete Institute, Farmington Hills, MI, 2011, 503 pp.
8. International Code Council, Inc., “International Building Code (IBC 2015),” Falls Church, VA, 2015, 736 pp.
9. California Building Standards Commission, “California Building Code (CBC 2016),” Sacramento, CA, 2016.
10. PTI Committee M-10, “Addendum #3 to the PTI M10.2-00 Specification for Unbonded Single Strand Tendons,” Post-Tensioning Institute, Farmington Hills, MI, 2011, 3 pp.
11. PTI Committee M-10, “Specification for Unbonded Single Strand Tendons (PTI M10.2-00),” Post-Tensioning Institute, Farmington Hills, MI, 2000, 36 pp.



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