The New and Improved Slab-on-Ground Design Manual

After a highly successful first run, Design and Construction of Post-Tensioned Slabs-on-Ground *is extensively revised*

By Kenneth B. Bondy

What type of structure represents the single biggest market for post-tensioned tendons in the United States? Commercial buildings? Bridges? Tiebacks? The correct answer may surprise you: slabs on ground supporting light residential housing construction.

Given the fact that one-third of all post-tensioned tendons sold in the United States are installed in such slabs, it's important that they be properly designed and constructed. That's why the Post-Tensioning Institute published a first edition of *Design and Construction of Post-Tensioned Slabs-on-Ground* in 1980 and a second in 1996. Since its initial publication, the document has been used by engineers and contractors to successfully design and construct hundreds of thousands of post-tensioned slabs on ground, which are needed to mitigate expansive soils' harmful effects on residential construction. These soils can be found throughout the United States.

The success of the first edition is undisputed. It thoroughly covers ribbed slab design and construction, including the soils investigations required to determine design parameters, site preparation, plans and specifications, construction materials, and installation and field procedures. Now commonly known as the PTI Method, the ribbed slab design consists of a solid-thickness slab with stiffening beams projecting from the bottom in both directions. After being widely used for residential slabs in Texas and Louisiana, two states where expansive soils are particularly prevalent, the PTI Method was incorporated in its entirety into the Uniform Building Code in 1988 as an acceptable design for post-tensioned slabs on expansive soils. The method began to also gain acceptance in California, Nevada and other states.

But 10 years after publication of the first edition, the PTI Slab-on-Ground Committee decided to revise *Design and Construction of Post-Tensioned Slabs-on-Ground.* The reasons were twofold: to reflect the industry's current knowledge of post-tensioned ground-supported slabs and to make the document even easier for design professionals to use.

What's New

Following are highlights of the second edition's extensive revisions:

- Both ribbed and uniform-thickness slabs are now described in the PTI manual. Unlike ribbed slabs, the increasingly popular uniform-thickness slabs have no interior stiffening beams, but they still effectively resist expansive-soil volume changes.

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A crew at work on a post-tensioned slab on ground. For the slab to function properly and resist subgrade movement, it must be well designed and constructed.

- The manual's three design examples have been annotated to clarify the one model of a ribbed slab on compressible soils and the two of ribbed slabs on expansive soils (one in a dry climate where the center-lift condition controls the design and the other in a wet climate where the edge-lift condition controls the design).
- Data are now available for the design of slabs on stable (nonexpansive) soils where differential settlement is negligible and post-tensioning is needed only to control shrinkage and temperature cracking.
- A complete design method is also presented for slabs on compressible, nonexpansive soils that must be designed for significant differential settlement. This compressible-soil design method, together with the revised PTI expansive-soil method, has been incorporated in the new 1997 Uniform Building Code.

Other highlights include:

- An expanded introduction that discusses the history and development of post-tensioned ground-supported slabs as well as alternative empirical design methods.
- Expanded discussions of soil parameters; site conditions; permissible depths, widths and spacings of stiffening beams; and edge and interior slab loading.
- Better analyses of slab moments, deflections caused by prestress edge eccentricity, and subgrade friction.
- A new equation for allowable concrete shear stress. More consistent with previously published recommendations for allowable concrete shear stresses, the equation reflects both concrete strength and average prestress compression, and it will generally result in increases in allowable concrete shear stress.
- An allowable differential slab deflection that now reflects the type of superstructure built on post-tensioned ground-supported slabs. Superstructures more susceptible to deflection (such as concrete masonry units) must now satisfy smaller allowable slab deflections; superstructures less susceptible to deflection (such as wood frame units) are permitted to have larger slab deflections.
- Condensed and simplified tables for differential swell (y_m).
- Notation that is now consistent with standard structural engineering terminology and the American Concrete Institute's *Building Code Requirements for Structural Concrete*, ACI 318-95.

Copies of the second edition of *Design and Construction of Post-Tensioned Slabs on Ground* can be ordered by calling the Post-Tensioning Institute at 602-870-7540. Cost of the 100-page publication is $25 ($20 for PTI members), plus shipping and handling. PTISlab, a Windows-based computer program that incorporates the expansive-soil design method described in the manual, is available for $100.

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