GEOTECHNICAL CONSULTANTS INC.

The Rise of Post-Tensioned Construction

Many of the newly-constructed mixed-use buildings that are adding vibrancy, new living options, and parking garages in central Ohio's urban core and inner-ring suburbs, are possible due to post-tensioned concrete construction.

Post-tensioned (PT) concrete construction is a method of reinforcing (strengthening) concrete or other materials with high-strength steel cables or strands, commonly referred to as tendons. The PT method creates longer spans more efficiently than traditional reinforced concrete.

Three primary advantages of post-tensioned (PT) concrete construction used in a podium deck or transfer slab are described below.

1. Buildings can have larger interior spaces unobstructed by vertical structural supports
Larger, unobstructed spaces are preferred for first-floor retail and restaurant spaces, particularly in multi-use buildings. Use of a PT podium deck above the first floor will transfer the load of the upper floors to the outer vertical structural system, allowing for greater clear-span interior space.

2. Irregular or random loads can be accommodated
In century-old high rise buildings, floor plates are nearly identical due to the necessary substantial vertical structural supports. In new construction, the use of podium decks allows for irregular loading because the deck carries the load of each individual floor to the structural supports. This flexibility is particularly attractive for residential towers with varying unit sizes and floor plans.

3. Longer spans can be achieved with less concrete and rebar material
Parking garages are essential for denser urban and suburban neighborhoods. PT construction is commonly used for multi-level parking garages and for flat, two-way decks associated with smaller parking garages and multi-use buildings.

Post-tensioning construction process

Specialty reinforcing steel contractors install the reinforcing steel, PT strands, and chairing systems for individual placement areas. Once the concrete is placed and develops sufficient compressive strength (usually 3,000 to 3,500 psi), the specialty contractor stresses each tendon to a predetermined hydraulic gauge pressure. The tendons are then locked into place using pre-installed wedges at the anchorages at one or both ends of each tendon.

The result is that the tendons, like rubber bands, want to return to their original length but are prevented from doing so by the permanent anchorages. The permanently stressed state of the tendons results in a compressive force acting on the structural concrete.

During the stressing sequence, the contractor stresses each strand to design hydraulic gauge pressure. After the structural engineer of record verifies that the PT strand elongations fall within acceptable ranges, the tendon "tails" extending outside of the concrete are cut. Then the tendon stub is capped with a protective grease fitting and the resulting pockets are filled with non-shrink grout.

Representative GCI Post-Tensioned Projects

- The Castle Building – 965 N. High Street, Columbus, OH
- The Wellington/University Residences – OSU Central, N. High Street, Columbus, OH
- Jeffery Park Garage, Columbus, OH
- 85 - 111 N. High Street, Columbus, OH
- Beatty Residential, S. High & W. Rich Street, Columbus, OH
- The Wilson, 15 E. Lane Avenue, Columbus, OH
- City of Columbus 8-Story Parking Garage
- Parks Edge Phase One: 12-Story Condominium Tower and 6-story Parking Garage, Columbus, OH
- Hollywood Casino Columbus Parking Garage, Columbus, OH
- The Griff Residential, Columbus, OH
- Grandview Yard Residential 3, Grandview Heights, OH
- Grandview Yard O1 and O2 Parking Garages, Grandview Heights, OH
- Pointe at Polaris Parking Garage, Columbus, OH
- University Residences OSU South, Columbus, OH
- Drury Inn & Suites Columbus Convention Center, Columbus, OH

Inspection Services

GCI provides inspection services for each portion of the reinforcing steel and PT system installation process including:

- Shear rail installations – type, configuration and locations
- Reinforcing steel installations – bar count, size, spacing and chairing
- Beam reinforcing steel
- Top and bottom mat reinforcing steel installations
- Temperature/shrinkage steel between banded lines
- Banded and uniform PT strand installations - tendon count, spacing and profiling
- Stressing work inspection – sequence, hydraulic gauge pressure and strand elongations
- Perimeter crash wall/upturned beam installations
- Trim steel around slab openings and corners
- Compressive strength of the concrete

For more information about post-tensioning testing services for your parking structures, office or apartment buildings, slabs-on-ground, bridges, sports stadiums, or water tanks, contact GCI at **614.895.1400**.

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