

BASE Line

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B A S E

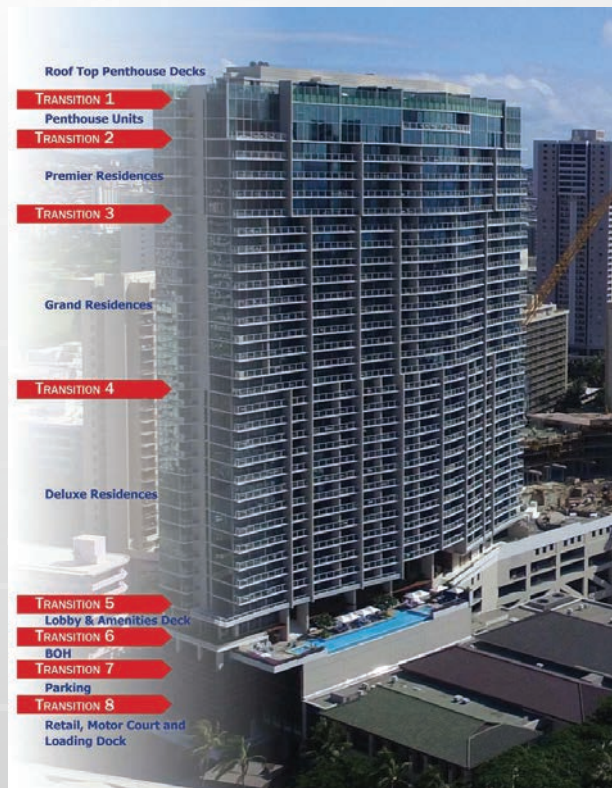
THE PT DIET

Thinner, lighter, and stronger with post-tensioning.

Post-tensioning (PT) is a method of strengthening concrete that allows for construction of architecturally creative designs and structures that would otherwise be impossible for projects with multiple site constraints. In building construction, PT allows for longer clear spans, thinner slabs, and fewer beams. This can help maximize allowable density and height on the property which creates more sellable area and generates cost savings by reducing the overall weight of the building, saving on construction materials needed for seismic and gravity loads.

The Post-Tensioning Institute recognizes projects worldwide for excellence in the application of PT with its biennial awards program. On May 1, 2017, PTI gave its top honor to The Ritz-Carlton Residences Waikiki Beach, Phase 1.

PROJECT OF THE YEAR: THE RITZ-CARLTON RESIDENCES WAIKIKI BEACH, PHASE 1



Awards jury comments:

- “The designers were able to use post-tensioning to mitigate the height restrictions by using thinner post-tensioning slabs and transfer girders.”
- “This building is a wonderful example of the advantages of post-tensioned concrete in tall buildings.”
- “Without post-tensioning, this building would be much taller, much heavier, much more expensive, and would present many more architectural challenges.”

Constructed in two phases, this project includes approximately 900,000 total square feet in two complementary 38-story towers, each 350 feet tall. Phase 1 of this luxury hotel and condominium project opened to the public in July 2016 and has become one of Hawaii’s most sought-after luxury residential addresses offering the ultimate in resort-style living with unobstructed views of the Pacific Ocean, world-class design and access to legendary amenities and services provided by one of the world’s best hoteliers.

Project Team

Developer: PACREP, LLC
Architect: Guerin Glass Architects
Contractor: Albert C. Kobayashi, Inc.
PT Supplier: Suncoast Post-Tension

The project site posed many challenges. With severe site constraints, building height and envelope restrictions, and a desire to maximize views and sellable space, structural simplicity was not a priority. The resulting building required the following features:

- Optimized thin PT slabs;
- 18 unique floor types;
- A PT transfer slab with upturned beams at the roof supporting 32 hanging steel columns;
- Over 50 major wall and column transitions;
- 17 transfer girders;
- 120-foot-long PT concrete truss;
- Sloping W-shaped columns capped with a PT tension tie beam;
- Concrete-wide-flange steel composite columns;
- And most critical to the occupants, unobstructed views of the Pacific Ocean.



The only way for the building to meet all project requirements was through the use of PT.

The majority of the floors were 7"-thick PT concrete flat slabs to meet stringent height restrictions and meet the goal of optimizing sellable residential area. The podium required 17 PT transfer girders to transfer tower walls and columns onto a different grid of podium and parking level columns and walls.



The ground floor truck maneuvering areas also had constraints that would not allow the podium's vertical elements over the loading dock to extend down to the foundation level. The solution to this was a two-story PT concrete truss spanning 120 ft.

The penthouse levels were designed with some spectacular large double-story atrium spaces. The atrium openings were achieved by hanging partial floor PT slabs with steel hanger posts from the roof level. The roof slab not only had to support the loads from the hanging posts, but also the loads from heavy mechanical loads in the center and landscaped rooftop terrace and pool loads on the perimeter. The roof level transfer slab could only be achieved utilizing PT.



Revit model of hanging penthouse slabs, PT slabs, and roof PT transfer slab.

Rendering of double-story penthouse atrium unit. Courtesy of Guerin Glass Architects.

TRIMMING DOWN IN CHICAGO

ONE SOUTH HALSTED CHICAGO, IL

Located in the West Loop neighborhood of Chicago, this new 45-story mixed-use tower sits atop a seven-story retail and parking podium.

In the parking structure, by taking advantage of the precompression provided by PT tendons in the beam cross-section, the number of temperature/shrinkage tendons in the slab was optimized. Further optimization was also done on the number of tendons and shear reinforcement in the parking level beams. Post-tensioning and reinforcement were also optimized in the typical tower slabs. The overall proposed savings were \$380,000 and the post-tensioning component was \$247,500.



CERMAK & WABASH CHICAGO, IL

This new transit-oriented development features an 11-story hotel and 23-story apartment tower on a shared podium with a total construction area of approximately 400,000 SF.

By proposing changes to the structure's columns, the hotel and parking PT slabs, and providing an alternate design for the residential floor slab by converting it from a 9" two-way RC slab to an 8" PT slab, a significant reduction in concrete and reinforcement quantities was achieved. Typical parking, residential and hotel levels were studied in detail using 3D finite element analysis software to study the layout of post-tensioned cables and mild steel reinforcement, while maintaining or improving slab performance. Stud rails were eliminated at a majority of columns.

Overall, the proposed modifications can result in savings upwards of \$1 million.



LINEA CHICAGO, IL

LINEA is a new 35-story, 366,834 SF tower on a site that was previously a parking garage, which was demolished to make way for the new 265-unit residential tower.

Value engineering was performed on the PT slabs and vertical elements. Typical parking and residential levels were studied in detail using 3D finite element analysis to optimize the layout of the post-tensioned cables and mild steel reinforcement, while maintaining or improving slab performance. Stud rails were eliminated at a majority of columns.



A vertical load take-down analysis was conducted, which resulted in an average 2,000 psi reduction in column concrete grade throughout the building, and a net savings of around \$35,000.

Without impacting the design concept or space usage, a total proposed savings of \$535,000 was achieved.

ELEVEN40 CHICAGO, IL

This new 26-story, 320,000 SF mixed-use project includes 320 rental apartments and 5,000 SF of ground floor retail space with parking provided in a five-story parking podium.

A comparative analysis and value engineering study found ways to simplify the PT, such as by reducing the number of full length tendons and providing additional dead-end tendons only where required by analysis. It was also determined that tendons were not being used as efficiently as possible at cantilever slabs, and by increasing the tendon elevations at cantilevers, overall PT could be reduced with improved slab deflections.

Together, these changes not only resulted in an improved slab performance but also a significant reduction in material quantities with potential savings of over \$250,000.

