

BASE Line

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B A S E



Post-tensioning: the BASE of sustainable design

Post-tensioning (PT) is a method of strengthening concrete that allows for construction that would otherwise be impossible because of site constraints or architectural design. In building construction, PT allows for longer clear spans, thinner slabs, and fewer beams. These benefits result in the ability to maximize both the allowable density and height on the property, as well as a reduction in seismic mass and savings in construction materials such as concrete and reinforcing steel.

Two of our projects utilizing PT were recently recognized by the Post-Tensioning Institute in their national 2013 PTI Awards program: [Joint Traffic Management Center Parking Structure](#) and [Trump International Hotel & Tower](#).

2013 PTI AWARDS

Recognizing Excellence in Post-Tensioning Applications

Joint Traffic Management Center Parking Structure - Award of Excellence

In March 2010 the City & County of Honolulu released a competitive design-build RFP for a multi-storied parking structure to accommodate a minimum of 380 cars in addition to parking spaces for 16 buses and two travel lanes at grade. The RFP included structural documentation for a 128 ft wide by 249 ft long trapezoidal-shaped structure but allowed the contractors to submit an alternate technical concept.

The RFP included two structural scenarios. The first was a precast prestressed structure using double tees, inverted t-beam girders and precast perimeter girders. The second was a cast-in-place system utilizing 37-inch deep post-tensioned beams spaced at 18 feet on center.



BASE, together with Hawaiian Dredging Construction Company and Anbe, Aruga & Ishizu, Architects, developed an alternate PT concrete scheme based on a revised column grid optimized for the site dimensions, parking layout, and reuse of the forming system. The final grid system was based on a 24 ft by 60 ft module that fit equally in to eight bays of the ramping portion of the garage. The layout resulted in a more efficient but slightly smaller 122 ft wide by 247 ft long trapezoidal typical floor that reduced the mass of the building.

This project exemplifies the benefits of using PT. Our alternate design proved to be more cost-effective over a precast, prestressed alternate and its use enabled us to soften the sharp corners to meet the aesthetic requirements of the owner. The awards jury commented, ***“The efficient design resulted in a savings of materials while increasing the number of vehicles that could be accommodated, enabling the project to attain a LEED Gold rating.”***

Trump International Hotel & Tower - Award of Merit



Waikiki. Trump. The former is one of the world's premier vacation destinations and the latter is synonymous with luxury development. The union of these two is the Trump International Hotel & Tower. This highly-desirable address set a world record for sales, selling all 464 units in eight hours for a total of over \$700 million.

The location posed a challenge, however: with severe site constraints, building height and envelope restrictions, and a desire to maximize views and sellable space, structural simplicity was not a priority. BASE rose to the occasion utilizing post-tensioning throughout the project to create innovative solutions to the structural challenges. The resulting building includes optimized thin post-tensioned slabs, 23 transfer girders, a 10 inch thick post-tensioned transfer slab at the penthouse, sloping columns, numerous wall-to-column transitions, unique composite steel plate link beams, and, most critically to the occupants, uninterrupted views of the Pacific Ocean.

One unexpected benefit of the height restriction is the structural efficiency created by the utilization of a thin post-tensioned floor system. **Overall structural weight**

was reduced by as much as 30%, reducing column, wall, and foundation requirements.

As seismic load is proportional to the structure's weight, the lateral load requirements were reduced as well. While not intended to achieve LEED points, this structural approach qualifies under innovations in design. Even with all of the vertical load transitions, **this structure required less concrete and reinforcing steel per square foot than other recently-constructed tall buildings in Honolulu, making it a more sustainable form of construction.** Jury comment: *"The result: an architecturally striking structure that features efficient use of materials and high seismic and wind resilience."*



Other notable PT projects include...

University of Hawaii Frear Hall Dormitory



This 197,000 SF, 810-bed dormitory is located on the University of Hawaii campus in Honolulu. The structural design satisfied one of the core tenets of sustainable design: the efficient use and preservation of resources. The reduced material requirements also resulted in client savings, leaving funds available for other important architectural and sustainable design requirements. **By using a PT structural system, BASE achieved a 31% reduction in concrete material and 18% reduction in reinforced material.** The project received an Innovation in Design point toward LEED certification because of this significant reduction in use of materials.

Wave One

Wave One is a 44-level, 600-foot tall, two million SF structure in Noida, India, that begins with three basement levels with a 15-level podium structure, topped with two towers joined together at the top eight levels. Our work included structural design along with a 3-D BIM model to track structural concrete, reinforcing steel and post-tensioning steel quantities. PT is a relatively new structural system in North India so our office completed structural designs and then worked closely with the contractor's PT supplier to verify the final construction requirements.

