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Ocean Villas Condominiums Long Beach, California

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Situated on the exclusive shoreline of downtown Long Beach, California, is the Ocean Villas Condominium project. Two 18-story towers house a total of 556 residential units with over 723,000 sq ft of living area, and 264,000 sq ft of parking is accommodated in three subterranean levels. At ground level, the entry driveway, two swimming pools, and a seaside promenade walkway are part of an 85,000-sq-ft landscaped plaza area.

One of the main goals of the project was to reduce overall construction time so that occupancy could commence as soon as possible. It was determined early in the development stage that a reinforced concrete structure utilizing a tunnel formwork system would meet the aggressive schedule, and would save approximately 30% in direct construction costs. At 230 ft in height, the buildings are the tallest formed by this type of system in a region of high seismic risk.

Tunnel forms, which can usually be reused 500 to 1,000 times, are an effective way to construct buildings that have repetitive elements or layouts. A typical construction cycle, which covered approximately 5,000 to 6,000 sq feet of surface area, was as follows:

1. Cast foundation and starter walls used to position tunnel forms
2. Install tunnel forms between starter walls with cranes and align with screw jacks
3. Install electrical conduits, blockouts for doors and slab openings, reinforcement for the walls and slabs

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Owner:
Genesis Real Estate Group, Inc., Dallas, TX

Architect:
EDI Architecture, Inc., Houston, TX

Structural Engineer:
Englekirk Partners Consulting Structural Engineers, Inc., Orange County, CA

General Contractor:
Summit Builders Construction Co., Irvine, CA

4. Form starter walls for the next level

5. Pour concrete for the slabs and walls, and suspend portable heaters inside the forms to help cure the concrete so that it reaches a compressive strength of 2,200 psi in 16 hours

6. Remove one L-shaped form segment, shore the slab, and remove the other L-shaped segment

Concrete Subcontractor (Tunnel Forms):
Highrise Concrete Systems, Inc., Irving, TX

With 21,000 sq ft per floor, it took 4 days on average to complete one level.

Floor framing consists of 5-1/2-in.-thick cast-in-place one-way slabs spanning between walls, which are centered 12 ft or 16 ft apart. At the plaza levels, a cast-in-place two-way slab system is utilized to support heavy landscape and fire truck loading. Both 10-1/2-in. and 14-1/2-in.- thick slabs with 10-in.-thick drop panels span 24 ft to 33 ft and are supported on 12-in. by 30-in. concrete columns.

The foundation system for each tower is a 5-ft-thick concrete mat, which is 110 ft wide by 230 ft long. Conventional spread footings are used under the columns supporting the three plaza levels and parking levels outside the footprint of the towers. To support the unbalanced soil pressure and to minimize lateral forces resisted by the tower walls, buttresses were added every 25 ft on center along the north basement wall.

Special reinforced concrete shear walls are used as the lateral-forceresisting system. Since the 1997 Uniform Building Code limits the height of bearing wall systems utilizing shear walls to 160 ft, the structural engineer demonstrated through experimental data and analysis that the proposed system possesses the ductility required to exceed code performance objectives for the 230-ft-tall towers. A displacement-based design procedure confirmed the available curvature ductility of 9 for the shear walls. The City of Long Beach Building Department subsequently granted an exception based on this evidence.

The shear walls are 12 in. thick in the subterranean levels, 8 in. ground to level 7, 6 in. levels 7 to 13, and 8 in. thick level 13 to the roof. The walls, typically 24 ft long, are coupled with 24-in.-wide by 72-in.-deep cap beams at the roof level. The 8-in. and 12-in. shear walls are reinforced with 2 layers of No. 5 bars at 12 in. on center and 10 No. 8 jamb bars. The 6-in. walls are reinforced with 1 layer of No. 5 bars at 12 in. on center and 6 No. 8 jamb bars.

In addition to faster construction time and lower costs, concrete framing provided other important advantages, including resistance to fire with no need for additional fireproofing. Since approximately 60% of the interior walls are concrete, a 30% to 40% reduction in sound transmission is realized compared to stud and drywall construction, resulting in quieter units. Also, due to the inherent thermal mass characteristics of concrete, utility costs are also reduced. In short,

concrete framing satisfied the needs of the owner and the residents of the buildings, providing a cost-effective solution for both.