PROJECT SPOTLIGHT

Revitalizing Hollywood & Vine

Innovative engineering provides solutions to complex challenges

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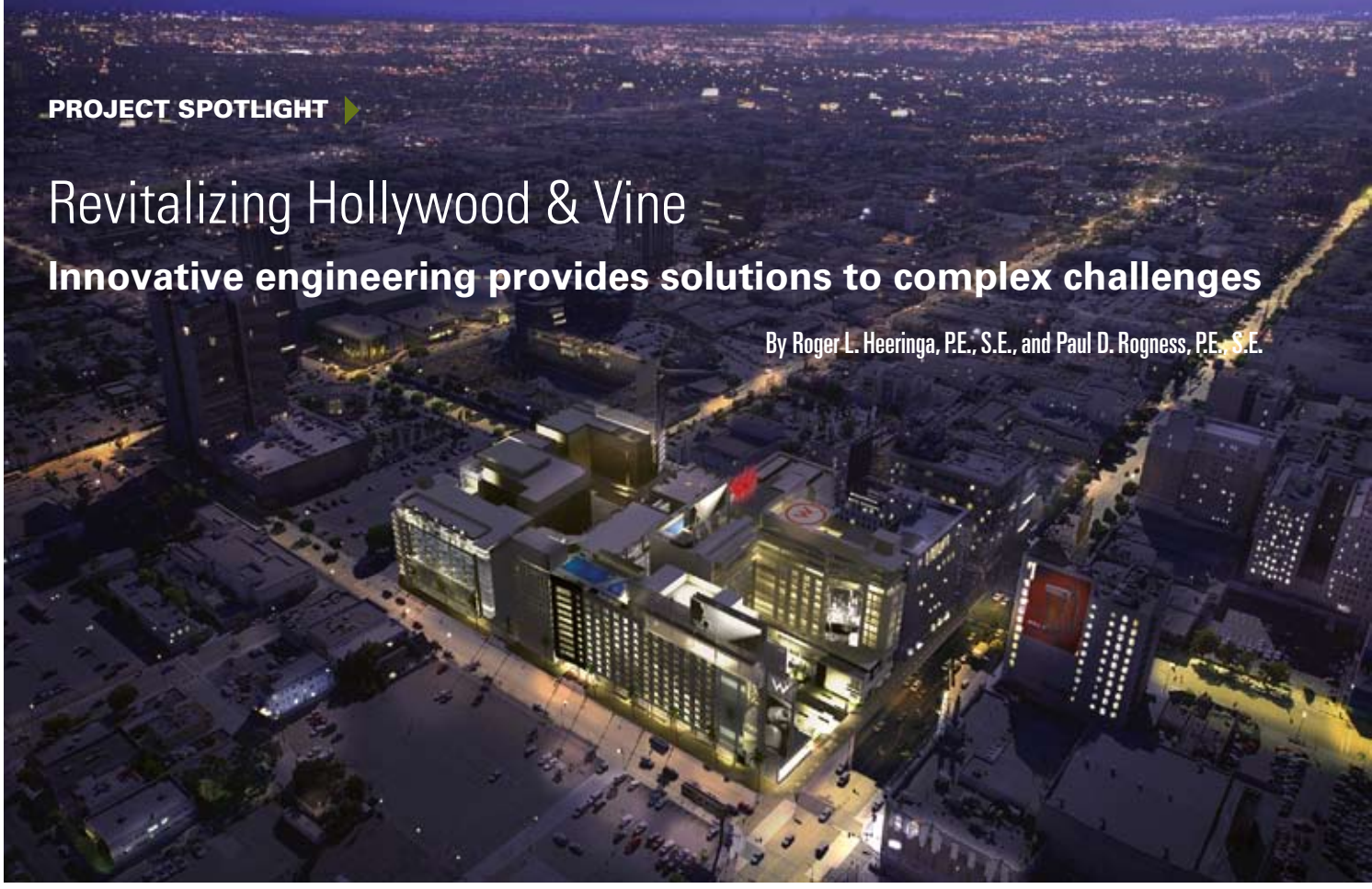

HKS Architects, Inc.

(above) A nighttime rendering shows the completed project. (right) Aerial view of the site during construction of Level 1 slab shows the scale and complexity of the project.

Located at the world famous intersection of Hollywood Boulevard and Vine Street in Los Angeles, the new W Hollywood Hotel & Residences and 1600 Vine Apartments is a $600 million, 1.7 million-square-foot, mixed-use project covering 4.5-acres. The project includes the first branded residences within the city of Los Angeles with hotel, retail, luxury for-sale residences, and for-rent apartments at the center of the Hollywood Renaissance.

The W Hotel is an 11-story, 305-room full-service hotel with a rooftop pool, a chic nightclub, a signature Innovative Dining Group (IDG) restaurant, and a Bliss spa. The W Hollywood Residences is a 15-story, 143-unit luxury condominium tower. The 1600 Vine Apartments project includes 375 apartment units in one eight-story and two 12-story towers. The project was constructed around the Hollywood/Vine Metro Red Line Station, which is located beneath Hollywood Boulevard and a portion of the site.

In total, the project includes 57,000 square feet of retail space and 8,500 square feet of meeting and banquet space. The five towers share 750 below-grade parking spaces on three levels and 600 spaces on four levels of above-grade parking within the apartment structure. The ground floor includes retail space for a bank, restaurants, and a boutique grocery store, along with a loading dock that serves the entire project and a bus layover for Metro drivers. Other unique features include three elevated swimming pools, two helipads, 30,000 square feet of advertising signage, and a sky bridge connecting the hotel rooftop to the W Hollywood Residences.

The primary structural framing system for the project is cast-in-place concrete. The below-grade levels are mildly reinforced, while the levels above grade leverage post-tensioned concrete. The lateral system for the rectangular hotel tower includes special reinforced concrete shear walls in the transverse direction and ductile concrete moment

Design and Construction Team

Project name
W Hollywood Hotel & Residences

Developer
Gatehouse Capital/HEI Hospitality

Project name
1600 Vine Apartments

Developer
Legacy Partners

Structural engineer
DCI Engineers

Architect
HKS Architects, Inc.

General contractor
Webcor Builders

frames in the longitudinal direction. The T-shaped condominium tower and the apartment towers are constructed with concrete shear walls in both directions. The foundation is a combination of a 3- to 6-foot-thick mat slab and 24-inch-diameter drilled concrete piers that support the structure around the Metro portal.

Unique structural engineering

As encompassing as this project is, there are a few outstanding aspects that created unique challenges for the structural engineering team at DCI.

Metro Red Line subway station — The Hollywood/Vine Station access occupies a significant portion of the Hollywood Boulevard street frontage. The foundation and below-grade parking for the new structure were designed around the existing subway improvements in an effort to eliminate potential impacts to the subway while maintaining access to the portal during construction. DCI accomplished this by using pile foundations for the structure adjacent to the portal. In some areas, the lighter retail and signage structures were constructed over the top of the portal. In these locations, soil over the portal was excavated and replaced by light-weight cellular concrete so that the loading on the portal did not increase.

Transfer beams — There are two main areas that required significant transfer beams. Several condominium columns are supported by four, 4-foot-wide by 6-foot-deep transfer beams to create an expansive 6,000-square-foot, column-free banquet space. The southeast corner of the site under the apartments includes layover space for parking five Metro buses. The adjacent loading dock area is designed for HS20 loading, including the specified turning radiuses and clearance for semi-trucks. This combined area includes six, 5-foot-wide by 6-foot-deep transfer beams spanning as much as 60 feet that support apartment gravity columns. The project includes a total of 40 transfer beams. To save reinforcement, reduce congestion, and improve long-term performance, DCI engineers used a bonded post-tensioning system that is traditionally used in bridges.

Advertising signage — In Hollywood, advertising is a significant source of revenue for property owners. DCI designed several signs that were integral with the skin of the building. The signs above the hotel and condominium are constructed on building columns that cantilever 70 feet upward and act as vertical and horizontal sign supports. The apartment building signage extends 110 feet above the roof and is supported by building columns and braced frames. Along Hollywood Boulevard, a 174-foot-tall sign structure is constructed over the Metro portal and is laterally braced to the main hotel structure by the retail roof, the rooftop bar floor system, and two horizontal trusses.

Glass box nightclub — Architects at HKS wanted to create a unique space for the rooftop nightclub. This was achieved by creating a glass box that cantilevers from the roof of the hotel toward Hollywood Boulevard. This glass box is supported on a column that is part of the Hollywood Boulevard sign structure and a one-story-tall steel truss that cantilevers 52 feet. The floor framing was designed with an acoustic floor and the truss was modeled dynamically with the goal of minimizing the transmission of sound and vibration from the nightclub to the hotel below.

Sky bridge — The architecture also includes a sky bridge connection between the hotel rooftop and the

Webcor Builders


Webcor Builders

Construction workers set a steel column over rebar for a signage structure.

DCI Engineers

Shear wall boundary elements extend above the deck during construction.


Webcor Builders

A one-story-tall truss cantilevers 52 feet to support the "glass box" nightclub.

11th floor of the condominium tower. Because these two buildings are seismically separated, the sky bridge had to accommodate up to 24 inches of seismic drift in all directions. The sky bridge is directly attached to the condominium at one end, while concrete-filled steel tubes extend from the hotel to support the other end to accommodate movement. The connections are detailed to allow movement in both principal axes.

Innovative design and detailing

The primary design and detailing challenges of this project can be distilled into three items: the detailing for the shear walls, the modeling of the lateral system, and the design coordination of the slab at Level 1.

Shear wall detailing — The site seismicity, combined with the lack of available locations for full-height shear walls, created numerous design challenges for the lateral systems. The project was designed under the 2001 California Building Code (which is based on the 1997 Uniform Building Code). The site is located less than 2 kilometers from the Hollywood Fault and near-source factors resulted in seismic base shear coefficients as high as 20-percent *g*. DCI engineers incorporated concrete shear walls as thick as 36 inches with high-strength, 8-kips-per-square-inch (ksi) concrete at the lower levels to resist these loads. To reduce congestion in the shear wall boundary elements, #18 and #14 ASTM A615 Grade 75 rebar was used for the vertical flexural reinforcing. This is not allowed by the UBC and required a modification request from the building department and additional testing to ensure that adequate elongation of the reinforcing steel would occur. To reduce congestion further, #6 hoops and ties were incorporated where shear wall strengths exceeded 6 ksi.

Lateral system modeling — Modeling the apartment structure was another challenge to the lateral design. The building is one large podium structure for six levels, and then it becomes three separate, 8- or 12-story-tall towers. Multiple ETABS models were analyzed to determine the maximum expected seismic load for each shear wall and diaphragm.

Level 1 slab design — Coordinating a project with two owners, numerous consultants, and government agencies presented a number of challenges for the design of the Level 1 slab. This level covers 200,000 square feet — or 4.5 acres — and accommodates a 12-foot elevation variance requiring extensive slab steps and slopes. The retail areas are designed as mild reinforced concrete to maximize future flexibility. The exterior motor court area, loading dock, and Metro bus layover are designed with post-tensioned concrete to minimize slab depths and maximize performance. The construction joint locations, slab steps, and tendon stressing sequence were coordinated with the contractors at Webcor to optimize the construction schedule.

Construction challenges

All projects include construction challenges for the design team. Hollywood & Vine's unique circumstances of schedule and materials were met by DCI engineers and solved with innovative solutions.

Accelerated schedule — The schedule for concrete placement presented a significant challenge during construction. During slightly more than 13 months, the contractor placed 100,000 cubic yards of concrete, all pumped from one location, and 14,000 tons of reinforcing. This corresponds to an average of 35 concrete trucks and 2.5 rebar delivery trucks each day. Teamwork and

Innovation for Shotcrete Shear Walls by **Shotcrete Systems, Inc.**

coordination between DCI, Webcor, HKS, and both owners was essential. Expedited shop drawing reviews and contractor RFIs were required throughout construction. DCI engineers were located on site to provide structural observation for more than half of the slabs prior to concrete placement.

Rebar congestion — There were many locations where concrete consolidation was a concern because of rebar congestion. These included intersections of transfer beams and shear wall boundary elements, as well as moment frame joints. DCI engineers coordinated with Webcor managers to ensure mix designs were adequate to achieve consolidation at these locations. High-strength concrete mixes included 3/8-inch aggregate and water-reducing admixtures to increase the slump of the concrete to between 8 and 9 inches. The contractor also built mock-ups of congested areas prior to the start of construction to ensure adequate concrete consolidation.

Shotcrete — To help facilitate the schedule, Webcor contractors requested to use shotcrete for all below-grade basement and shear walls. This included shear wall boundary elements with #18 vertical bars and #6 hoops and ties at 4-inches-on-center. Team members at DCI, Webcor, and from the building department developed a test panel program to ensure adequate consolidation could be achieved. Full-scale test panels were constructed with reinforcing that matched the most congested areas. After shotcrete placement, these panels were cored in numerous locations and saw-cut in half to observe consolidation. The test panel program lasted six months and the shotcrete placement method was approved by DCI engineers and the building department days before the first scheduled placement.

Conclusion

Scheduled to open in the fourth quarter of 2009, the Hollywood & Vine project will revitalize this historic intersection. Creative, innovative solutions and continual communication was essential throughout the project to solve complex engineering challenges and achieve a successful project. ▼

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