STRUCTURAL ENGINEER

Breathing life into a 101-year-old coffin factory

HISTORIC BUILDING'S TRANSFORMATION INTO HOTEL REQUIRED NEW SERVICE CORES, FOUNDATIONS AND FRAMEWORK FOR ROOF AMENITIES.

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Renovated Nylo South Side Hotel, looking northwest. *Photo by 5G Studio Collaborative.*

Owner: *Matthews Southwest*
Construction manager: *Azteca*
Architect: *5G Studio Collaborative*
Structural engineer: *JQ*

Adaptive reuse has become commonplace in today's building environment as owners seek to alleviate some of the upfront costs associated with new construction and provide sustainable redevelopment of existing structures. Programs are also being implemented by more cities to attract developers toward revitalization projects through tax incentives and other creative financing programs.

The building located at 1325 South Lamar St., south of downtown Dallas, was constructed in 1911 for the Dallas Coffin Company to house their offices and manufacturing center. The DCC operated at this location until the 1950s, and then the building was utilized by Sears & Roebuck from 1960 to 1993. The building sat vacant until Matthews Southwest purchased the property in 2005 with the goal of converting the historic structure into a boutique hotel.

The Nylo South Side hotel is a key part of Dallas' south side revitalization, anchoring one of the Southern Dallas Redevelopment initiatives championed by the City of Dallas. In addition to private financing, the roughly $20 million project received funding from the Dallas Development Fund, which serves as a New Markets Tax Credit financing agency, and the City of Dallas Regional Center, which assists individuals and their families through the EB-5 immigration process. The Nylo South Side is one of the first projects in the nation to integrate both NMTC and EB-5 financing.

Dallas Coffin Factory Building prior to conversion to Nylo South Side, looking northwest.

Project description

The structure is approximately 145 by 72 feet and consists of five levels above grade and a partial basement, containing approximately 53,000 square ft. The building consists of classically proportioned, exterior load-bearing multi-wythe brick walls ranging from 12 to 24 inches, and 6 in. flat-plate floor slab supported by 18 in. diameter concrete columns with 36 in. diameter tapered capitals. Structural bays are 14 ft. 8 in. by 14 ft. 6 in., and typical floor-to-floor heights are 11 ft., with the exception of the first and second levels, which are 13 ft. The foundation consists of continuous brick footings below exterior walls and 7 ft. square isolated spread footings below building columns.

The new building program called for a new rooftop amenities deck with swimming pool, fully enclosed bar and lounge area, exterior seating areas, mechanical spaces, new vertical circulation, new exterior entrances, exterior entrance canopies, and new site structures.

Condition assessment

Original architectural drawings were discovered, but original structural documents were unavailable. Therefore, a combination of visual observations, non-destructive testing and destructive testing methods were employed. Exploratory work included test pits to determine type, configuration, size, and elevation of foundation elements. The in-situ concrete compressive strengths determined by cores were found to range between 2,500 and 3,600 psi, and slab thicknesses ranged from 5.9 to 6.9 in. Several types of reinforcing steel were encountered, including square, round, and twisted bars. Round bars (straight and twisted) varied between 1/4- and 3/8-in. diameter, with ultimate tensile strengths between 82,000 and 139,000 psi. Square bars were 3/4-in. by 3/4-in. with an ultimate tensile strength of 81,000 psi.

Ground penetrating radar was utilized to attempt to locate and verify size, depth, orientation, and spacing of the reinforcing steel within the floor slab. Reinforcing was found in a radial pattern extending from the columns, in a circular pattern around the columns, and in multiple layers in principal directions and diagonally between columns with variations throughout the floors. Based on review of historical data, the floor system was a four-way slab system similar to a Turner-Mushroom or S-M-I system, but the exact reinforcing system could not be conclusively determined.

Above: Load test procedure at second level.
Below: CFRP strips externally bonded to underside of existing slab adjacent to new service core.

Analysis and design

Similar to other historic buildings, existing building systems and paths of egress did not meet current building code requirements. Therefore, new service cores were required to extend from the basement to the new rooftop deck. At these new openings, supplemental support for the slab was provided by new 6-in. load-bearing masonry walls around the perimeter of the shaft(s). In addition to supporting the new cores, the shaft walls were designed to take a portion of the lateral loads at each existing level due to the discontinuities in the floor diaphragm created by the new shafts.

Foundation support for the new service cores was provided by mat foundations. New foundations placed in close proximity to existing footings were supplemented with helical screw piles to prevent additional bearing pressure on the soils supporting the adjacent existing footings. Helical piles were selected because of the restricted site conditions and their low overhead clearance installation capabilities.

Cantilevered galvanized steel truss on east side of pool, looking southwest.

As the service core floor openings disrupted the continuity of the slabs, a finite element model (FEM) was created to determine the required supplemental reinforcing. A baseline model was established by modeling the slab without openings using the assumed loading for the original building usage. This model was compared to a second model with the openings included, using current code stipulated design loading. Where the models indicated that significant carbon fiber polymer (CFRP) reinforcing would be required, load tests were performed in accordance with ACI 318-05, Chapter 20, to verify the capacity of the slab in an effort to reduce reinforcement quantities. Tests were performed adjacent to an existing stair opening similar in configuration to the new service core. The load tests were successful, allowing CFRP quantities to be reduced substantially.

New rooftop amenities deck and "faux" water tank, looking west.
Photo by 5G Studio Collaborative

Because the roof was to be occupied, the existing roof framing was not capable of supporting the new loading demands without significant reinforcement. However, the existing columns were adequate to support the higher loading. Therefore, the amenities deck and pool structure were elevated above the existing roof by a steel framework "stubbed-up" with new steel columns aligned with the existing building columns. To maintain the concept of the deck and pool "floating" above the existing structure while not attaching to the perimeter load-bearing walls, a cantilevered steel truss was utilized along the east side of the pool to transfer the loads back to the interior building columns. The bottom chord of the truss provided support for the pool substructure, and the top chord provided support for the upper pool deck.

The upper pool deck and cabana areas consist of 2x4 (nominal) IPE wood decking, a sustainable wood product, supported by steel framing. Other exterior and interior portions of the rooftop deck consist of steel framing with concrete slab on form deck. At the enclosed lounge and service core, the new steel columns extend up to support the roof structure of steel beams with glue laminated, tongue-and-groove wood decking. A new enclosure at the northwest corner of the existing roof to house mechanical equipment also supports a "faux" water tank that displays hotel signage. Although other rooftop signage was proposed and denied by the city, a historic photo showed that a water tank once existed at this roof location.

An investigation into published live loads for light manufacturing buildings of this era revealed design floor live loads ranging from 100 to 120 psf (pounds/square foot), substantially greater than the current building code prescribed floor live load for hotels. However, after accounting for the assembly loading at the ground floor, upper floor level corridors, and the amenities deck, engineers determined that the existing footings would be subjected to increased loading. To gain additional capacity, existing footings were enlarged so their new size would generate soil bearing pressure similar to the original footing design.

The owner and architect worked closely with Preservation Dallas, a non-profit organization focused on historic building preservation, to ensure that the historic integrity of the structure remained intact. The project was also designed to achieve LEED Gold and has already received Certified

Rehabilitation status from the National Park Service, both meaningful designations for an historic structure entering its second century of service.

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