



## Warner Drive

### A Building Transformation

By Sara Means, S.E. and David Cocks, S.E.

*Structural Focus was an Outstanding Award winner for the Warner Drive project in the 2011 NCSEA Annual Excellence in Structural Engineering Awards Program (Category – Forensic/Renovation/Retrofit/Rehabilitation Structures).*

The Warner Drive project involved the conversion of an existing one story under-utilized warehouse into an upscale venue for production space or events such as an Academy Awards party. The existing concrete tilt-up panel warehouse is approximately 30,000 square feet and has a beautiful double barrel wood roof. The roof consists of diagonal sheathing and wood joists spanning between arched glulam beams. The glulam beams were originally supported on perimeter concrete pilasters and a row of interior concrete piers at the center of the building. Tension rods tied the glulam arch ends together to provide for the 80-foot span.

A row of columns down the center of the space would not work for the envisioned open production/party space. With that in mind, the client requested that the interior concrete piers be removed, as well as the existing tension rods at the bottom of each arched glulam beam. A steel truss was designed to support the roof and replace the concrete piers. The steel truss of HSS members is 6 feet wide by 9 feet deep and spans 110 feet. The truss is supported on 2 large structural steel columns on each end, replacing the row of 9 existing interior columns in the center of the structure. The truss now acts in two directions by supporting the gravity loads from the roof as well as the horizontal thrust that is induced from the arched glulam beams after the tension rods were removed. The existing concrete pilasters at the exterior walls were strengthened to also resist the horizontal thrust induced by the glulam beams. Additionally, the top of the truss formed a mechanical platform to support new rooftop mechanical units.

Previously a warehouse, the need for significantly more parking was key in the conversion to an events venue. In order to create enough parking spaces to accommodate a large scale event, a one story parking area was added below the building. The existing slab on grade was demolished and a large hole was excavated



*Courtesy of Michael Schmidt Photography.*

below the building. The dimensions and sequencing of the excavation were carefully planned to minimize the need for temporary shoring to protect the structure above. The first floor of the warehouse was replaced with a two way slab spanning between drop panels and columns. Due to space requirements and the parking layout, there is one area of the garage where the supports are 33 feet apart. This large span required the two-way suspended slab to be 15 inches thick. Approximately 90 parking spaces were added to the site.

Structural Focus worked closely with the contractor to develop a construction sequence that would require only minimal shoring to the existing building. First, two of the existing interior concrete piers were removed and the roof was shored in this area. The footings and two columns, which support the new truss, were placed. The truss was then installed above the existing roof while the rest of the interior concrete piers remained in place. The large truss came in two pieces, was spliced in the middle, and weighed 1 kip per foot. Once the truss was in place, the existing glulam beams were connected to the truss and the interior concrete piers were removed. The total truss deflection did not exceed  $\frac{3}{4}$  inch (L/1760) after being fully loaded. The existing slab on grade was then demolished and the subterranean parking area was excavated. The retaining wall locations for the parking were held in from the exterior wall of the building so that the existing wall footings would not be undermined and temporary excavation shoring of the existing building would not be required. The retaining walls were cast, the interior parking area footings and columns were cast, and then the two-way slab was poured.

In addition, a new two story office space of approximately 7,000 square feet was added at

the front of the warehouse. The new walls are architecturally finished cast-in-place concrete, and the roof and floors were built with exposed “butcher block” flooring. Wood members (2x) were stacked side by side to create a mechanically laminated deck. The underside of this deck was left exposed and creates a beautiful ceiling in the space below. The “butcher block” floor is actually an historic technique that has mainly been used for manufacturing floor systems with heavy loading, and is not typically used in an office application. The building’s lateral system consisted of the wood deck spanning between the cast-in-place concrete shear walls. Due to the diaphragm aspect ratio of the office space and the heavy concrete walls, the building has very high diaphragm shear demands. These demands are resisted by heavy nailing between the 2x joists and by plywood sheathing above.

The construction sequence described above allowed for minimal shoring to the building, which saved the owner very significant costs. The construction technique of the “butcher block” flooring was a cost-effective way to provide a unique and architecturally pleasing floor and roof system. This project met all of the owner’s requests, exceeded his expectations, and gave life to a once forgotten building. ■

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