Sue and Bill Gross Women's Pavilion

Hoag Memorial Hospital Presbyterian
Newport Beach, California

2006 NCSEA Excellence in Structural Engineering Award Winner

Courtesy of TAYLOR.

TMAD TAYLOR & GAINES was presented with the NCSEA 2006 Excellence in Structural Engineering Outstanding Project Award in the category of New Buildings over $100 million for the Sue and Bill Gross Women's Pavilion of Hoag Memorial Hospital Presbyterian.

The Project

The Women's Pavilion project at Hoag Hospital is an 11-level, base isolated, steel moment frame building with a 2-level steel framed entry canopy. When the facility opened ahead of schedule and under budget in October 2005, it nearly doubled the clinical space on the hospital campus. It will serve as the new main entrance for the hospital and will house more than 15 new and existing services including women's health services, ambulatory procedure services, laboratory services, patient education, and a hospitality center.

Background

The 320,000 square-foot structure includes one mechanical story at the top and a partial floor at the interstitial level. The main seismic-force-resisting-system of the building features Special Moment Resisting Frames (SMRF) in both principal directions. Braced frames are used at the mechanical story. Trusses are introduced between the second and the interstitial floor to increase the building stiffness since the interstitial level is only a partial floor. Concrete shear walls are used between the basement and the first floor. Floor diaphragm is typically 3¼-inch lightweight concrete over 3-inch metal deck. The building is supported by high-damping rubber types of isolators. Use of the concrete shear walls increases building weight and reduces uplift force on the isolators. A mat foundation is used to reduce uneven, differential settlement.

Moment Frame

The Women's Pavilion, located two kilometers from the Newport-Inglewood fault, is the first hospital building in California to incorporate a moment frame and base-isolation system. Unlike the traditional "brace-frame" design, a moment frame creates a more flexible design leaving ample room for large windows.

The design of moment frames and base-isolation system was "tuned" to dampen the movement in the event of an earthquake. To test its effectiveness, three moment frame connections were tested at University of California San Diego. The tests demonstrated that the proposed moment frames could successfully withstand a large seismic event. The results led OSHPD, the California Health Care Regulatory Agency, to conclude that the frame met all requirements imposed by the California Building Code.

Base Isolation

The most notable structural element of the building is its base isolators, which consist of steel plates and rubber sandwiched together under the building frame. These base isolators allow for lateral movement of 30 inches in any direction during a seismic event. Once again, extensive testing was required to verify the desired performance in an earthquake. Four prototype isolators were tested for tension and shear to strict criteria established by OSHPD and the results were reviewed by third-party experts.

The structural system utilizes two types of prototype base-isolators. There are 34 Type-II moment frame isolators (20-inch high and 46-inch diameter) and 20 Type-I gravity frame isolators (20-inch high and 40-inch diameter).

Design Team & Teamwork

The in-house structural design team performed numerous non-linear time-history analyses to study and bound the behavior of the base-isolators, and demonstrate conformance with strict criteria established by OSHPD and the peer reviewers. Close collaboration among members of the structural design team and the architect ensured a well balanced building (the distance between the center of mass and the center of rigidity was less than 14 inches in the east-west direction and 5 inches in the north-south direction for the typical floor plan 235 feet long in the east-west and 150 feet long in the north-south direction).

Courtesy of Warren Aerial Photography, Inc.

In order to ensure high quality for shop and field welding, controlled preheating was used, which minimized the undesirable expansion and contraction. The tight site provided further challenges. An enormous crane was used to hoist column pieces, weighing 25 tons and precast panels weighing 10 tons, more than 300 feet away.

Although the project faced countless challenges, teamwork and cooperation among the structural engineer, architect, contractor, owner, and OSHPD were the primary reasons for overall success of the project.

Based on overall success of the project, OSHPD officials declared Women's Pavilion a model for hospital construction in California. The design maintained the aesthetic requirements established by the owner, and also met the seismic requirements that will keep the structure and its inhabitants protected during an earthquake. The Women's Pavilion successfully combined complex functional requirements of an acute care hospital with the therapeutic components of a healing environment, setting a standard for future healthcare facilities in California ▪

PROJECT TEAM

Structural Engineer
TMAD TAYLOR & GAINES
Architect, Interior Design
TAYLOR
Construction Manager
Jacobs Facilities Inc.
General Contractor
McCarthy Building Companies, Inc.
Key Subcontractors
Herrick (structural steel)
Malcolm Drilling