

The Estate "Suncatch"

Creating a Modern Masterpiece

By Melissa Kroskey, P.E. and Daniel Korntved, S.E.

San Diego architect Norm Applebaum designed this 54,000 square-foot estate utilizing his signature exposed cantilever beams piercing through the sky and creating a dramatic sloping roof that appears to defy gravity as it floats above expansive clerestory glazing. The abundance of glass disperses sunlight throughout the home and meshes indoor and outdoor spaces in true Southern Californian living style. The "Suncatch" Estate consists of 27,000 square feet of living space over a 27,000 square-foot subterranean garage housing the owner's Ferrari collection. The footprint of this grand estate is roughly the size of a football field and nestles on 30 hillside acres in the prestigious area of Rancho Santa Fe, California.

SDSE Structural Engineers designed over 200 cantilever elements in order to make the owner's and architect's dream of this architectural masterpiece a reality. One of Suncatch's main features is exposed structural steel beams painted oxide red primer and infilled with Douglas fir. Cantilever beam spans reach up to 70 feet. One of the many design challenges involved calculating the camber required for the cantilevered beams



Steel beams infilled with Douglas fir create dramatic roof lines. Door frames are surrounded by glazing and constructed from solid steel plates cantilevered up from floor framing. Courtesy of Rose Nielsen.



The Estate "Suncatch" received an Outstanding Project Award, New Building Under \$30 million, in the 2007 NCSEA Excellence in Structural Engineering Awards Program.

The Estate out to out is as long as a football field. Notice the piercing of the roadway through the swimming pool. Courtesy of Paul Barnett.

so that, at the completion of construction, the exposed wide-flange steel beams would end up straight and level. Complicating this issue was the variety of conditions involved in supporting the beams with concrete walls, other cantilevered beams, bent steel columns, and steel column "trees." Beams were cambered up to five inches, and some cantilever spans were even extended in the field to achieve the desired aesthetics.

For architectural uniformity, the exposed sloping roof beams are all one size (W24x229), as are the columns (W10x112). Where the standard beam and column sizes were not adequate, engineers added structural steel plates hidden behind the wood in-fill. At the living room, a welded steel plate girder was designed and fabricated 16 inches deep with 2½-inch thick flanges so that it could be concealed within the joist space provided by the wood ceiling. This heavy plate girder, weighing 420 pounds per foot, allows the W24x229 cantilevered beams to appear to defy gravity as they reach to the sky and leave people (including us engineers) wondering, "How did they do that?"

The infill for the steel beams, clear vertical grain Douglas fir, was also used for ceilings, floors, fascia, and trim for a total of one-half million board feet of Douglas fir.

The home also features glass window panels up to 30 feet in height and 1¼ inches thick. Some panels have leaded glass doors through them, with the door and glass supported by inverted U-shaped frames of solid steel plate construction cantilevered from the floor framing. Glass clerestory windows are located between the tops of all of the interior and exterior walls and roof framing. The absence of floor-to-ceiling walls throughout the house, and the fact that only the steel columns extend up from the walls to the roof, achieves Applebaum's vision that the roof is floating above the home.

Project Team

Structural Engineer: SDSE Structural Engineers
Architect: Norm Applebaum Architect, AIA
Owner: Undisclosed by request
General Contractor: Lang Contracting
Steel Detailer: Richard Ciucki
Steel Fabricator: Progressive Steel
Concrete: Sandpoint Construction

The steel columns cantilever above the walls through the clerestory glass to transfer lateral forces from the roof diaphragm into the concrete, masonry, and plywood shear walls below the glass. Other lateral force-resisting systems for the home included ordinary steel braced frames and ordinary steel moment frames.

Along with the exposed steel beams used to frame the roof, a unique look for the exposed concrete veneer walls was developed by the Architect. All of the concrete building walls, basement walls and site walls were constructed from concrete masonry blocks with this exposed cast-in-place concrete veneer. Applebaum wanted to emphasize continuous horizontal joints in the exposed concrete, and therefore the concrete walls were innovatively constructed in long 36-inch lifts using wood I-joists up to 110-feet long as the form board supports. To eliminate vertical joints, a surfer on site recommended the use of neoprene as a form liner.

A scheduling conflict posed yet another challenge: the fascia finish wood at the eaves, over 1500 linear feet, had to be installed prior to placing the heavy tile roofing. Sand bags, equivalent to the weight of heavy tile, were placed uniformly over the entire roof so that the long cantilevered eaves would be in their final position prior to installing the trim boards. The sand bags were removed as the roof was tiled, thereby negating any deflection or movement, which would have caused the fascia board joints to split.

The design of this residence started in 1997 when the client declared, "I want the finest house in the region." Approximately eight years later, the house was finished and many people including Julius Shulman, the famous architectural photographer, have exclaimed this master work of art is one of the great houses of the 21st century.■

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A tree column supports steel beams above the driveway. The driveway walls are finished in a unique concrete veneer with horizontal joints at 36 inches (no vertical joints). Courtesy of Norm Applebaum Architect, AIA.



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