Creatively positioning a simple steel grid yields openness while preserving privacy.

A Desert Oasis in Steel

BY SCOTT WILLIAMSON, P.E.

NESTLED WITHIN AN EXPANSIVE golf community in Scottsdale, Ariz., the Brown Residence enjoys stunning desert views from almost every space. The architectural objectives for this single-family home were accomplished, in part, through the extensive use of exposed structural steel.

Careful architectural design made it possible to edit views of the neighboring houses, while focusing them on the distant mountains. Architecturally Exposed Structural Steel (AESS) was a natural choice for the more open elements of the house, particularly the family room and the formal living/dining pavilion. Structural steel frames large expanses of glass walls and oversized pivot doors allowing abundant light and air into the spaces. Broad overhangs framed with structural steel wide-flange shapes and shading devices of closely spaced HSS sections provide protection from the harsh desert sun.

The roughly 3,600 sq. ft, single-story residence presents an unassuming, modest scale to the street, but steps down with the slope of the site allowing the spaces inside to become quite generous. Simple stucco volumes play against the more voluminous steel and glass pavilion of the living/dining room, which anchors the site and creates a private courtyard. Concrete garden walls and concrete and stone hardscape define this courtyard and other exterior spaces. A

The clean lines and earth tones of the structural steel framework express the honesty of the structure while allowing occupants to focus on the views beyond.

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Above, left, and below: Using a uniform, simple, light steel framework of W4 columns and W8 beams provided the necessary structural support while minimized visual obstruction.

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steel-clad swimming pool adjacent to the informal family room provides a pleasant escape from the desert heat.

The lower-profile stucco volumes of the residence are framed with concrete masonry unit (CMU) walls and wood joists. However, even on these structures, steel is used for the large, cantilevering shading devices. Steel wide-flange shapes cantilever more than 8 ft supporting HSS sections, shading the primary views from these areas. These structures are kept to a functional minimum so as to not detract from the view. This was best accomplished through the use of structural steel.

The large family room is framed entirely of structural steel. Four-in. steel wide-flange columns are spaced at 8 ft on center,

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▲ Welding the exposed steel connections provided a clean, modern appearance and helped seal the building envelope.

How to Get the Right Look

Frequently structural steel framing is designed to remain exposed to view after the structure is completed. Especially in high-end structures where appearance is important, engineers and architects may wish to specify closer dimensional tolerances and smoother finish surfaces than what is required for ordinary structural steel framing.

To that end AISC has established the designation Architecturally Exposed Structural Steel (AESS). The various requirements for AESS are covered in Section 10 of AISC *Code of Standard Practice for Steel Buildings and Bridges*, available as a free download at **www.aisc.org/freepubs**.

A good additional reference is the AESS supplement to the May 2003 issue of *Modern Steel Construction*. It includes a sample AESS specification and discusses some of the aspects of specifying AESS that may add significant costs to the steel package. For a free online version of that supplement, go to **www.modernsteel.com/backissues**. For more up-to-date pricing information regarding the use of AESS, contact the AISC Steel Solutions Center at **www.aisc.org/ssc**.

supporting 8-in. wide-flange beams. Structural steel decking spans the 8 ft between the beams, and therefore, no other framing is necessary. Fixed glass panels alternate with oversized glass pivot doors along the exterior wall to fill the area between the columns—floor to ceiling—in order to maximize the view. The steel columns were left exposed, as are the bottom flanges of the steel beams.

Specifying AESS dictated the tolerance and finish requirements necessary for this approach to be successful. Ceiling panels span in-plane and between the bottom flanges of the beams to conceal mechanical, lighting and insulation. A glass and steel skylight framed entirely of structural steel angles, T-shapes and metal decking pops up roughly 3 ft at the north end of the fam-

ily room. The skylight has a solid roof with 21-in. overhangs, allowing light to enter only around the glass perimeter and shading the harshest direct sun. Reinforced CMU walls on the three remaining sides of the space provided the necessary lateral stability, allowing the steel elements to remain as minimal as possible rather than relying on any frame action. This also allowed the use of simple bolted connections at concealed locations. Welded connections were still used at exposed locations to create the cleanest, most modern appearance and, in some cases, to seal the building envelope.

The main focus of the entire residence is the steel and glass pavilion of the formal living/dining room. Using structural steel minimized the framing and maximized the views of the relatively tall, voluminous space. To keep the columns to the smallest possible 4-in. wide-flange shapes, they are spaced at only 6 ft on center on all sides of the pavilion, and lateral loads were resisted by well-concealed bracing rather than frame action.

To optimize the framing for both gravity and lateral loading, a 3D model of the pavilion was analyzed with RISA-3D. The roof of the pavilion is framed entirely of 8-in. wide-flange beams on the same 6-ft spacing as the columns, eliminating the need for transverse girders. However, using matching wide-flange fillers in the spaces between the beams provides a uniform soffit.

Because all of the steel is exposed, all connections are fully welded to seal the structure, which also provides additional stiffness. The use of structural steel allowed for the expansive 8-ft overhang in all directions, while keeping the depth of the structure minimal. The bottom flanges of the beams are coped for the final 2 ft, 6 in. of the overhang, further reducing the mass of the roof, and 1½-in. structural steel deck, exposed from below, is all that is required to span between the beams.

Because the majority of the structural steel is exposed, and most of the spaces between the structure are filled with glass, the tolerances for fabrication and erection of the steel were much tighter than traditionally allowed. Likewise, connections were detailed with aesthetics and simplicity in mind. In general, finishes on and around the steel were kept to a minimum, expressing the honesty of the structure and allowing the occupants to focus on the views beyond. MSC

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Software
RISA-3D

Using filler beams the same depth as the main support system provided for a uniform soffit.

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