A renovation project at Texas A&M University takes a new material direction and lightens the feel of an institutional building.

Breaking with TRADITION

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THE 12TH MAN IS a well-known tradition at Texas A&M University in College Station, Texas, a school laden with tradition.

The reference is to the student section at the school's football games, signifying that they stand ready to step onto the field and play when needed by their team.

So it was an appropriate name for the $85 million renovation and expansion to the school's Memorial Student Center (MSC). The new 12th Man Hall serves as the grand entrance to the east end of the MSC and is the first space encountered when entering from the adjacent Rudder Tower Conference and Events Center.

Originally constructed in 1948, the MSC underwent major additions in 1970, 1972 and 1989, with cast-in-place concrete chosen as the primary structural frame each time.

Breaking with tradition, the Hall uses structural steel in lieu of cast-in-place concrete for both the primary structural frame and individual structural elements. The 38-ft-tall, three-story space measures 275 ft by 50 ft. The roof structure is comprised of 3-in.-deep steel deck supported by wide-flange beams spaced approximately 12 ft on center; wide-flange was chosen over open-web steel joists to maximize ceiling heights and accommodate a thin perimeter roof overhang. The ends of the beams were coped over the supporting girders to reduce beam depth to 10 in. as they reach the perimeter curtain wall. Miscellaneous

◄ The completed interior of the 12th Man Hall.

steel channels were then welded to the perimeter deck angles to create a parapet and a 6-in.-deep roof overhang beyond the face of the curtain wall. The lateral system consists of cantilevered steel columns and steel braced frames. Structural steel bracing was also used for a narrow section of roof diaphragm to transmit forces to the lateral load-resisting elements.

Lightening the Load

The primary architectural goal of the renovation was to "lighten" the feel of what is a very institutional building—one of the primary reasons for the switch to steel framing—and facilitate a more desirable gathering space for students. This goal is epitomized with elements such as 12 pairs of exposed tapered steel HSS, a dramatic three-story glass curtain containing integral steel and aluminum shading devices, thin cantilevered entrance canopies, suspended stairs and connector bridges.

Symbolically, a total of 12 columns support the roof structure for the 12th Man Hall on the east elevation of the building. Project architect Perkins+Will conceived a column that gave the abstract appearance of two arms outstretched upward to support the roof structure. These columns are fixed at the foundation and serve as part of the lateral load-resisting system. The body of each column is constructed of a W18×158 with a WT9×79 welded to each face of the web to create a cruciform shape. The addition of the WTs stiffened each column about the weak axis not only for resistance to gravity loads, but also for resistance to lateral loads in each orthogonal direction. The body of each column is capped with a steel plate that serves as the base for the "outstretched arms," which extend to support the roof structure. The arm sections are comprised of two half-cone-shaped pieces of ½-in.-thick, 50-ksi steel plate welded together with a partial penetration weld and a ¼-in. cover weld on each side. The weld seam was ground smooth and is located along the back or exterior side to avoid detection. The arms are 16 in. in diameter at the base, tapering to 8 in. as they extend 8 ft above the cruciform shape to support the roof structure. Each arm, painted with intumescent paint for fire resistance, is skewed 29° in one direction and 12.35° in the other to accentuate the intended abstract form visible through the perimeter curtain wall.

The Hall is infused with natural light via a floor-to-roof curtain wall on the north, south and east façades. The cur-

▲ Construction of the 12th Man Hall.

▼ The exterior of the addition and the pedestrian bridge to adjacent Rudder Tower.

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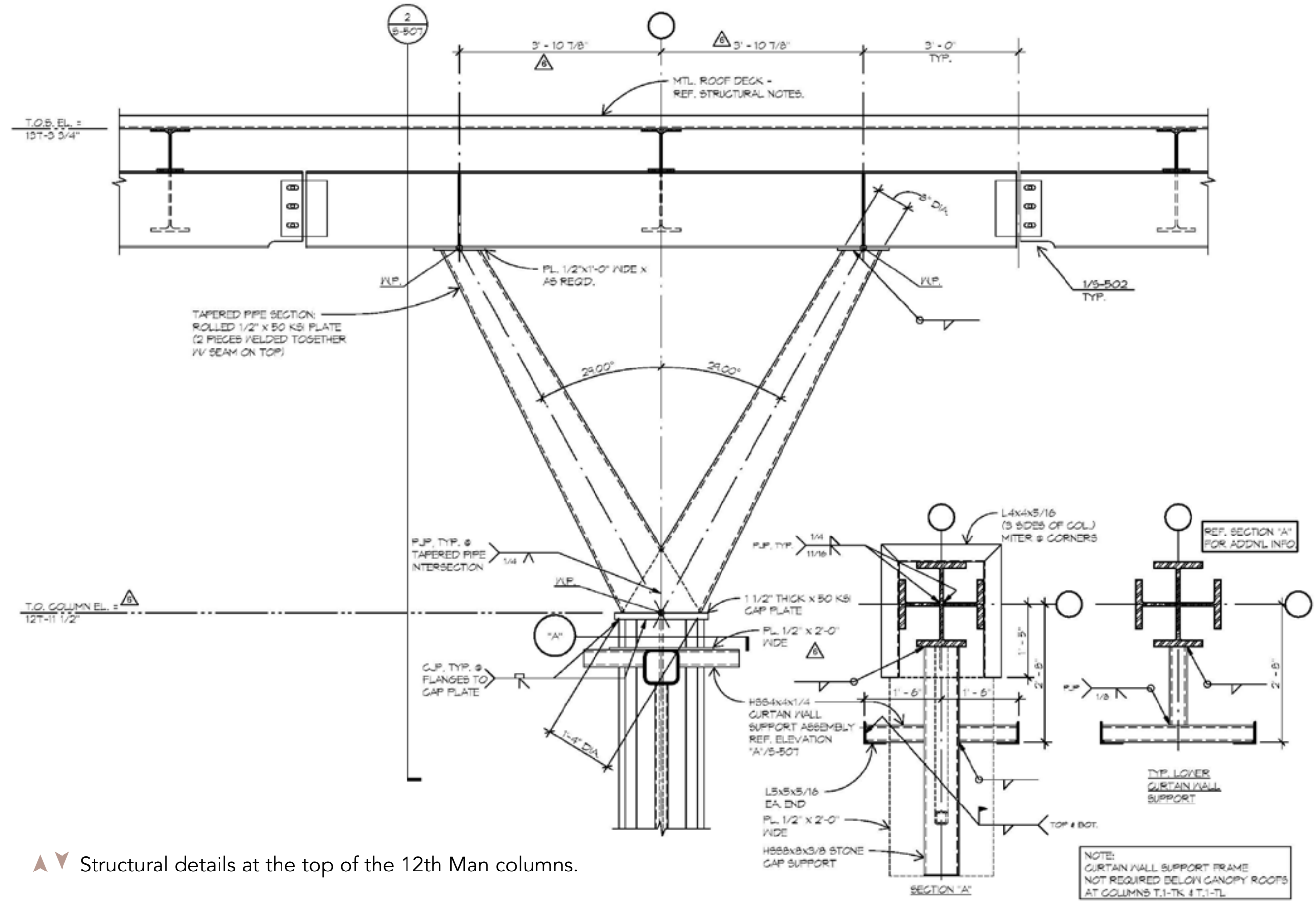
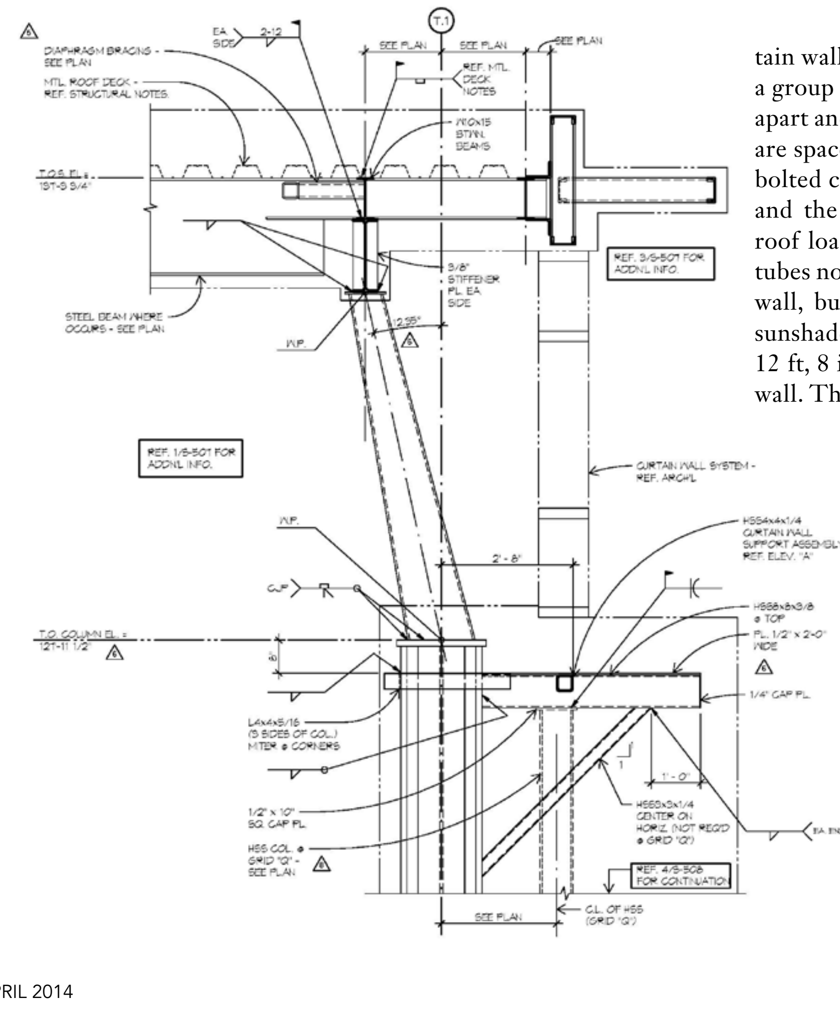


Structural details at the top of the 12th Man columns.



tain wall spans horizontally and is laterally supported by a group of three HSS14×4×3⁄8 tube steel posts spaced 4 ft apart and centered between the building columns, which are spaced 24 ft on center. Vertically slotted holes at the bolted connection between the top of each support post and the roof structure prevent the transfer of gravity roof loads to the posts and foundations. These vertical tubes not only support the horizontally spanning curtain wall, but also support two layers of cantilevered steel sunshades. The lower sunshades are at an elevation of 12 ft, 8 in. above grade and extend 9 ft from the curtain wall. The upper sunshades are at an elevation of 28 ft, 9 in. above grade and extend 6 ft from the curtain wall. Each sunshade consists of a welded HSS frame filled with tightly spaced aluminum shade rods, with the frame connection welds meeting the requirements for architecturally exposed structural steel (AESS). To reduce fabrication costs, the design team used recommendations from the AESS guide published in the May 2003 issue of *MSC*. Matching the budget and visual expectations to the categories given in that document, the upper frame met the lesser requirements of AESS Category 3, while the lower frame met the requirements of AESS Category 2 due to closer proximity to the human eye. An HSS "stub" section was shop welded to each curtain wall support post, with each "stub" extending 3 in. beyond the exterior face of

The interior scissor stair under construction…

…and completed.

the curtain wall. This allowed for installation of the curtain wall and subsequent building enclosure prior to connecting each of the sunshades.

The curtain wall on the north and south elevations of the Hall is supported on cantilevered steel entrance canopies, with cantilevers measuring up to 12 ft. A 12-in. structural depth was achieved for these canopies, despite supporting the additional curtain wall weight, by specifying a reverse camber at the end of the cantilevered members.

Bridges and Stairs

A steel pedestrian bridge connects the second level of the MSC to adjacent Rudder Tower. This bridge consists of an exterior portion that spans approximately 36 ft from Rudder Tower and penetrates the curtain wall between the aforementioned 12th Man columns, as well as an interior span that bridges the floor of the hall nearly 40 ft to connect with the MSC. The interior portion consists of conventional steel floor construction comprised of concrete-filled steel deck and steel beams and perimeter girders. However, in keeping with the goal of lightening the structure, the exterior portion of the bridge consists of two approximately 14-ft-deep Vierendeel steel trusses. Using trusses minimized member depths to maximize overhead clearance for pedestrian traffic below—and implementing a Vierendeel-configured truss maximized surface glazing and therefore natural light. HSS18×6×½ members make up the truss chords, with the top chord of each truss serving as the roof girder and the bottom chord serving as the floor girder. Vertical web members consist of HSS6×6×½ in order to minimize the structure and maximize exterior glazing. Moment-resisting connections at the web-to-chord interface are achieved with complete-joint penetration welds.

Adjacent to the connector bridge and central to the Hall are two steel stairs. One stair is a simple straight-run stair that transitions from the Hall floor down to the basement level of the MSC. A separate scissor stair hangs dramatically over the lower stair, taking visitors from the Hall to the west end of the second-level bridge and allowing access to either the MSC or Rudder Tower. This hanging stair has an unsupported mid-landing and was analyzed with RISA-3D finite element software. The stair structure is comprised of a pair HSS12×6×⅜ bent steel stringers for both the upper and lower flights. Two composite steel beams were added at the second floor, each aligned with a stringer, to transfer the tension force into the second-floor diaphragm through a ⅜-in.-thick welded steel tie-plate. Each lower flight stringer is welded to an embedded plate cast into the concrete at the ground floor.

The name of this grand entrance to the MSC is coined from one of the longest-standing and dearest of Texas A&M traditions. Yet this structure breaks with tradition by using structural steel to transform a building that was seldom used by the student body in recent years to one that has become the University's "living room." ■

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