Cornering the market on roof truss design

Leveraging cold-formed steel at the University of Texas at Austin

By David Boyd

A crane was used to lift the unique corner and cantilever conditions to the roof of the AT&T Executive Education and Conference Center at UT at Austin.

Back in 1883, a small school was started in central Texas with 221 students on 40 acres of land. From those humble beginnings, the University of Texas at Austin (UT at Austin) has grown to become the largest campus in the University of Texas system and one of the largest in the nation. Currently home to nearly 50,000 students, 2,700 faculty, and 19,000 staff, UT at Austin has become a leader in many aspects of the university system. As stated in its core beliefs, The University of Texas at Austin is "an enduring symbol of the spirit of Texas — big, ambitious, and bold — the university drives economic and social progress in Texas and serves our nation as a leading center of knowledge and creativity."

The latest addition to its vast campus — the AT&T Executive Education and Conference Center — exemplifies these core beliefs. This development is being used to create a completely new entrance to campus: big, ambitious, and bold. The structure is home to a diverse number of functions, including student residences, training facilities, graduate student classrooms, and conference facilities.

Similar to the mixed-use goals of the Conference Center, the building materials used to construct this project also utilize a wide range of products. Full of diversity and versatility, the materials range from heavy structural steel and concrete for the main building frame, to lightweight yet strong, cold-formed steel for the roof truss system.

Cold-formed steel trusses are a remarkably versatile solution for applying complex, architecturally interesting, and 100-percent non-combustible roof systems. On this project, approximately 285 individual steel trusses were used to form the hipped, mansard-style roof system on the two towers.

Cold-formed steel truss fabricator Hart Components of San Antonio, Texas, faced numerous challenges in designing the steel truss system required to achieve the dramatic look desired by Lake Flato Architects. The roof was designed as a hip system with a large, 8-foot cantilever. Traditional cold-formed steel truss designs can efficiently support overhangs and cantilevers up to 4 feet. However, the steel trusses on the Conference Center certainly were outside of traditional limits. Steel truss material, software, and engineering provider Aegis Metal Framing, LLC was required to design unique connections in order to meet the additional gravity and uplift loads produced by such a large cantilever condition.

Solving non-traditional challenges

One of the many benefits of using cold-formed steel trusses is the ability to design around other elements of a structure, such as structural steel beams, HVAC units and ducts, and other miscellaneous items. In a traditional hip roof system, a girder truss is placed parallel to the end wall, typically 8 to 10 feet back from that wall. Single sloped jack trusses are then placed perpendicular to the main hip girder to create the slope on the end wall. At the corners, where the two slopes come together, a corner girder is typically located at the ridge at a 45-degree angle from the hip girder. This corner girder assists the truss installer in creating an accurate ridgeline. As

seen in the photo at right, a corner girder could not be placed directly at the ridgeline of the building because of large window-cleaning booms that were placed at each corner of the two towers. Thanks to the creativity of Hart Components, this significant design challenge was overcome. One corner girder was placed on either side of each boom. Additional steel framing was then added by the truss installer, Marek Brothers, so that the support needed for the corrugated metal deck was still in place.

Once the final truss system was designed by Hart Components, reviewed and certified by Aegis Metal Framing, and approved by Lake Flato Architects and its structural engineer, Campbell Consulting Engineers, it was time to begin fabrication. Cold-formed steel trusses are precisely engineered systems, and as such, they are best fabricated in a factory environment. There are numerous benefits to building steel trusses in a controlled setting — such as automated cutting operations, efficient material handling equipment, and precise, fixed jigging systems — to ensure consistency and uniformity. All of these factors work to guarantee the most consistent, highest-quality structural framing elements to satisfy the particular design requirements of an individual structure.

Given the unique corner and cantilever conditions, as well as the space-limited jobsite, Jim Smith and the installation crew from Marek Brothers, Buda, Texas, had their work cut out for them. Smith stayed in constant communication with Robert Dicianni at Hart Components to maintain coordinated installation and production schedules. Timing and communication were crucial to ensure that the trusses built at Hart's factory in San Antonio would fit perfectly once delivered to the jobsite, and that the jobsite was prepared for the shipped trusses.

At the jobsite, the key to a safe and successful cold-formed truss installation is bracing. Although a complex and often misunderstood subject, proper bracing of the truss system, both during erection (often referred to as construction bracing) and as part of the permanent roof structure (permanent bracing) is essential to ensure proper roof system performance. The design of permanent bracing is typically provided by the truss engineering supplier or the project engineer. Guidelines for proper construction bracing are available from the Cold-Formed Steel Engineers Institute (www.cfsei.org) and the Cold-Formed Steel Council (www.cfsc.sbcindustry.com).

As seen in the photo, a corner girder could not be placed directly at the ridgeline of the Conference Center towers because of large window-cleaning booms that were placed at the corners.

Conclusion

Jim Smith of Marek Brothers summarized his feelings about the truss system and installation on the Executive Education and Convention Center by stating, "Robert Dicianni and Hart Components went above and beyond many times during the course of this project. The trusses went together great. The extensive bracing package from Aegis was excellent. I can't imagine installing a truss package without it." In addition to the design challenges, there were very tight time constraints as well. For example, the crane used to lift everything to the roof was to be dismantled within the month. Therefore, coordination and timeliness of truss deliveries was crucial to the successful completion of the roof system.

As the old cliché states, "All's well that ends well." In the end, all of the trusses were placed and the decking was completed on time and within budget, in spite of some major challenges. ▼

David Boyd serves as sales representative for Aegis Metal Framing, LLC. Prior to the formation of Aegis, David held various technical and marketing positions at MiTek, dating back to 1995. His broad industry experience, product knowledge, and technical skills give him a solid background in the growing market of cold-formed steel components. He can be reached at 314-851-2200 or dboyd@aegismetalframing.com.