Tower Units & Steep Sloping Roof Make for Inventive Design

Multi-family project features complex structural elements to achieve towering results.

by SBC Staff

The residents of a new multi-family unit in a suburb north of Indianapolis may not appreciate the intricate truss design work that went into their building. But Eric Kolosky, truss technician with Trussway Ltd., and Joe Heinsman, one of the project engineers with Lynch, Harrison & Brumleve Inc., remember it well.

The 200-unit apartment building in Carmel, IN contains three levels of living space (about 220,000 sq. ft.) and features a number of complex structural elements to achieve its intended aesthetic. The first floor of the building is reserved for commercial space. Apartment units line the second and third floors around the outer and inner perimeter. The fourth floor has a "mezzanine" level or partial story that extends the fourth floor wall height to two full stories. There are two levels of underground parking, and an open-air courtyard with pool sits in the middle of the complex.

Each of the complex's four corners is capped by towers. The south side of the building faces the main street of the city's art district, so the towers (southeast and southwest) serve as its focal point. The southeast tower is easily identifiable with rounded walls and a cone-shaped roof, while the southwest tower is square. Each tower contains a unique truss system.

The truss systems have one thing in common: they're all tray trusses that bear on both the top of mezzanine walls and a lower tall wall that is less than the full two-story walls. Heinsman explained that this type of truss configuration steadies the walls and prevents them from moving in or out, and the walls hold the trusses up. "That's true of all tray trusses, but in this scenario it's even more deliberate, because of the tall walls and higher corner zone wind loads," he said.

But that's where the similarities end. The truss configurations as well as their orientation in the towers' roof system are completely different.

Southeast Tower Fit for a King

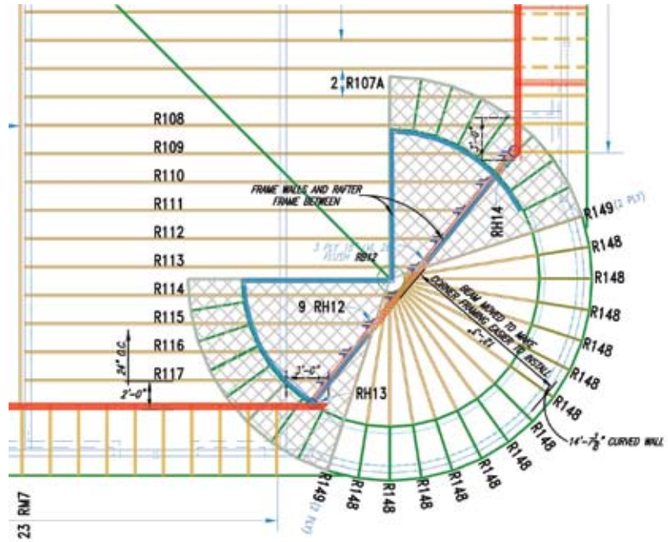
Based on its appearance, you may guess that the southeast corner (see photo on facing page) was the most complicated to design. Not so, Heinsman said. "It appears to be messier and required more coordination, but it really wasn't as structurally complicated as the southwest corner." The two main objectives were 1) making the transition from the walls to a true curved roof, and 2) tying the steep vaulted scissors trusses into a beam that dissected the tower.

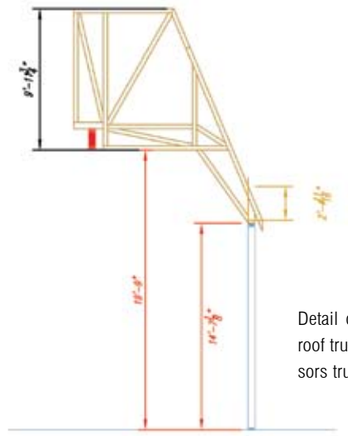
The stick-framed walls were built to create a semi-curved effect, but they don't form a true circle. The walls are curved between openings but had to be straight at the openings, creating an alternating straight and curved shape at the top of the wall. The identical scissors trusses were set to fan out into a half-circle. On the inside, scabs were needed on some of the trusses to create the transition from the non-circular wall to the truly conical truss configuration.

Around the perimeter of the building at the mezzanine level, continuous 3-ply LVL beams carry the roof trusses for the entire roof. This was necessary because a mansard runs the perimeter of the building splitting the 2-story exterior walls in half with the top half slopping inward. The beams come together at the southeast corner with short cantilevers. They are supporting another beam, set at a 45 degree angle, which splits the corner in half. Heinsman said the truss supplier had some excellent ideas to improve the way the supporting beams were configured. The end result required a 1-ply paralam for the cantilevered beams to simplify the connection of the angled LVL beam.

The tower is framed with high-heeled scissor trusses, creating a true conical roof shape. Scabs added to the sides of many truss bottom chords create an alternating straight and curved shape at the top of the wall. This makes way for the transition to a true continuous circle for the tower. A total of 15 trusses with a 28/12 pitch create a "fan effect," said Kolosky. The trusses tie into the angled beam (top).

A cantilevered beam (top left) carries the beam that runs across tower at a 45 degree angle (top right). An identical configuration is replicated on the opposite side. "The two cantilevered beams are one-piece paralam to avoid concerns over the hanger distributing load to multiple plies in a very short cantilever," Heinsman said. Kolosky and Heinsman worked together to adjust the placement of the beam to allow the scissor trusses to tie into it and simplify the installation.





Detail of Southeast tower roof truss layout and scissors truss profile.

Continued on page 18

"The design was complicated enough that I'm thinking 'good luck' to the framer. But they did a really good job," said Kolosky. The framing crew built several elements on the ground before setting them, including the dormers. "The pictures are a little deceptive because the roof pitch is so steep the dormers don't really look like dormers," Heinsman said.

Square Tower Is No Square

Although the rounded tower may be more visually exciting, Heinsman said the square tower on the west end actually yielded the most complicated design. "Structurally it was kind of interesting because we had to deal with load coming from two directions." He said the basic square shape from the outside looks deceptively simple. "You have trusses running east to west, but then the south wall has short jack trusses that had to be tied to the trusses behind them with blocking and strapping to give additional stability." Tying the jacks to the main span trusses and the ceiling and roof diaphragms allows them to function as lateral braces for the top of the wall just as the main span trusses do.

Continued on page 20

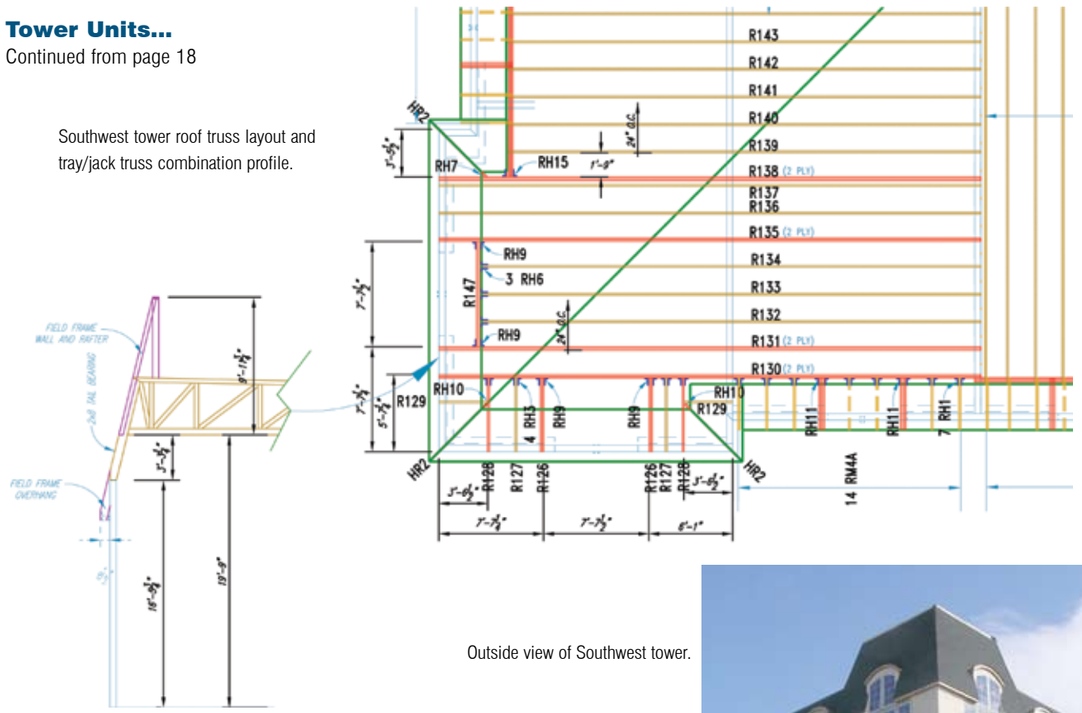
The short span roof beam hanging on a girder tray truss. Also, a header truss at the dormer supported by a tray girder truss at each side of the dormer.

View of loft corner. The top left shows jack trusses tying into the main east-west trusses to provide stability to the walls. (The framing and straps tying the jack trusses to the main span trusses are not yet in place.)

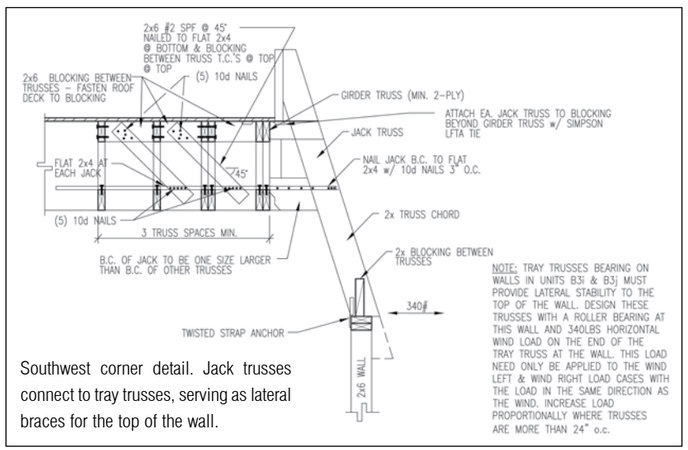
Tower Units...

Continued from page 18

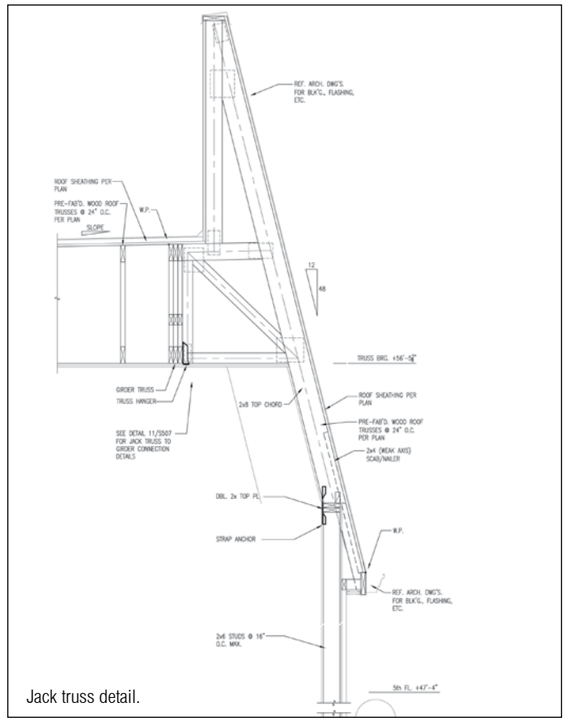
Southwest tower roof truss layout and tray/jack truss combination profile.



Outside view of Southwest tower.



Southwest corner detail. Jack trusses connect to tray trusses, serving as lateral braces for the top of the wall.



Jack truss detail.

SBC wants to hear about your interesting and/or challenging project. Email editor@sbcmag.info with details. **SBC**

STRUCTURAL BUILDING
COMPONENTS™
THE FUTURE OF FRAMING

www.sbcmag.info

Dear Reader:

The mission of ***Structural Building Components Magazine (SBC)*** is to increase the knowledge of and to promote the common interests of those engaged in manufacturing and distributing of structural building components to ensure growth and continuity, and to be the information conduit by staying abreast of leading-edge issues. SBC will take a leadership role on behalf of the component industry in disseminating technical and marketplace information, and will maintain advisory committees consisting of the most knowledgeable professionals in the industry. The opinions expressed in SBC are those of the authors and those quoted solely, and are not necessarily the opinions of any affiliated association (SBCA) .

Truss Publications, Inc.

6300 Enterprise Lane • Suite 200 • Madison, WI 53719
608/310-6706 phone • 608/271-7006 fax
www.sbcmag.info • admgr@sbcmag.info