Louisville Landmark

By Michael E. Corrin, P.E.

Preston Pointe, a steel-framed mixed-use building, is a distinctive addition to Louisville, KY's historic skyline.

The Preston Pointe mixed-use building features a unique concave cone-shaped sloping roof. In plan, the building is a 93′-8″ square. The first five floors are general office space, the sixth and seventh floors contain four two-story condominium units, and the eighth floor is mechanical space. The open floor plan calls for 39′-8″ column spacing from the exterior columns to the interior core columns.

The facility encompasses 103,700 sq. ft with one level of parking partially below grade. The total height of the building is 171′, qualifying it as Type 2A high-rise construction under the 2002 Kentucky Building Code (based on IBC 2000).

The nature of the project's design lent itself to composite steel floor framing. While a concrete framing system with post-tensioned beams and a one-way slab was considered for the first floor structure above the parking level, an evaluation by the architect and general contractor determined that steel would best meet the budget and schedule requirements. The selected floor system is 5.25″ lightweight structural concrete composite slab with 2″ deck.

All primary steel was specified to be ASTM A992 grade 50. The typical floor beams are W18×40 with W24×62 girders. Column sizes vary from W10×100 for the base gravity columns to W14×120 for the rigid frame columns at the base.

Roof Structure

The design feature that best exemplifies the intricate use of steel framing is the structure's stunning curved roof. The complexity of the roof structure proved to be the most challenging aspect of the project, not only in achieving the proposed design, but also in developing a system that was both feasible and economical.

Early in development, the contractor was involved and discussion began regarding possible methods of framing the roof structure. One of the first framing schemes considered was the use of steel trusses on radial lines and 2× wood purlins spanning between trusses. However, this would have required the top of each purlin to be cut to the corresponding radius as it progressed up the concave cone. An easier solution was to place the tube purlins continuously across the top of the trusses, allowing the tubes to form

The roof is framed with steel trusses along radial lines with 2" HSS members as purlins.

the curved shape of the roof as they were secured to each truss.

The contractor built several full-scale mock-ups of the roof to assess the constructability and overall appearance of the curve of the structure. The creation of these mock-ups was extremely important in achieving the designers' vision for a smooth curve. The base of the roof starts above an open terrace on the corner of the fifth floor and curves upward to its highest point. The opposite corner of the building stands nearly 90' above the base. The roof is framed with steel trusses along the radial lines of the roof, with a top chord radius of 380'-0". The roof purlins are 2" hollow structural sections (HSS). These sections lay with their long sides bearing on the top chord of the trusses and are continuous across the diagonal of the building to create the roof curve. A fire-treated plywood deck was screwed to the tube purlins to act as a structural diaphragm with a second layer of underlayment and a direct-glued PVC Sarnafil roof membrane on top.

The radiused roof trusses were designed using WT6 as chord members and double angle web members. The trusses span between wide-flange beams that are located in segments around the structure, reducing the maximum span to 52'.

Lateral System

In accordance with the Kentucky Building Code, the building was classified as Seismic Design Category C, primarily due to the site's "D" soil classification. Therefore, the lateral system for the structure was designed with fully rigid welded moment frames on each of the building's four sides. Even though lateral drift primarily controlled the design, the analysis indicated that the design serviceability considerations would not be a problem in the final configuration. Additional diagonal bracing was used to stiffen the structure where the roof begins to curve upward and the lower two sides of the building "drop off." In its final constructed state, the tube steel purlin system and the plywood roof create a rigid diaphragm that distributes the lateral forces to the perimeter frames.

In total, 683 tons of steel were used. Approximately 120 days were required to erect the structural steel.

Despite varying elevations, curves, angles, and potential for fit-up catastrophes, the design team faced almost no fit-up problems with the steel structure, which confirmed their belief that steel was the right choice for the project. The glass on the southeast corner of each primary office floor curves inside the square building frame, creating an appealing garden terrace at each level. The use of natural open spaces, combined with the polished stainless steel façade of the building, brings a modern but elegant touch to the landscape. ★

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