Making Headlines

BY JEROME DIMERCURIO P.E.

A steel-framed folded plate roof is the lead story at the new headquarters for the Sarasota Herald-Tribune.

Courtesy Arquitectonica.

ARCHITECTURE FIRM ARQUITECTONICA FIRST ENVISIONED THE ASYMMETRICAL, FOLDED PLATE ROOF OF THE SARASOTA HERALD-TRIBUNE'S HEADQUARTERS IN CONCRETE, TO COMPLEMENT THE LOCAL SARASOTA, FL ARCHITECTURE. The roof's complex geometry, however, would have required a mostly stick-built form system, and the maze of shores needed to support them would have extended through three floors of the building to grade, delaying finish work for months. Instead, Arquitectonica and structural engineers Jenkins and Charland, Inc. decided upon structural steel to facilitate construction and expedite the schedule. Not only would steel help prevent construction delays, it would easily provide structural wind resistance for a site prone to hurricanes.

Structure and Roof

Tall, slender columns extend three levels beyond the building skin to support the roof and to create the impression of a free-floating canopy over the office structure. The roof cantilevers up to 20' beyond these perimeter columns, providing a broad overhang that shades the offices below. The roof also continues beyond the building footprint to shade a public plaza from three stories above. Wind uplift of this open portion of the roof was a critical design consideration.

The structure was sited to allow on-grade parking beneath the building so the surrounding space could be used for the plaza. This siting, combined with the asymmetrical geometry of the roof, created a highly irregular column grid with bays varying from 15' to 55' in length. There were few "typical" framing conditions. Portions of the office floors were required to cantilever up to 15' from transfer girders to allow vehicle access below.

The office floors are framed with SmartBeam castellated sections and wide-flange girders acting compositely with a 3" steel deck and lightweight concrete composite floor system. A limit on maximum depth of 27" for both wide-flange and castellated sections was required to limit overall height of the building to conform to zoning. This further complicated the design, but analysis was simplified through RAM Frame and its section library, which includes SmartBeams. Transfer girders were all standard rolled sections with depths limited to 27".

With beam spans of 55' and very few fixed partitions, an investigation of the vibration characteristics of the floor system was critical. This was a special concern within an area of the building that would house a television studio, where floor vibrations could affect camera operations. RAM Frame facilitated this operation with floor vibration magnitudes given in the output. The area occupied by the television studio partially rests on one of the 15' floor cantilevers, and so the composite floor vibrations were considered in conjunction with cantilever beam deflections and vibrations.

A removable, steel-framed raised floor system is used throughout the building above the composite slab to facilitate installation of data lines and

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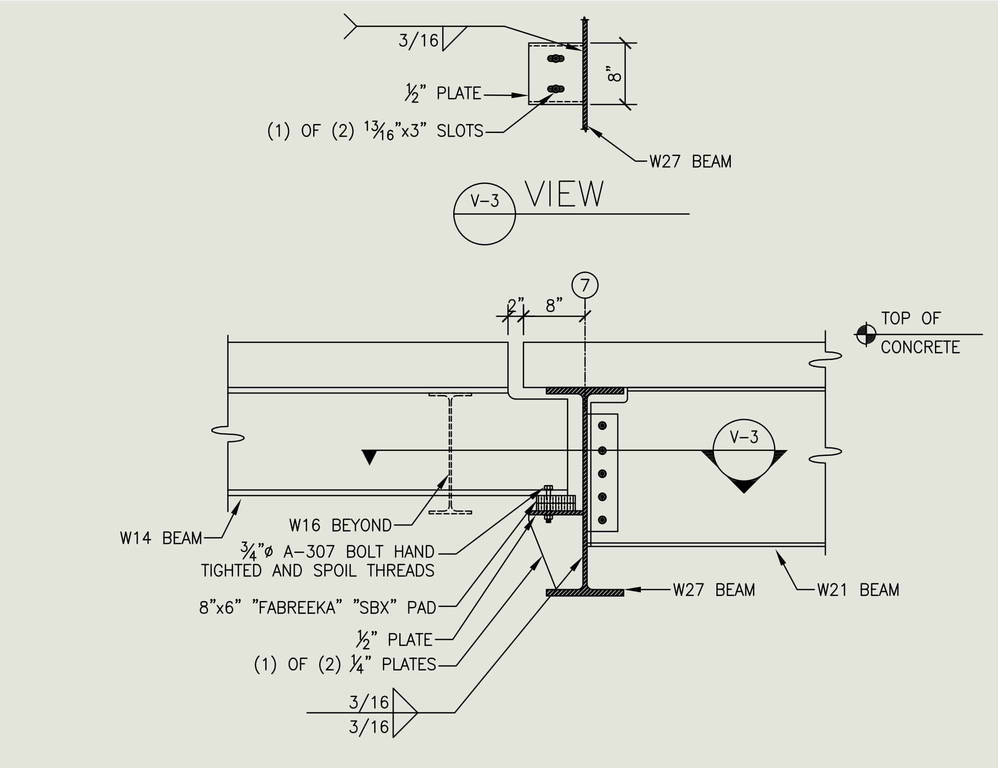

Courtesy Jenkins and Charland, Inc.

All connections along the building's expansion joint were slide bearing connections. Because the calculated thermal expansion and contraction was small, relatively small bearing pads could be used, reducing the size of these connections. Beam-to-beam connections featured shallower beams supported on seats, maintaining the overall depth of the structural framing.

HVAC, and to allow easy integration of future office configurations and technologies.

Wind Resistance

An insulated hurricane wind resistant glazing system covers most of the building. Mitered, "bent" HSS was used at 10' intervals vertically and at multiple elevations horizontally to support this system.

Steel moment frames, acting in conjunction with concrete shear walls that surround elevators and stairwells, provide lateral stability against the region's 130 mph design wind loads. The frames allow a totally open environment within the office floors—a feature that was necessary to achieve the architectural concept. RAM Frame simplified the lateral analysis of both the steel frames and walls.

Connections

Shear transfer between the composite floor slab and the concrete shear walls was achieved through expansion-anchored angles and shear studs welded to the angles through the floor deck. This detail allows for ample field adjustments and eliminates embedded items within the cast walls that require exacting coordination. Beams and girders were supported on the shear walls by connections that employ cast-in embed plates with shear studs. Double clip angles or shear plates were field-welded to these embed plates, allowing some field flexibility in erection. Where girders were supported at wall corners, an embed plate that wrapped the corners was required to adequately transfer the loads.

The length of the building dictated the use of an expansion joint. A row of double columns would have destroyed the architectural concept, so all connections along the joint became slide bearing connections. Design of the sliding connections was a challenge within the limited structural depth. The finished ceiling limited the depth of framing members and slide bearing seats to a total of 27". Where slide bearings occurred at columns, a deeper overall depth was made possible by keeping the connection within the column. The minimal movements of the two sections of the building (calculated to be due mostly to thermal expansion and contraction, and predominantly perpendicular to the joint) allowed for use of a fairly small bearing contact area. This helped keep the bearing connections small enough that they could be contained fully within the plan area of the column sections. At beam-to-beam slide bearing connections, the framing was reconfigured to allow for shallower beams to be supported on the bearing seats. The slide bearing connections at the roof were the most difficult due to an overall depth limit of 24", as well as the skewed geometry of the roof itself. The original detail provided by the structural engineers was modified in collaboration with the fabricator to facilitate fabrication and erection.

Many connections, especially at the roof, were geometric challenges, with beams skewed in two directions. A central, flat recessed area where satellite equipment is to be placed out of view further complicated the roof framing. To maintain continuity of the roof diaphragm, continuous plates skewed to match the angles of the roof planes were welded to the top flanges of supporting beams at valleys and peaks. The steel roof deck was then welded to these plates.

Field-welded and bolted moment connections, both column-to-beam and beam-to-beam, were used within the lateral frames and within the multiple cantilevered areas of floor and roof framing. The bolted moment connections were specified at the top of frame columns to limit the amount of field welding. The roof geometry made fabrication of these bearing connections a challenge. A standard, welded moment connection was specified in all other areas. This detail was a challenge to fabricate and erect at roof conditions.

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New York Times, Inc., New York

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Engineering Software
RAM Frame
Autocad

Detailer
Pacific Drafting, Inc., Carson, CA, AISC member, NISD member

Detailing Software
ASteel

Fabricator
E & H Steel Corporation, Midland City, AL, AISC member

General Contractor
Turner Construction Company, Orlando, FL

Courtesy Arquitectonica.

The striking folded-plate roof is framed with SMI's SmartBeams, supported by an irregular column grid that was dictated by architectural requirements.