STEEL TUBE INSTITUTE

HSS

ARTICLE

THE TERMINAL OF TOMORROW

Aside from being known as the world's busiest airport up until 2005, O'Hare International Airport in Chicago, Illinois is also credited with a major shift in airport design in the late 1980's through early 1990's. At that time a new construction project for the United Airlines Terminal designed by Helmut Jahn Architect, with C.F. Murphy Associates and Thornton-Tomasetti Engineers, used a substantial amount of Hollow Structural Sections (HSS) to achieve stunning open-air aesthetics – a major change for the airport industry.

Until the O'Hare renovation, airport terminals around the country often had an unexpressive structure and were often reinforced with concrete. Jahn/Murphy/Thornton-Tomasetti changed that within the $1.5-billion redevelopment program, of which the architectural centerpiece was the $450 million United Airlines Terminal which encompassed 15 acres (60,000 s.m.) of glass, 42 new gates, 10,000 tons of steel and 1,300,000 s.f. (130,000 s.m.) of building area.

Steel – especially HSS – made a unique and major contribution to this new era in airport architecture and the HSS and connections utilized by Jahn/Murphy/Thornton-Tomasetti opened the door for future airport design to take on a more pleasing-to-the-eye aesthetic. For these reasons, the United Airlines reconstruction came to be known as "The Terminal of the Future" or "Terminal of Tomorrow".

HSS was used in many ways during the project from passenger areas, to an illuminated tunnel between Terminal 1 and Terminal 2, to a presence even in the parking lots. Aside from its aesthetically pleasing large clear span framing, HSS has many other benefits that made it the clear choice for this project.

HSS allowed for quicker construction and caused less disturbance on site. The framing was adaptable to skylights and ceiling windows, a favorable addition to the large open spaces. The bendability of HSS supported a plethora of shapes and arches, giving Jahn/Murphy/Thornton-Tomasetti the flexibility they demanded for this project.

In the passenger areas, purlins made from round HSS were used to support the partially glazed roof panel system. To support the glass mullion system, these unique purlins span between the vaulted girders. The purlins are built-up members comprised of an 8-5/8″ (20 c.m.) diameter HSS and a 4″ (10 c.m.) T-Section, that were fillet welded together in the fabrication shop. The T-Sections provided a flat surface to simplify connections to the skylight systems. The diagonal bracing was manufactured using steel rods as a way to stabilize the structure.

These purlins are also a feature of the two cylindrical concourse roofs which terminate with domes. The domes were created by gracefully extending and curving the HSS purlins around the dome to form horizontal rings. As a case study from the 1980's by Thorton-Tomasetti states, "The project represents a total integration of mathematical models, structural form and architecture."

Many instances of round HSS columns installed during the renovation can of course also still be found at O'Hare. The curbside passenger drop zone features round HSS columns painted an eye-catching red. These red HSS can also be found in the tube trusses in the parking garage's link bridge side walls. More round HSS sections were utilized to construct columns throughout the passenger areas.

Of course, O'Hare isn't the only airport that now utilizes HSS in its construction. The Indianapolis International Airport New Terminal and Concourses also used HSS. Known as the "Crossroads of America", HSS was used to represent this nickname by constructing an aerodynamic building that used structural steel to work with the sun and the wind.

One such example is the uniquely shaped roof which includes a saddle double curve in one direction and a single curve in the other. Two-way exposed steel trusses support a grid of 50, six-foot long curved joists used for the secondary framing. Another Thornton Tomasetti project, Dave McLean, vice president at Thornton-Tomasetti Group, explained, "The roof is supported by column trees. Each tree is made up of four round (HSS) columns at an angle, and they extend to the bottom of the roof trusses, which are running north-south and east-west." The roof contains a circular skylight that is about 200 feet in diameter created by a mixture of tubular structure and cables. These visible, steel structures allow for large areas free of columns that easily accommodate any needed future security revisions.

For airports across the country – and now around the world – the lessons of O'Hare continue to ring true. Because steel, and HSS in particular, can accomplish the dual role of dependable structure and stunning architecture, it has become the material-of-choice for opening airports to the skies before ever leaving the ground.

August 2013