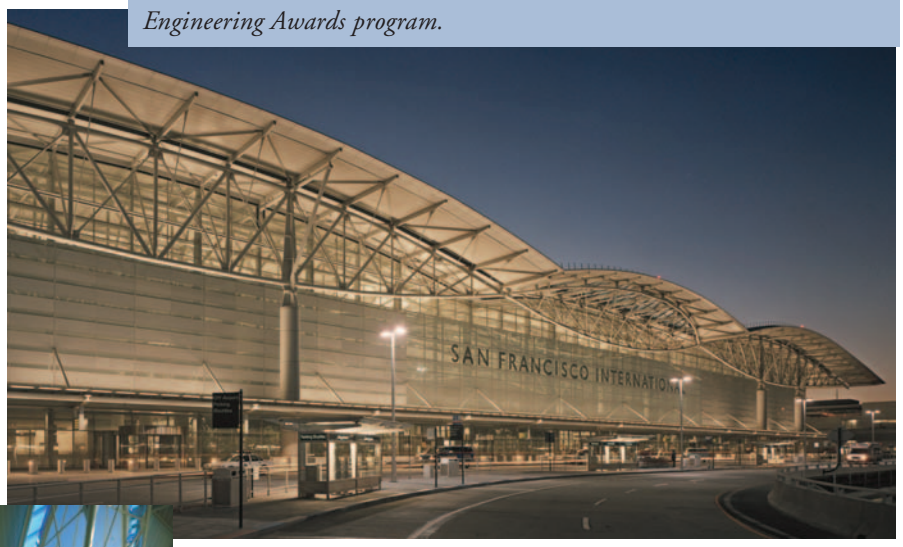
International Terminal

San Francisco International Airport

International Terminal, San Francisco International Airport, was presented an Outstanding Project Award (Building Project over $25M in Construction Value) in the NCSEA 2002 Excellence in Structural Engineering Awards program.

There is a lot of talk about architect-engineer collaboration in the construction industry, but rarely are the results as stunning as the International Terminal at the San Francisco International Airport. For this $840-million expansion project, the structural engineers at Skidmore, Owings & Merrill LLP (SOM) collaborated with joint-venture architects SOM/Del Campo & Maru/Michael Willis Architects to create an elegant, long-span structure designed to withstand a 1000-year earthquake.



Courtesy of Tim Hursley

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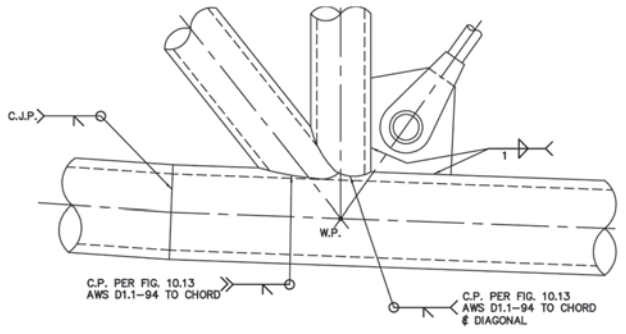
Completed in 2000, the design of the 1.8-million-square-foot Terminal addressed a complex set of program requirements through careful integration of all disciplines. These issues included maintaining approach roadway access below the Terminal in the east-west direction during the five-year construction phasing; separation and efficient functioning of ground-level security, baggage, and service vehicles; organizing flow and interconnection of federal inspection services at the arrival and departure levels; simplifying flow of airline passengers; adhering to airspace height limitations; and facilitating interconnections to existing domestic terminals, new boarding gates, and all modes of transportation.

The roof structure and main façade of the Terminal—visible from approaching roadways and the air—give the entire airport a visual cohesiveness and an iconic identity, both as a major public facility and as San Francisco's front door to the world. The genesis of the design is found in both the structural requirements generated by the site and the desire to create a symbolically appropriate form for the airport.

The building form reflects the need to span existing entry and exit roadways that run under the Terminal. The main roof structure consists of two sets of balanced cantilever trusses supporting a central third set of trusses linked together to create a continuous wing-like form. The system of trusses spans 380 feet at its center and 160 feet at each end cantilever, with an overall length of 860 feet. The Terminal's glass-enclosed "great hall"—705 feet long, 210 feet wide, and up to 83 feet high—creates a dramatic departure point for travelers, but does so with an economy of form and material.

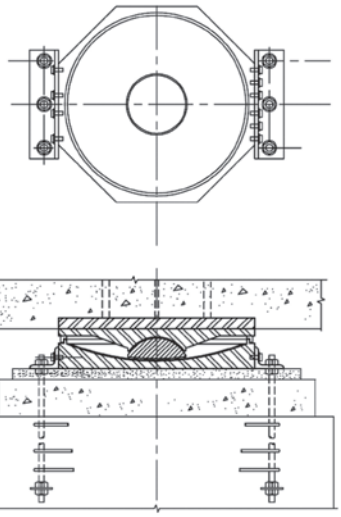
Utilizing state-of-the-art steel tubular T-Y-K joint detailing and fabrication techniques, the exposed steel trusses sit on spherical ball-joints atop 20 cantilevered concrete-filled steel box columns. The center spans are interconnected by cast steel pinned joint assemblies. Throughout the design phases, the main truss aesthetic, proportioning, and profile were continually refined to achieve a maximum integration of form and economy to provide the Terminal's signature identity.

The Airport's seismic performance goal of continued operation following a major earthquake is achieved through an innovative seismic isolation system, making it the largest base-isolated structure in the world. The system uses 267 friction-pendulum cast steel base



Courtesy of SOM

spotlight



3 FRICTION PENDULUM (FP) BEARING UNDER COLUMNS
SCALE: NONE

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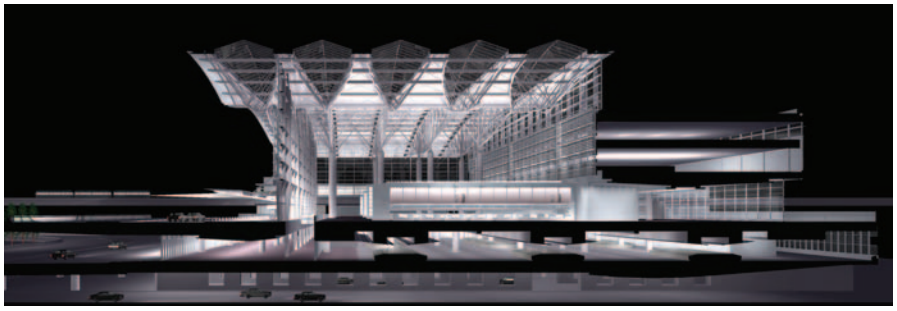

isolators installed at the foot of each structural column, which permit up to 20 inches of lateral displacement. This design allows the weight of the building itself to provide inertia and damping, so that seismic energy is dissipated rather than absorbed by the structure, reducing earthquake force demands on the building by 70 percent.

While the utilization of seismic isolation achieved superior seismic performance goals, the significant reduction in force levels allowed the overall architectural vision to be realized in the great hall's roof and window wall. The technically innovative seismic design of the new International Terminal—with its long spans and tall curtainwalls—is a structural engineering milestone on its own, yet the International Terminal deserves equal recognition for its eloquent merging of engineering and architectural design.