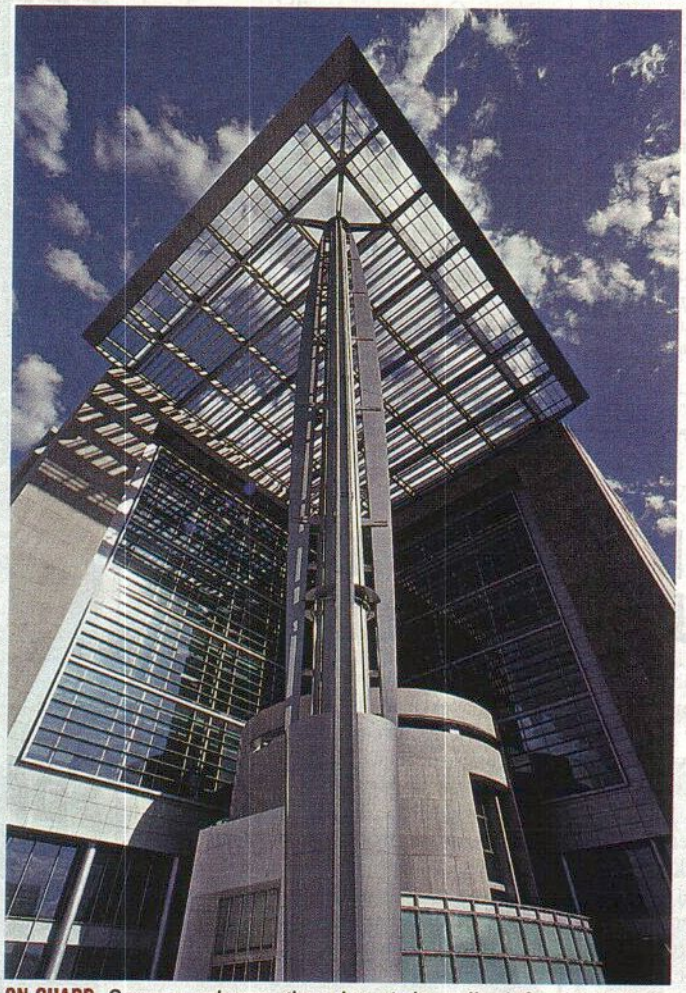
Federal Courthouses

BLAST RESISTANCE WITH OPEN LOOK COSTS MILLIONS OF DOLLARS MORE

WITH ITS 170-FT-TALL STEEL-and-glass "palm tree" entrance canopy and glazed curtain wall, the first U.S. courthouse built to tightened blast-resistance guidelines looks nothing like a fortress. But extra security built into the 407,000-sq-ft Las Vegas building accounts for $4.7 million of the original $96.8-million price tag, according to estimates by officials of the U.S. General Services Administration. To date, there have been $5.1 million in authorized scope changes. And though the building is set to open July 17, a pending dispute over costs may push the the final price even higher.

Federal officials strived for a building with an inviting appearance, as a way to attract people downtown. But a legacy of vulnerability left by the 1995 terrorist bomb that brought down Oklahoma City's federal building prompted a major focus on security in federal buildings across the U.S. The result: lots more steel in the frame; a window wall engineered to keep glass shards from flying into the building; and a 200-ton "tree trunk" designed to withstand the kind of blast that destroyed the Alfred P. Murrah Federal Building.



ON GUARD Canopy column, glazed curtain walls defend building.

GSA awarded the design-build contract to J.A. Jones Construction Co., Charlotte, N.C, in 1996. The contract was based on a 30%-complete conceptual design, prepared by Dworsky Associates, Los Angeles, in a practice called bridging. During that stage, GSA officials insisted on enhancing the building's esthetics, even though it rendered the structure more difficult to engineer, says Jones. The agency also chose Dworsky's L-shaped footprint.

To finalize the architecture, Jones hired Langdon Wilson Architecture. The Los Angeles-based firm spent a year in design before construction began in 1997. "The cost of the blast requirements was very much an unknown at the beginning, and there was some risk taken because of it," says Niall Kelly, a Langdon Wilson associate partner.

W.E. "Ted" Stanley, Jones' project manager, claims "the bridging documents misrepresented the total amount of structural steel needed to meet blast requirements." He says column and beam sizes had to be doubled, which increased the amount of steel by nearly 3,000 tons.

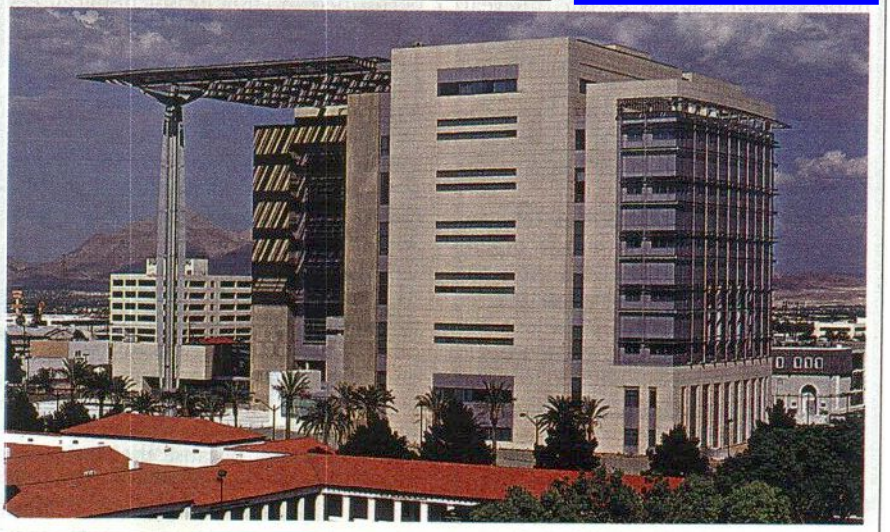
So far, there have been $5.1 million in authorized scope changes covering part of the extra steel tonnage. The contractor, declining to offer hard numbers, says it is seeking millions of dollars more.

Mary M. Filippini, a spokeswoman in GSA's San Francisco regional office, declines to comment on the dispute itself. But she says GSA remains satisfied with how it procured the contract. For the first time in its Pacific Rim region, GSA prequalified bidders before awarding the design-build contract.

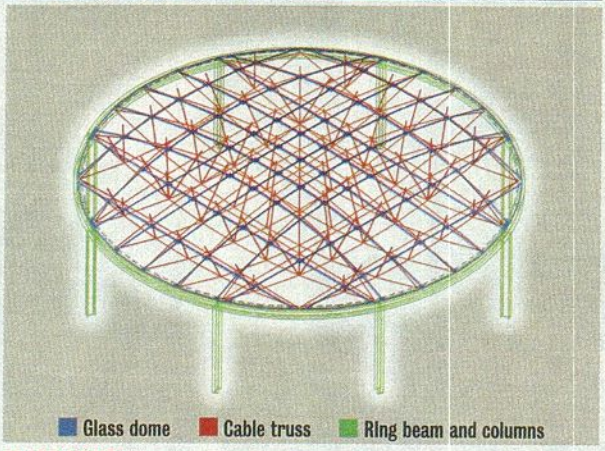
As a matter of policy, GSA does not reveal details of its blast requirements. Also for security reasons, details of anti-blast features are kept under wraps—literally and figuratively. But consultants do speak generally about systems.

Conceptually, "the courthouse is designed to hang together" to avoid progressive collapse, says Eve Hinman, president of Hinman Consulting Engineers Inc., San Francisco, a Jones consultant also involved with developing GSA's blast-resistance requirements issued in 1996.

The structure has moment-



PHOTOS BY MICHAEL GOODMAN FOR ENR



GLASS DOME Entry cylinder skylight has rectilinear grid.

resisting perimeter frames, with bracing inserted between the frames and the cladding. Compared to the simple concrete structure in Oklahoma City, the steel frame is more ductile and has greater energy-dissipation capacity, says Juan Carlos Esquivel, project manager at Las Vegas-based structural engineer Martin & Peltyn Inc. "It's like a frame behind a frame, which provides two lines of defense," he says.

For extra resistance at the building's corners, steel frames have box columns, instead of wide-flange columns. Cover plates provide extra reinforcement at beam-to-column connections.

The 25,000-sq-ft entrance canopy, a 160-ft square weighing 500 tons, fills out the courthouse's roof "footprint," turning the L into a rectangle. The offset tree trunk stands opposite the crook of the L. From the trunk's top, 160-ft-long beams extend to the ends of the L's legs, tying the canopy to the building's frame.

Unable to find a conventional steel fabricator to make the canopy's 8.5-ft-dia, column, with tapered ends, from 2-in.-thick steel, Jones turned to a specialty tank fabricator, Salt Lake City-based Eaton Metal Products Co.

Eaton's crews rolled the column steel in 10-ft lengths, welded them into two sections and erected them one on top of the other on site using two cranes. Next, other subcontractors erected diagonal members, like branches, that reach out from the trunk top to the canopy. Crews then hoisted canopy perimeter girders, supported them temporarily with cables, and welded them to trunk diagonals. Canopy cross members followed.

The canopy's steel-and-glass surface lets light filter through to the two conventional-looking double-glazed walls, built from unitized panels of aluminum frames and 1-in.-thick insulated panes. But the panes are made from laminated glass, which when shattered holds fragments in place. And the units are integrally connected to the building frame, rather than clipped on. The system makes the curtain wall more blast resistant, says Kevin C. Cole, design manager at Minneapolis-based curtain wall supplier, Harmon Ltd.

The canopy towers over the building's 72-ft-tall entrance structure, a 57-ft-dia cylinder topped by a glass dome, that hugs the crook of the L. Instead of radial geometry, the dome has a rectangular surface grid, with various-sized glass panels. The look complicated engineering and the effort to make the dome blast-resistant, says Will Shepphird, project engineer for the dome's designer-fabricator, Advanced Structures Inc., Marina Del Rey, Calif.

The dome bears on a two-way prestressed cable truss. At dome grid intersections, where corners of four glass panels meet, custom stainless steel fittings, with spider-like legs, permit panels to flex somewhat, says Shepphird.

ASI assembled and pretensioned the cables off site, then folded up the structure and transported it to the site, where it was erected on falsework. Crews used timber jigs to hold the spacing of the 100 glass panels to allow adjustment of the spider fittings.

For 70-year-old Lloyd D. George, the U.S. district judge for whom the courthouse is named, esthetics weigh in over the design complexities: "I wanted the courthouse to be the center of the community," he says, as in days gone by. ❑

By Tony Illia in Las Vegas

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