Southern Exposure

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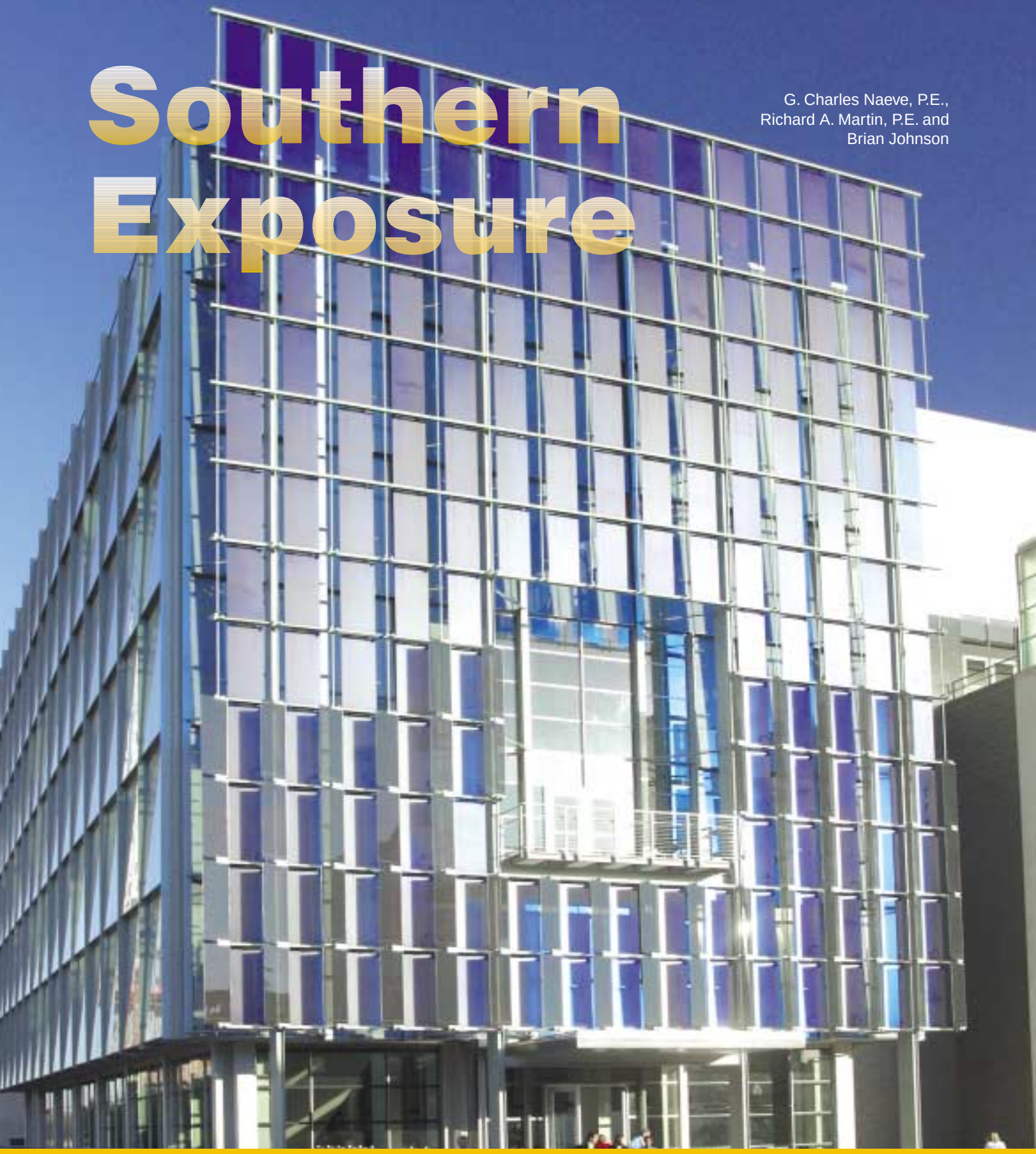

An atrium of exposed structural steel offers an impressive welcome to visitors to the convention center in Austin, TX.

In 1998, The City of Austin approved bonds for expansion of the existing city Convention Center. The original building, completed in 1992 and designed by the Austin Collaborative Venture, had been successful in luring convention business and visitors to Austin, and an expansion was warranted. The Austin Collaborative Venture, led by Page Southerland Page (PSP) Architects with Lawrence W. Speck, FAIA, was chosen to double the size of the facility with a 400,000-sq.-ft addition on a plot of land about half the size of the original building.

The restricted site led to a vertical solution, with meeting rooms and a 45,000-sq.-ft ballroom placed above a 125,000-sq.-ft, column-free exhibition hall. The exhibition space is contiguous with the existing halls and bordered on the west and north with circulation and pre-function space. The northwest corner punctuates this circulation with a new entrance facing north toward Austin's central business district. The entrance takes the form of a glass pavilion with an exposed structural steel framework, a shingled glass façade, and a west-facing skeletal screen-wall.

The approximately $80-million convention center expansion, completed in May 2002, is largely a structural steel building. More than 4500 tons of structural steel were used in the building, including 400 tons of grade 65 trusses. The program for column-free exhibition halls led to a clear-span structure. Nineteen-ft-deep trusses spaced at 30' on center span 210' between columns on the north side. A 65'-deep super-truss with a span of 270' is placed on the south side.

This strategy, when coupled with the existing exhibit halls, provides an L-shaped, clear-span space of about 165,000 sq. ft. The floor trusses, supporting the ballroom above, hover impressively in the ceiling of the exhibit halls; but only the lower third of the super-truss gives any evidence of the work being performed. The upper two thirds of the truss are concealed within walls and ceiling space, extending to the high roof of the ballroom.

SHOWCASE STRUCTURE

The substantial structure of the main building is contrasted with the elegance and lightness of the glass pavilion framing. Here the structural steel is showcased as a part of the building's architecture, adding order and material context to the architectural palette. Painted steel fins frame the shingled panes of blue-green glass, and slender box columns stand free adjacent to the glass skin. The columns reach for an ordered roof of tree-like struts braced with stainless cables and machined stainless fittings. A west-facing art-wall stands free of the pavilion, shading the enclosed space with a field of cobalt-blue glass panels overlain by a grid of photovoltaic fins. The art wall extends to a height of 96' and is interrupted only by an entry vestibule and a glass-floor balcony extension. As the afternoon sun begins to illuminate the screen-wall, shards of blue light move through the interior of the pavilion, changing with the sun's daily and yearly movement, extending the visual depth of the art wall to include the dimension of time.

Within the glass pavilion, an escalator runs free of enclosure to an intermediate landing adjoining a cantilevered balcony, projecting through the west façade, at 22' above the hall floor. The escalator then turns 340 degrees in plan to reach for the

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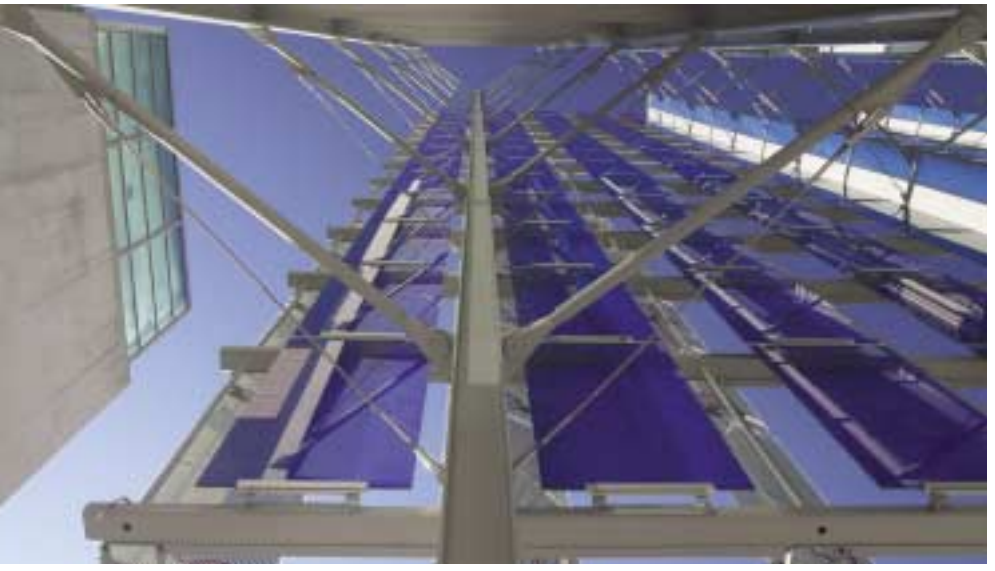
The 65'-deep super-truss spans 270'.



The exterior "art wall" uses panes of cobalt-blue glass supported by structural steel struts to filter sunlight into the atrium.

ballroom pre-function area, 31' above the landing. The escalator ride is an event for convention-goers, with spectacular views of the city skyline to the north and glimpses of the hill-country to the west. At night, the space becomes a lantern for the convention center area, with a pale-green-lighted ceiling plane illuminating the entire pavilion.

ARCHITECTURAL GOALS

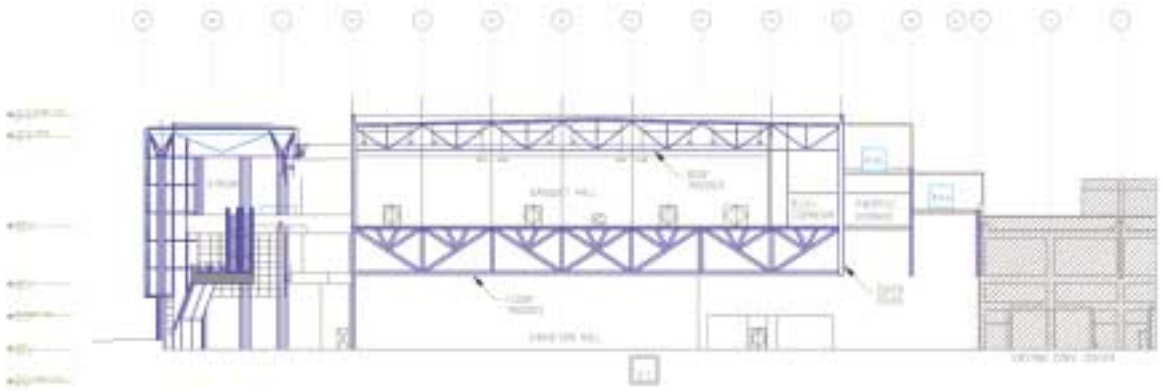
The pavilion was designed to be a celebratory space and the focus of the addition. In the early phases of design, architect Lawrence Speck identified the pavilion as an area with many goals. Functionally it had to serve as the convention registration area, provide vertical circulation to the ballroom above, facilitate perimeter circulation to exhibit halls and meeting rooms, and provide a primary building entrance. Architecturally, the pavilion was to provide a sense of arrival and inspiration to the convention attendee. The vision for the space was one of a large shingled glass box, 90'-tall by 62'-wide by 140'-long.

In order to realize this vision, Speck and Project Architect Brett Rhode, AIA, collaborated with Matt King of Ove Arup and Partners on structural frame concepts, and with James Carpenter, of James Carpenter Design Associates, on artistic design of the west facing art wall. Davidson Norris of Carpenter Norris Consulting provided day-lighting and glass selection expertise. Architectural Engineers Collaborative, the project structural engineer, was enlisted to work with the team in a collaborative design effort, and to execute the construction documents.

STRUCTURAL TREES

The structural concepts for the atrium were a direct response to the architectural desire to provide a minimal, three-dimensional framework complimentary to the shingled glass façade. In order to keep the members as small as possible, a structural engineering strategy was developed to gain as much continuity as possible at the floor and roof attachments. This strategy was accomplished by essentially cantilevering up from the foundation with exposed concrete fin columns, 16"-wide by 4"-deep, and cantilevering down from the roof structure with an inverted pyramid consisting of four, 3"-diameter solid bars.

A central thin box column, 6"-wide by 30"-deep, spans vertically between the concrete base and the column tree for a height of 60'. The box columns



Section looking east. Trusses 19' deep spaced at 30' on center span 210' between columns on the north side. A 65'-deep super-truss with a span of 270' is placed on the south side.

stand free of the glass wall, punctuated on 12' centers by 2"-diameter solid struts and paired with ½"-diameter stainless cables. At corners, the concrete fins and steel box columns become cruciform in shape, adding stiffness to the pavilion structure.

A parallel benefit of the three-part structure (concrete base, column link and column tree) is that the construction satisfied the building-code fire protection requirements for the space. The "atrium occupancy" called for a two-hour fire-resistance rating to the 18' height and a one-hour construction between 18' and 25'. Above 25', the construction could be unprotected. The two-hour fire-resistive requirement was satisfied by the concrete columns, and the one-hour construction was provided by an intumescent coating on the steel. Above the 25' height to the top of the atrium at about 90', the structure simply was painted, allowing the steel shapes to be exposed in their true form and shape without restrictive coatings.

The framework meets strength and serviceability requirements of the building code by carrying gravity loads within its three-dimensional shape, by resisting local lateral loads internally and by transferring global lateral loads into the adjacent main building frame.

GLASS WALL FRAMING

Early discussions on the glazing system centered on the advantages of a hanging façade with members loaded primarily in tension. Glass panes and framework could be minimized if not subject to compressive stress and the potential for compressive buckling. In order to hang the façade, the roof structure was extended beyond the tree columns to capture tee-shaped hangers at 10' on center. The glass façade, fabricated and installed by WinCon, consists of shingled panes of insulated glass. The glass slopes within the 18" depth of the tee, with the tee stems projecting beyond the façade as elegant exterior fins. Between the tees, on 12' vertical centers, frame horizontal steel HSS, 8"-wide by 4"-tall. The HSS support two slanted 5'-by-12' panels. Glass panels are 1"-thick, low-E insulated glass, imprinted with a ceramic frit to improve thermal efficiency and reduce glare. Panels are surface mounted to conventional aluminum frames with glazing between individual pieces of glass.

The horizontal HSS framing also performs the structural function of transferring wind loading to the box columns through triangulated, paired strut-and-cable assemblies. These assemblies enable bracing of the thin box columns by restricting column rotation and lateral displacement. The bracing makes it possible for the columns to be very thin, 6" wide, for their 60' height.

ART WALL STRUCTURE

The art wall structure was conceived as a mirror image of the pavilion column structure. Paired struts and cables are mirrored about the horizontal window support tube. The exterior-wall box columns, reduced in depth to 24", support a horizontal grid of steel HSS, 6"-wide by 4"-tall, at 12' on center. One-inch-diameter sag rods tie the HSS together and become the armature for attachment of the photovoltaic panels. The columns and wall cantilever beyond the height of the adjacent roof

An interior view of the completed exhibition hall.

space to block the trajectory of the afternoon sun. Blue glass lies in the plane of the wall while glass photovoltaic panels project to collect energy from the afternoon sun.

ATRIUM CONSTRUCTION

AISC-member Beck Steel prepared shop drawings for the atrium structure in a three-dimensional format, locating every bolt and pin in the entire structure within one three-dimensional file. Individual members were extracted from the file and further delineated as pieces in the traditional manner. This process and the resulting fabrication produced a structure that was easy to erect in spite of its complicated geometry and numerous pieces.

A YEAR LATER

The Austin Convention Center Expansion is now approaching one year

of occupancy. For those involved in the design, there is still the pleasant surprise of watching the convention attendees as they enjoy the atrium space, look through the glass to our city beyond, rush to a meeting room, or stop to greet a colleague. At convention time, the space has the feeling of an active public square, and the structure joins the architectural palette as a comforting backdrop to the vibrant activity. ★

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PAVILION DAYLIGHTING CONSULTANT
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STEEL ERECTOR–BUILDING
Peterson Beckner Industries, Houston, TX (AISC member, SEAA member)

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