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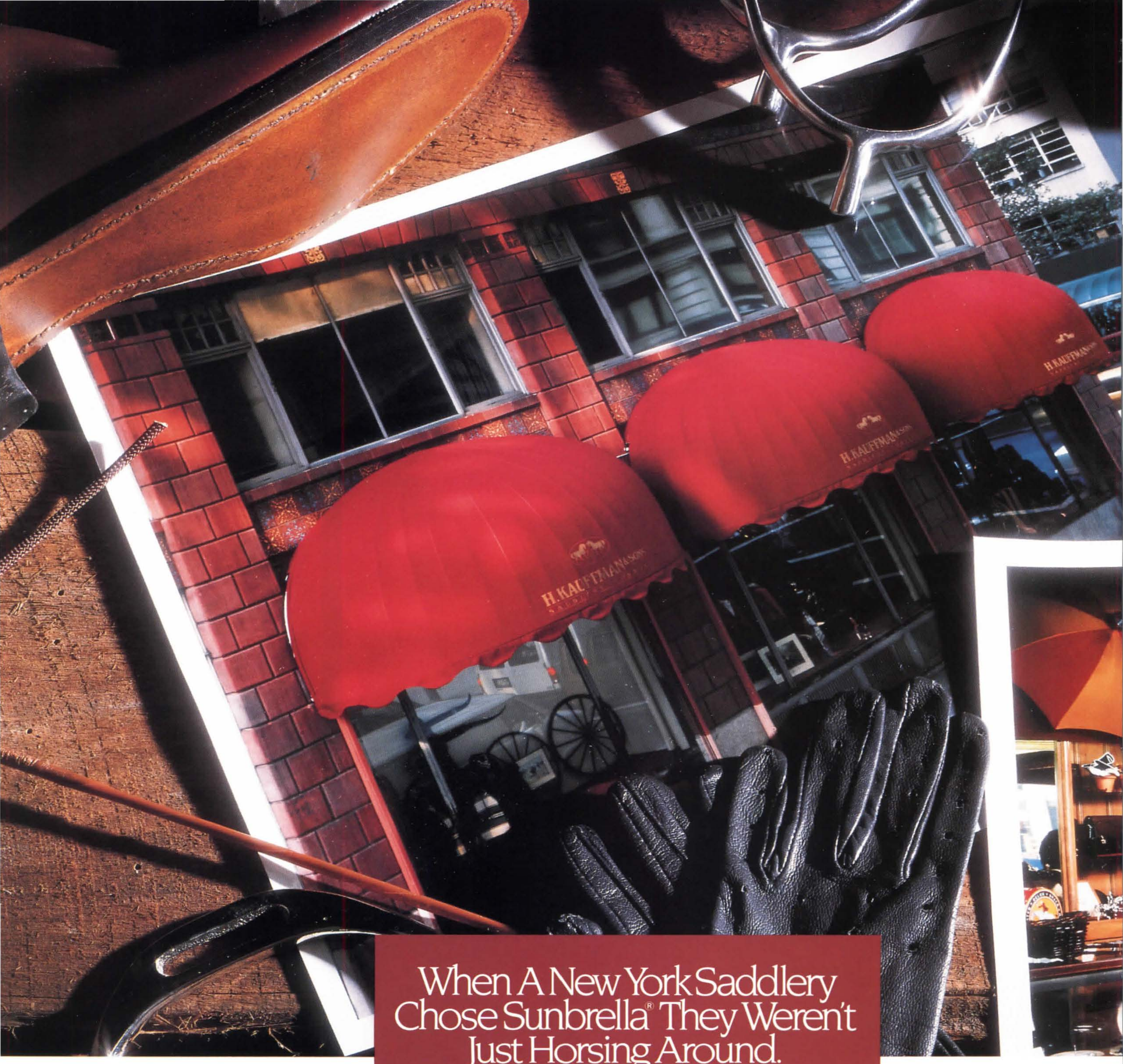
URBAN INFRASTRUCTURE



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Transforming Transportation

Architects must play a more active role in opportunities afforded by ISTEA.

When Congress passed the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, the law was supposed to end the Age of the Interstate and begin a new era of community-based infrastructure planning. The nation's vast, 43,000-mile interstate highway system—the major focus of postwar federal transportation dollars—successfully linked cities from Takoma Park, Maryland, to Tacoma, Washington. However, these highways also destroyed urban centers by severing neighborhoods from downtowns, hastening the demise of central business districts and encouraging suburban sprawl.

ISTEA's remedy is to call upon cities and localities to take an active role in deciding how to spend transportation dollars. By requiring public participation at the planning stages of transportation projects, the law generates citizen involvement in the decision-making process. ISTEA encourages community-based initiatives by calling on skills of architects, planners, and others who hope to improve their neighborhoods. It fosters a new set of goals for transportation policy: environmental and esthetic quality, and economic and social equity, ending transportation's isolation from its context.

Now, halfway through its six-year authorization, is ISTEA actually changing transportation planning in this country? According to the Washington, D.C.-based Surface Transportation Policy Project (STPP), a nonprofit coalition of 100 groups, including the AIA, the answer is, "Slowly." STPP has found that most states still favor traditional spending programs, especially highway improvement, and they have largely ignored the new flexibility to spend highway dollars on mass transit. The slowest spent funds are in ISTEA's new "enhancement" categories: money for renovating transportation buildings, converting rail corridors to bike paths, and acquiring scenic easements. Metropolitan areas, too, are only just beginning to take advantage of transportation-related civic enhancements.

Now, ISTEA's slow but hopeful progress is threatened by a new proposal that refocuses federal investment on pavement. The U.S. Department of Transportation has proposed a National Highway System that would include 21 new "high-priority corridors" and 16 beltways around cities. Backed by such organizations as the Highway Users Federation, the American Road and Transportation Builders Association, and the Associated General Contractors of America—a "road gang" that aims to protect federal interstate investment—these proposed highways could portend further disinvestment in urban areas.

Presently, no provision within ISTEA ensures that a fair share of highway funds go to metropolitan areas—the regions most neglected by the interstates. However, U.S. Representative Robert Borski (D-PA) recently introduced H.R. 4305, establishing a National Transportation System that would link a National Highway System with airports, mass transit, light rail, and other transportation modes. The U.S. House of Representatives incorporated these positive implications for cities into its recently passed National Highway System bill; the legislation is now being considered by the Senate.

ISTEA's progressive attempts toward integrated infrastructure planning give transportation the potential to rejuvenate urban America, much as the interstates spurred development of suburbia. It is now more important than ever for architects, who have the skills to design infrastructure and plan downtowns, to advocate sound transportation policy. Architects must attend public hearings and argue for better alternatives when highway engineers urge unnecessary pavement on localities. They must encourage local and regional authorities to redefine transportation, from efficient machinery to a vehicle for improving city life.

Deborah K. Dietsch

Letters

Visually challenged critique
Edward Gunts' reaction to the Maryland State Library for the Blind and Physically Handicapped (ARCHITECTURE, June 1994, page 41) is itself "jarring and strident," rather than integrating. It conveys no understanding of the building I visited a few weeks ago. Baltimore is a rich pastiche of urban texture with plenty of room for this articulate new neighbor. And why not provide the visually challenged community with an architecturally challenging building rather than one indistinguishable from its surroundings?

Gunts' troubled relationship with the physically challenged ("blind," "oculus," "giant eye," "physical deformities") does not translate into good architectural criticism; rather, I am left with a feeling of embarrassment that he has revealed something of himself better left private.

Philip W. Kabza, AIA
Facilities Management
University of Virginia
Charlottesville, Virginia

My compliments to Edward Gunts on his perceptive commentary on the Maryland State Library for the Blind and Physically Impaired by Ayers/Saint/Gross.

It is indeed startling that such a structure was permitted in so distinguished a neighborhood. Directly across the street is Benjamin Henry Latrobe's Roman Catholic cathedral, called by Nikolaus Pevsner, "North America's most beautiful church."

Almost within sight of the nasty corner formed by the Maryland State Library is the first Washington Monument by Robert Mills, the visionary Neoclassical Unitarian Church by Maximilian Godefroy, and the Walters Art Gallery by William Adams Delano.

The gallery has an addition dating to 1974 that is a spectacular failure from both architectural and urbanistic standpoints. The local associate of its Boston architect-of-record, Meyer Ayers Saint Stewart, was the ancestor firm to the architect of the Maryland State Library. Nothing but jobbery could have led to this commission 20 years later; to adumbrate the many formal similarities between the two works is to see what little progress Ayers/Saint/Gross has since made in its desperate and ultimately unattractive effort to attract attention.

One of Gunts' observations is even more to the point, namely, that the peculiar and solipsistic architecture of the Maryland State Library has created a kind of ghetto for the physically challenged. To do the right thing, the architects should have seen to it that their work partake of the decorum of the Enoch Pratt Free Library—instead of ignoring it—for the well-being of all its users.

Baltimore is arguably the finest integral work of Neoclassical architecture and urbanism on a metropolitan scale yet surviving in the United States. The architecture of the original Pratt Library is proof that the ideals behind its example are still valid in our time. But with every misdirected project such as the Maryland State Library, this great city's

testament is placed in ever greater jeopardy. When will its governors be truly enlightened? When will its architects become truly professional?
Stephen Falatko, AIA
The Institute for the Study of Classical Architecture at the New York Academy of Art
New York City

The Baltimore chapter of the AIA honored the Maryland State Library for the Blind and Physically Handicapped with its Grand Award for Design Excellence in 1993. Your magazine panned this Baltimore library in a "Protest" that was more personal opinion than professional architectural criticism.

Whether one likes or dislikes this building, your article raises an important question. Given the overwhelming number of truly badly designed buildings, how do you choose which buildings to slam?
Steven G. Ziger, AIA
Ziger/Snead Architects
Baltimore, Maryland

Your "Protest," which comments upon our design for the Maryland State Library for the Blind and Physically Handicapped, goes beyond thoughtful and rational criticism to demean the library's users, our firm, and the profession your magazine is supposed to advocate.

This seemingly personalized piece neglects to mention that the library's design received the AIA Baltimore chapter Grand Design Award this past fall, was designed within a highly contextual overall master plan for the entire block, and was built on time and under budget.

More disturbingly, your article dismisses the fact that the users enthusiastically participated in the development of the design (specifically requesting a distinct and separate identity) and are thoroughly pleased with the resultant building.

While there may be those who may disagree with the style, one wonders why this article paints its criticism in such a mean spirited and insulting manner.

Architecture is arguably the most public of all of the arts, and therefore, its attributes should be openly and fairly critiqued.

One normally expects the nature of criticism—whether it be of film, literature, art, or architecture—to be both instructional and enlightening and that articles in a magazine of the stature of ARCHITECTURE would present issues in a manner that informs rather than insults.

Furthermore, one would expect that a critic might celebrate the art form that he or she has chosen to write about in a thoughtful way—even if critical—as opposed to taking an approach that ultimately demeans that specific art form.

Finally, while we recognize your desire to stimulate discussion, when it is done in such a shrill and vicious manner, we all end up talking about the words instead of the architecture.
Richard A. Ayers, AIA
Adam A. Gross, AIA
Ayers/Saint/Gross
Baltimore, Maryland

Architectural absurdities

Architecture has indeed fallen to a sorry state when ARCHITECTURE magazine features such absurdities as Gehry's American Center in Paris, the insanity of Eisenman in Montreal, and the Weisman Art Museum in Minneapolis (ARCHITECTURE, June 1994, pages 24-25, 56-63, 84-93).

Architects should not be surprised at the public's lack of understanding of the profession when such ridiculous gyrations are touted in the profession's premier publication.

To make things seem even more confusing, you protest against a much more rational building, the Maryland State Library for the Blind and Physically Handicapped, which utilized less gimmickry in addressing the stated program than any of the three projects listed above.

Why is the public turning to engineers or other nonarchitects for solutions to their building problems? Funny you should ask.
Robert N. Hesseltine, AIA, CSI, CCS
Anchorage, Alaska

Events

August 9-September 13
"Three Recent Projects by Zaha Hadid" at the Architectural League of New York. Contact: (212) 753-1722.

August 15-19
Advancements in CADD Production Technology: Applications and Management program, in Colorado. Sponsored by the Department of Engineering Professional Development at the University of Wisconsin-Madison. Contact: (608) 263-4705.

August 17-20
What Drives Design? The annual conference of the Industrial Designers Society of America, in Dearborn, Michigan. Contact: (703) 759-0100.

August 19
Entry deadline for Association for Commercial Real Estate Literature and Video Awards Program, recognizing both corporate and project brochures, videos, newspaper and magazine ads, newsletters, and proposals. Contact: (703) 904-7100.

August 19-21
Architecture of the Essential, the Sixth International Alvar Aalto Symposium in Jyväskylä, Finland. Contact: 358 41 624 809.

August 24-28
American Society of Interior Designers' national conference and international exposition in San Antonio, Texas. Contact: (202) 546-3480.

August 26-28
Breaking the Ice: Building New Leadership, a program sponsored by the AIA Minorities and Women in Architecture Committee and the Expert Panel on Diversity in Washington, D.C. Contact: (202) 626-7453.

August 29-September 4
International Congress on the rehabilitation of the Architectural and Built Heritage, sponsored by the Centro International para la Conservacion del Patrimonio, in Mar del Plata, Argentina. Contact: Gustavo Arraoz, (301) 229-6506.

September 6-9
Aluminum Anodizers Council annual meeting and workshop, in Chicago. Contact: (708) 526-2010.

September 8-9
Glass Expo Midwest, a two-day conference held at the Ramada O'Hare in Chicago, sponsored by DAL Enterprises. Contact: (703) 720-5795.

September 16
Submission deadline for 1995 applications for funding for organizations, offered through the Design Arts Program of the National Endowment for the Arts. Contact: Wendy Clark, Christine Gill, or Eddie Whitehurst, (202) 682-5437.

September 26
Submission deadline for the Boston Society of Architects Honors Awards Program, open to all Massachusetts architects and any international architect who has designed a built project in Massachusetts. Contact: Elizabeth Simmons, (617) 951-1433.

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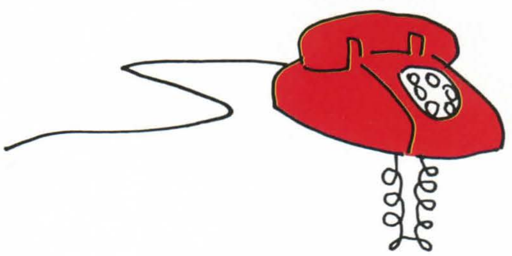

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Complete with watchdog, doorman and nameplate.

OFFICIAL WHITE HOUSE PHOTO

WHITE HOUSE MEETING: President Clinton welcomed AIA President L. William Chapin and allied small-business leaders.

AIA Supports Clinton's Healthcare Reform Plan

In June, as the national healthcare debate escalated on employer mandates to provide health insurance, AIA President L. William Chapin and leaders of 15 allied small-business groups met with President Clinton at the White House to register support for "universal" healthcare—coverage for all Americans. While most small-business groups have flatly opposed employer mandates to provide health insurance, the AIA's new lobbying caucus, called the Small Business Coalition for Health Care Reform, supports such a mandate—calling compulsory health coverage a "shared responsibility" among employers, employees, and the government. The coalition asserts that if every company had to buy coverage, then insurance rates would drop significantly.

About two-thirds of architecture firms offer health insurance to employees, recent AIA data show; 79 percent pay the full cost, spending an average 11 percent of payroll on health benefits. "Small businesses pay 30 to 50 percent more than large corporations for the same insurance plan," Chapin notes. Moreover, architecture firms organized as partnerships or sole proprietorships—73 percent of all firms—have been limited by the tax code to deductions of only 25 percent of health insurance premiums, while firms chartered as corporations can take off 100 percent of premium costs on their tax filings. (Congress allowed the corporate deduction to expire last January 1, but is expected to restore the deduction this year.) The AIA's coalition, like most small-business interest groups, advocates the full-cost deduction for noncorporations.

The Institute is also pushing for nondiscriminatory, "portable" health insurance that covers an employee regardless of job changes, because architects—younger ones especially—tend to change firms frequently and often are excluded from new employers' plans because of preexisting health conditions. Also, insurers may terminate policies arbitrarily if the terms of coverage prove uneconomical.

Barbara Nadel, principal of a firm in Brooklyn, New York, for example, discovered in early June that her insurance carrier had dropped her policy without prior notification. Nadel eventually regained coverage through her state AIA chapter. "It's very frustrating," Nadel laments. "Most sole proprietors I know can't get comprehensive insurance and so have catastrophic health coverage, which is like having nothing at all." Nadel says she supports the concept of a national employer mandate to provide health insurance.

Not all firm principals, however, support mandatory health coverage. Architect John C. Baker of Walker Baker and Associates in Harrisburg, Illinois, provides insurance to his staff of 14, but employees must pay for dependents' coverage themselves. Baker say he fears that mandatory coverage would cost too much. "When you have fewer than 15 people on staff, you don't get a good rate," Baker complains. "When you get into mandated insurance coverage, the only way we could make it through the year would be to let someone go or raise fees, and you can't raise fees out of thin air."

Robert Peck, the AIA's group vice president for government affairs, admits that the Institute has received several letters and calls opposing its pro-mandate stance on healthcare reform. "The letters tend to be very partisan," notes Peck. "And I understand the response—that anything government does will not turn out well." However, AIA's internal research shows that most AIA members support mandatory health coverage.

As of early July, three of four bills passed by committees in Congress stipulated an employer mandate to offer health insurance, which supporters see as the surest route to universal coverage. President Clinton has suggested he will veto any final measure that does not achieve that goal.—*Bradford McKee*

Exhibit Explores New Chicago Public Housing

Public housing in Chicago has finally broken out of the discredited government-subsidized mold for overcrowded, high-rise towers. Last summer, the *Chicago Tribune* staged an ideas competition to redesign the towers of the notorious Cabrini-Green housing complex. The results were provocative, but this June, successful, more practical solutions to the city's public-housing problems were displayed at the Chicago Architecture Foundation. The foundation's exhibition, called "Solutions: Reinventing Public Housing," showcased adventurous prototypes for low-income dwellings designed by nine Chicago firms. Since 1988, the success of these models has raised hopes for the political and social viability of government housing.

These housing innovations, however, came late—nearly 20 years after a federal court ordered the Chicago Housing Authority (CHA) to substantially improve its degraded inventory of public housing. In 1969, Dorothy Gautreaux, a black mother on welfare, filed a class-action suit against the CHA, charging that its housing patterns for 20,000 units built after World War II further disenfranchised poor blacks rather than fostering their independence from public assistance. Superblock towers like the crime-ravaged Cabrini-Green complex, Gautreaux pleaded, did not provide security, privacy, or domestic propriety. Even Chicago's smaller, scattered-site projects of the day, like the Lawndale developments, proved too dense.

The court found in 1969 that pressure from white, suburban politicians had consigned public-housing developments to derelict corridors of the city, belted in by highways and railroads. Siding with Gautreaux, the federal court ordered CHA to develop new, scattered public housing in nonblack neighborhoods. But over the next 18 years, the CHA continued to acquiesce to the official design standards of the U.S. Department of Housing and Urban Development (HUD), and conditions scarcely improved for residents.

In 1987, dissatisfied with the agency's efforts toward an overhaul, Federal District Judge Marvin Aspen placed CHA's scattered-site housing program in receivership and appointed one of Chicago's largest private developers, The Habitat Company, to act as trustee developer. Habitat drew up a public request for proposals from architects to design low-rise housing with no more than four units per site that would fit the urban context. Phillip Hickman, director of Habitat's Scattered Sites, pressed HUD officials to approve, for instance, pitched roofs; bay windows; and higher quality cladding than HUD generally specified. "Our challenge was to convince HUD that for the same amount of federal dollars, we could design and construct custom developments" reflective of their neighborhoods, notes Habitat President Daniel E. Levin.

Seeking designs to suit its restrained program, Habitat selected nine of the 28 responding architecture firms to design the prototypes. While the trustee developer initially focused on rehabilitating several existing structures, it began erecting new housing in 1991. To date, Habitat has built 1,000 of 1,600 planned units, at $92,000 per unit.

As displayed in the exhibition, each of the designs realized by the nine firms emphasizes modest individuality and private domain; most revive cost-effective details long lost from even market-rate and luxury housing. Architects Bauhs and Dring drew from Chicago's residential tradition of brick masonry exteriors, elevated stoops, arches, and Palladian windows for four abutting four-bedroom units on North Campbell Street. Individual dwellings are demarcated by changes in roof profiles. For a cluster of seven three-bedroom units on North Racine, Bauhs and Dring broke the continuity of individual facades to create the effect of row housing. In both projects, each unit has its own entry from the street.

Town houses by Johnson & Lee Architects incorporate panelized wood-frame construction with brick veneer, vinyl siding, and aluminum windows of insulated glass. Material choices were limited: Christopher Lee considered two colors of brick a luxury, given the tight budget, but the firm distinguished similar units by varying the stacking of adjacent three- and four-bedroom varieties. The architects also avoided the monotonous profile of public housing with setbacks on the street facade and hipped or gabled roofs.

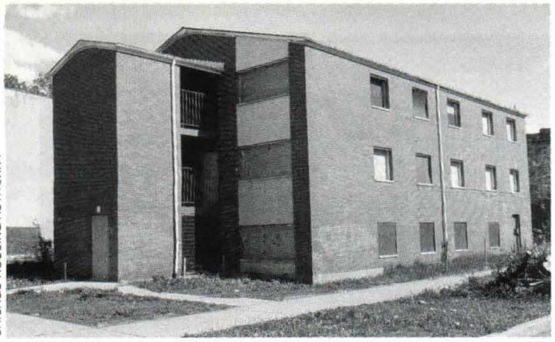
Similar curb appeal inspired the designs of Roy H. Kruse & Associates, which incorporated tough, low-maintenance materials such as stone and brick, and established a traditional, intimate scale by darkening the color of brick at the buildings' base and adding false gables at the cornice. Mayer Jeffers Gillespie's brick-based units change to vinyl siding at the second floor, and Victorian scalloped shingles cover the upper gable. Nagle, Hartray & Associates built town houses and apartments for the elderly to a slightly larger scale and styled the exteriors as those of Chicago Victorian workers' cottages. The economical structure accommodates ornamental detail such as bands of brick at doorknob height around the outside and shingle-clad awnings over doors.

Architects Pappageorge/Haymes, like several other firms, disguised the mass of a 16-unit building by facing the side to the street and running the length behind it. Classical porticos shelter the entrances, and facades are variegated by brick "shutters" and quoining at the corners. Solomon Cordwell Buenz & Associates (SCB) staggered brick, siding, and scalloping on the elevation and kept down costs by specifying prefabricated wood-stud panels for quick construction. SCB designed open floor plans to cross-ventilate each unit.

Triad Consortium's two-unit buildings feature parapet roof profiles that merge with the rest of the neighborhood on South Dorchester Street, and their bay windows suggest a single-family house. Harry Weese Associates stopped short of bay windows, but broke the building's facade with projecting wall sections, which are exaggerated by a lighter color of brick than the main facade. Concrete lintels above windows are derived from surrounding buildings. Front stairs and stoops engage residents with the neighborhood.

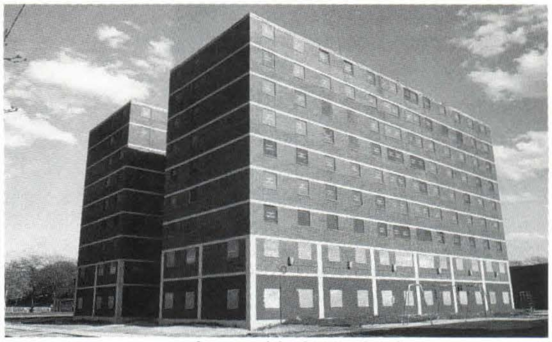
Habitat insists that the improved architecture of this public housing is still not enough to ensure the initiative's success. Proper management and maintenance must follow, so CHA has contracted several private, nonprofit groups to keep management within reach of tenants.

Local critics have charged that the program simply has resituated low-income families in other poor areas. Hickman maintains that it is difficult to find affordable land for public housing in middle-class neighborhoods and that these new housing prototypes instill greater confidence in welfare families and compel them to take a greater stake in their property.—*Bradford McKee and Harold Henderson*



CHICAGO HOUSING AUTHORITY

LAWNDALE HOUSING: 1968 example of scattered housing.



CHICAGO HOUSING AUTHORITY

WASHINGTON PARK: 1969 superblock sacrificed tenant privacy.

SCOTT MCDONALD / HEDRICH-BLESSING

KRUSE & ASSOCIATES: Brick base grounds multi-unit mass.

SHIMER / HEDRICH-BLESSING

PAPPAGEORGE/HAYMES: Side faces street for residential scale.

DAVID CLIFTON

NAGLE, HARTRAY & ASSOCIATES: Workers' housing recalled.

SCOTT MCDONALD / HEDRICH-BLESSING

BAUHS & DRING: Staggered elevation evokes local row houses.

HARR / HEDRICH-BLESSING

KRUSE & ASSOCIATES: Gables, window tracery, and brick base contradict institutional image of public housing.

Details

The Japan Art Association awarded architect **Charles Correa** of India the 1994 Praemium Imperiale Award for architecture. **Samina S. Quraeshi**, principal of Boston-based Shepard Quraeshi Associates, has been named the new Director of the Design Arts Program of the National Endowment for the Arts. **HNTB Corporation** and **Robert A. M. Stern Architects** have been selected to design the new National Advocacy Center at the University of South Carolina; the project is a joint venture of the Department of Justice, the Executive Office for the United States Attorneys, and the University of South Carolina. **Smith-Miller + Hawkinson** is designing a house for critic **Kenneth Frampton**; the firm has also been retained to design a visitors complex for Corning, Inc. in Corning, New York. Former associate professor of architecture at Syracuse University **Marleen Kay Davis** has been appointed Dean of the College of Architecture and Planning at the University of Tennessee in Knoxville. The New York City School Construction Authority has named **Ralph Steinglass** Vice President for Design and Engineering. **William Rawn Associates** has been selected to design Disney's $36 million public school, Celebration School and Teaching Academy, outside Orlando. The Worcester Massachusetts Redevelopment Authority has selected **Centerbrook Architects & Planners** to design a new railroad bridge over the city's Central Avenue. The Massachusetts Turnpike Authority has selected **Cambridge Seven Associates** to renovate Massachusetts Turnpike Traveler Service Centers. **Ellerbe Becket** has won a design competition for a new $190 million retractable-dome stadium in Arizona. **The Hillier Group** has been selected to design a new facility for the International School of Prague in the Czech Republic. Los Angeles-based **Nadel Partnership** has established an office in Chicago. Former President of Heery Architects and Engineers **Joseph M. Harris** has been appointed the new President and Chief Executive Officer of **Hanson Lind Meyer**. Former Vice President of Planning and Development for the Baltimore Orioles **Janet Marie Smith** has been named Vice President of Sports Facilities for TBS Properties, a division of Turner Broadcasting System.

News

Design Community Celebrates Gay Rights

Questions of sexual identity, stereotypes, and prejudice dominated two design events held in New York City concurrent with the 25th anniversary of the Stonewall Rebellion—the flashpoint of the modern gay-rights movement. The StoreFront for Art and Architecture opened "Queer Space" in its Acconci/Holl-designed gallery on June 18; and architects, interior designers, and graphic artists assembled June 24 at the Cooper Union for Design Pride '94, the first international conference of the New York-based Organization of Lesbian and Gay Architects and Designers (OLGAD).

SIGNAGE: Notes gay landmark.

OLGAD staged a day of slide presentations and panel discussions. Stanley Abercrombie, editor-in-chief, *Interior Design* magazine, tackled the question of whether the history of changing attitudes toward sexual diversity has affected the way designers design. His remarks set the tone for a series of historical glimpses of homosexual designers, including Eileen Gray, Russell Wright, and Philip Johnson.

The conference delivered a mixed message. David McFadden, assistant director of the Cooper-Hewitt National Museum of Design, cautioned designers to be wary of the gay esthetic they wished to cultivate. A stereotype can be a positive form of identification, he noted, but warned it also encourages marginalization and offers an excuse for bigotry.

Ensuing panel discussions tackled the notion of a gay design esthetic and the legitimacy of "queer space." Equating space with sexual preference proved an unconvincing exercise. More successful was the group's handling of practice issues, such as discrimination and advocacy of housing, education, and civil rights for people afflicted with AIDS.

The elusive topic of "queer space" was addressed more successfully at StoreFront for Art and Architecture, where responses to the gallery's call for projects addressed stereotypes, icons, and discrimination.

The 14 selected projects, on view through July 30, ranged from videos and photographic essays to Brian McGrath's *GayDar Maps*, architectural drawings identifying "erotically charged" urban spaces, and Michelle Fornabai's interactive *Death Drive*, which re-created the site of actor James Dean's fatal crash.

Projects lined the gallery's movable panels and filled all available floor space, complemented by the work of Paul Lewis, Peter Pelsinski, and Marc Tsurumaki, exhibit designers from New York-based Operatives.

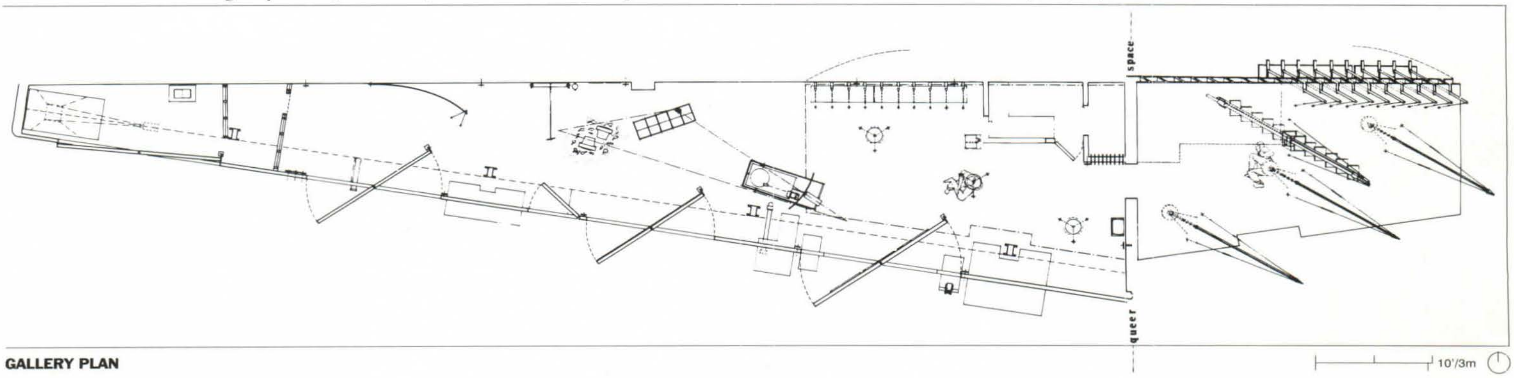
Individuals funded the StoreFront projects, since all requests for grants or sponsors were denied. John Buscarello, chair of Design Pride '94, indicated OLGAD also did not receive corporate sponsorship; Design Pride relied on private donations, ticket sales, and fund-raisers. In an industry that traditionally rewards diversity, this lack of participation is disheartening.—*Ann C. Sullivan*

MICHAEL MORAN PHOTOS

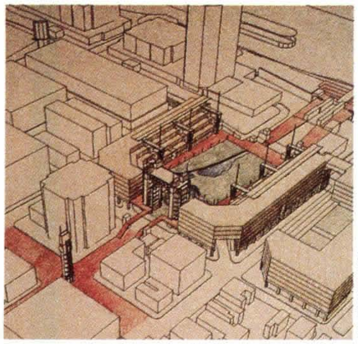
STOREFRONT: Exhibit design by Lewis, Pelsinski, and Tsurumaki incorporates stools.

MAPS: McGrath's urban analysis (left).

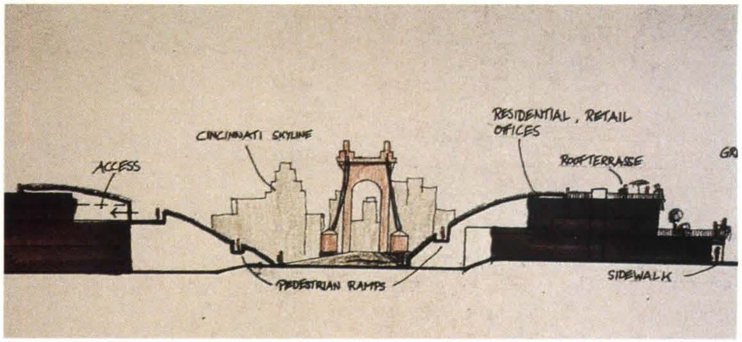
VIDEO: Fornabai's ode to Dean.



GALLERY PLAN


JAMES CHENG

FIRST PLACE: Cheng's U-shaped complex.



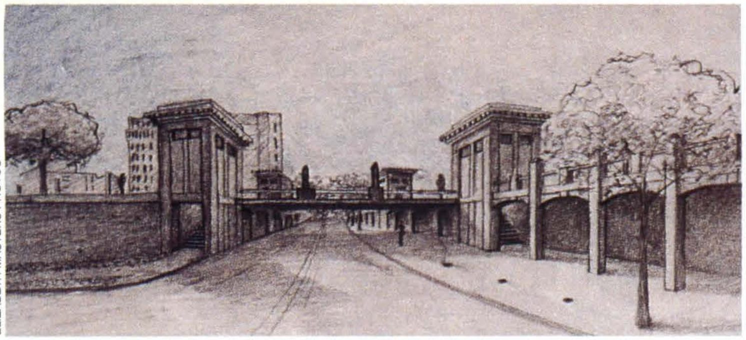
CHRISTOPHE RENTZEL

SECOND PLACE: Rentzel's blue-grass hills frame southern terminus of bridge.

Competition Proposes Kentucky Gateway

An architect from Cincinnati won an international competition in May to design a gateway to Covington, Kentucky, from the 1867 John A. Roebling Suspension Bridge, which links Covington to downtown Cincinnati. The first structure to span the Ohio River, the Roebling Bridge is the focal point of a $200 million riverfront development project. The Roebling Gateway Park Corporation and the City of Covington initiated the gateway competition to provide the area with a cohesive urban strategy. Architect James Cheng, of KZF Associates, received $10,000 for his first-place design.

Cheng's scheme revolves around a public plaza that redirects bridge traffic beneath a landscaped terrace of gardens, ponds, and a waterfall. A horseshoe-shaped plan, opening toward the suspension bridge, incorporates a public park within new retail, office, and residential development. A nine-story masonry-and-steel arch and observation deck anchor the south end of the development and echo the two masonry towers of Roebling's suspension bridge. Smaller archways direct vehicular traffic through the four-story mixed-use complex, which includes an entertainment strip called "Speakeasy Alley," a skating rink, marketplace, and boardwalk. A clock tower will



THIRD PLACE: Masters' arcade reinforces pedestrian scale.

THIRD PLACE: Stair towers mark threshold to Roebling Bridge.

ELIZABETH MASTERS PHOTOS

be constructed south of the site, reinforcing the axis from the bridge to downtown. Cheng's scheme proposes future housing blocks adjacent to the gateway site, as well as commercial space and a convention center.

Christophe Rentzel, a student at Louisiana State University's School of Landscape Architecture, captured second place and $5,000 with his scheme. Rentzel, a Swiss native, proposed a residential and commercial development bermed into three, Kentucky blue-grass-covered hills. After crossing Roebling Bridge, automobile drivers are directed around the landscaped area. Undulating pedestrian paths link the landscaped hills with the riverfront and a sculpture garden and playground.

Philadelphia architect Elizabeth C. Masters designed the $2,000 third-place scheme—a public green in the American tradition. Masters proposed an open square fronted by judicial, commercial, and residential buildings with an east-west courthouse axis. New materials and facade proportions defer to existing architecture. Masters' plan suggests setback requirements and height limitations that reinforce the north-south axis established by the bridge and downtown Covington; new construction reflects the change in scale from the pedestrian plaza to the commercial downtown. A fountain and column dedicated to Kentucky veterans anchor the south end of the square.

Grady Clay, former editor of *Landscape Architecture*, chaired the five-member jury, which included Ralph Johnson, director of design at the Chicago office of Perkins & Will; and Michael J. Pittas, former director of the National Endowment for the Arts' Design Arts Program. Construction of Cheng's first-place gateway proposal is scheduled to begin upon final civic approval of his plan; a budget has not yet been determined.—*A.C.S.*

AIA New York Forges New Directions

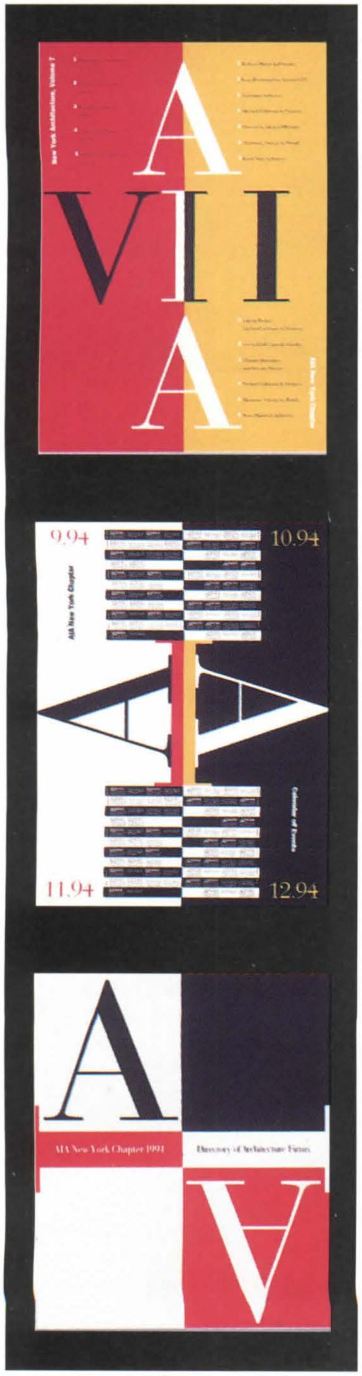
New York City is brimming with large-scale public projects for architects: the rehabilitation of public schools; transit station restorations; and the revitalization of waterfronts and parks. But over the past decade, the local profession has lost touch with the public realm.

To increase architects' involvement, the 2,200-member AIA New York chapter is striving to gain a higher public profile, following the appointment of a new executive director. According to current Chapter President Bartholomew Voorsanger, "We need to bring energetic people already engaged in the public sector into this organization." One such person is Carol Clark, who last month succeeded Lenore Lucey as Executive Director. Lucey resigned this spring after nearly eight years at the chapter's helm to join the New York-based construction giant Lehrer McGovern Bovis.

Clark is former Deputy Executive Director for Intergovernmental Relations at New York City's Planning Department and previously worked for the Municipal Art Society's Planning Center and the Public Development Corporation of New York. While not an architect, Clark holds an M.S. in historic preservation from Columbia University. "Some of the most successful chapters—Boston, Chicago, and Los Angeles—are headed by nonarchitects," she notes.

As executive director, Clark aims to create a more visible role for architects at the city level and to champion design excellence for public projects. Clark also plans to forge new joint programs with local civic groups, such as the Municipal Art Society, and hopes to make the chapter's activities more relevant to younger members. For Clark, one of the most important tools for communicating with younger members is the chapter's monthly magazine, *Oculus*, which is currently searching for a new editor, following the resignation of editor Suzanne Stephens this month.

To reflect the chapter's changes, AIA New York has contracted graphic designer Michael Gericke of Pentagram Design to revamp its publications. Gericke has already unveiled schemes for the chapter's calendar and membership directory (left) and is scheduled to redesign *Oculus* next year.—*R.A.B.*



AIA PUBLICATIONS: Pentagram's designs.

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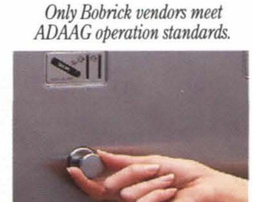

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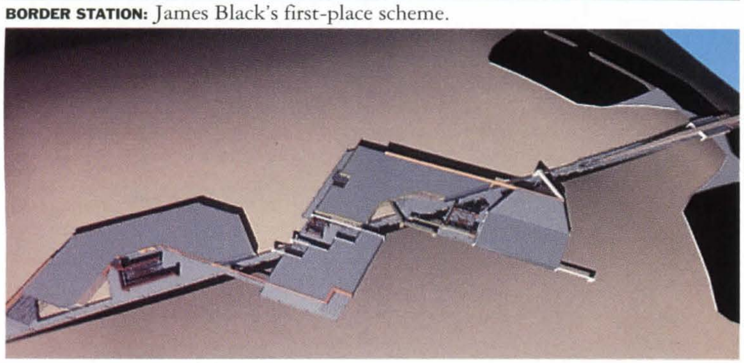
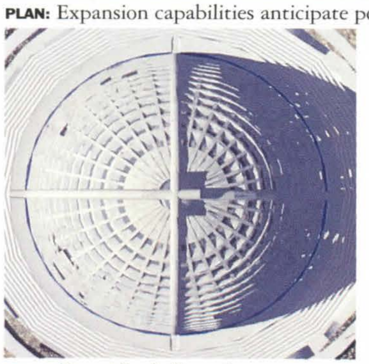
JAMES BLACK

BORDER STATION: James Black's first-place scheme.



PLAN: Expansion capabilities anticipate population growth at border communities.



DOME: Ron Allen's first-place entry.

SECTION: Dome extends below grade.

AIAS Sponsors CAD Competition

The American Institute of Architecture Students (AIAS) has announced the winners of its first computer design competition, "Más Allá de la Frontera: Beyond the Border," cosponsored with Graphisoft U.S., a software company based in San Francisco. Entrants were challenged to design an international complex for trade and cultural exchange on the Mexico-United States border.

Ron Allen, a student at Mississippi State University (MSU), and James Black, from the University of Kentucky, each received first-place honors for their entries. Second-place awards went to MSU students: Manche Mitchell, and Anthony Lawrence and Bradford Swinney. AIA Gold Medalist Norman Foster chaired the jury, convened during AIA's convention in Los Angeles.

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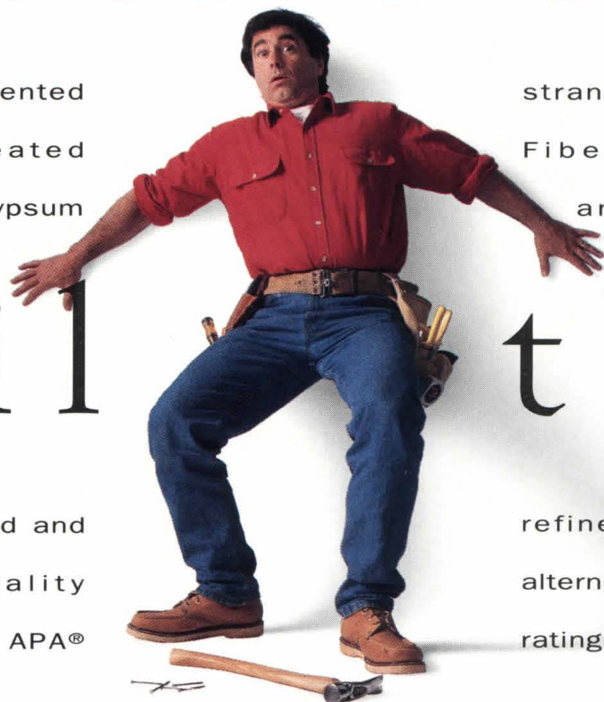

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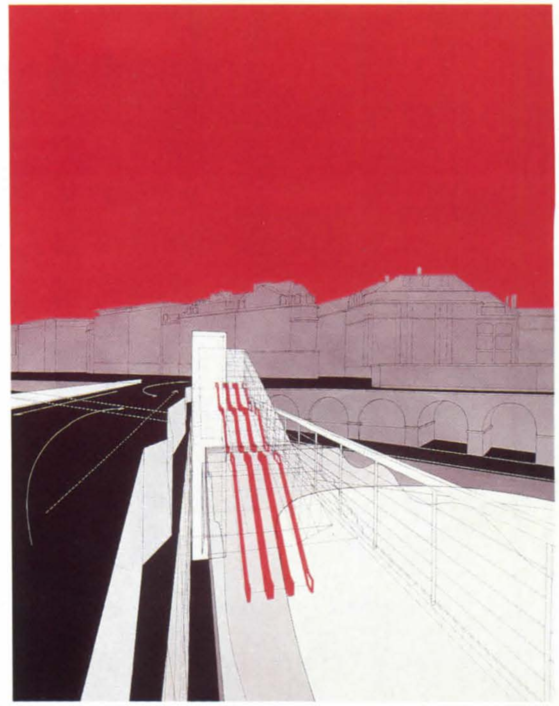
On the Boards

A four-story steel-and-glass bridge animates a Swiss transportation hub.



DAN CORNISH

Metropont
Lausanne, Switzerland
Bernard Tschumi Architects

Bernard Tschumi's Metropont is one of the four inhabited bridges conceived as part of the architect's competition-winning entry to link the Flon Valley to the upper reaches of Lausanne, Switzerland. Metropont functions as a transportation center and incorporates public spaces, offices, and retail development. The four-level bridge will span approximately 600 feet across the valley.

Located on the western end of the valley, Metropont will act as an interchange for inner-city travel, as well as link multiple routes to the historic city: The bridge will direct three train and subway lines, two bus routes, and pedestrian traffic entering from four levels.

The glass-and-steel bridge is programmatically and structurally divided into two sections. Twin stories of office and commercial space comprise the western section; vertical circulation shapes the eastern end. Train platforms will be located beneath the valley floor.

According to Tschumi, the western band was conceived as an enormous, hollow steel beam that stabilizes the bridge. The second level of commercial space is suspended from the top surface of the beam; a continuous steel trellis encloses the structure.

On the eastern side of the bridge, escalators, stairs, and elevators are contained within an angular glass box that will lead from train platforms to top-level offices; a tensioned cable system, braced by the escalators, will support the glass enclosure. A stepped café will be nestled between stair runs. Suspended from the underside of the bridge, a steel-and-glass canopy will shelter below-grade stairs and escalators.

A semitransparent framework, running the length of the eastern section, will support a "media strip," an automated band of advertising, images, and light that will animate the space, visible from within the bridge and the valley beyond.

Following an international design competition in 1989, Tschumi was one of three entrants invited to participate in the competition's second phase, resulting in his winning bridge-city scheme; Tschumi's final plan for Lausanne was adopted by city officials in 1991.

Studies for two of the four proposed bridges, Metropont and Pont Montbenon, which will house a new art center, have been developed by Tschumi's New York office. Currently in design, construction of Metropont is scheduled to begin in late 1995, at an estimated cost of $25 million, excluding the underground train platforms.—*A.C.S.*

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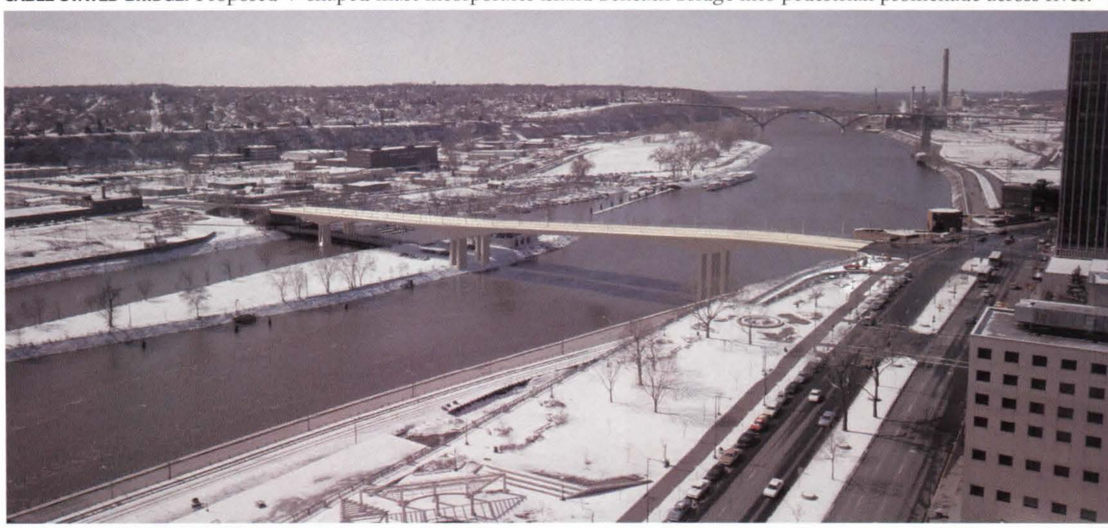
A bridge proposed as a monumental gateway is reduced to an overpass.

CABLE-STAYED BRIDGE: Proposed V-shaped mast incorporates island beneath bridge into pedestrian promenade across river.



STEEL GIRDER BRIDGE: Final proposal diminishes civic potential of urban infrastructure and bridge's link to capitol.

St. Paul Compromises Bridge Design

After five years of city council meetings, community task force recommendations, and design revisions, the latest version of the Wabasha Street Bridge in St. Paul, Minnesota, looks as banal as any highway overpass. This unceremonious span is designed to mark the region's oldest crossing over the Mississippi River, linking St. Paul's cultural corridor to a floodplain on the southern shore. In 1989, the city commissioned New York City artist James Carpenter to design an "instant landmark" to replace an 1850s suspension bridge. The evolution of Carpenter's scheme, however, suggests that city officials aspire merely to cost-cutting efficiency rather than civic grandeur.

Indeed, some citizens balked at spending $41 million on Carpenter's original design: a V-masted, cable-stayed bridge rising 270 feet from a currently neglected island in the middle of the river. To qualify for federal funding, Carpenter developed three schemes, including a traditional twin-arched bridge and a utilitarian steel girder bridge. The city council approved the utilitarian design, if only to save St. Paul taxpayers $11 million. Given this embrace of drab functionalism, why did the city bother to employ a talented New York architect?

Before construction documents are drafted, the city council should reconsider the role of the Wabasha Street Bridge as a prominent civic landmark. Plans for the bridge have already spurred proposals for development along the flanking riverfront, including a Mississippi interpretive center, aquarium, and science museum. To realize these visions of economic revitalization—and assert the city's stature as Minnesota's political and cultural capital—St. Paul deserves a more memorable gateway.

The tensile expressionism of Carpenter's initial V-masted design recalls the interdisciplinary spirit of the early 1900s, when the design of urban infrastructure manifested the civic pride and optimism of the City Beautiful movement. In St. Paul, that spirit resonates in the nearby state capitol, a vigorous mass of white marble created by Cass Gilbert to echo buildings at the 1893 World's Columbian Exposition. As a prominent route to the capitol, the Wabasha Street Bridge should not only complement Gilbert's achievement, but also establish an entry to the city as potent and iconic as San Francisco's Golden Gate Bridge.—*M. Lindsay Bierman*

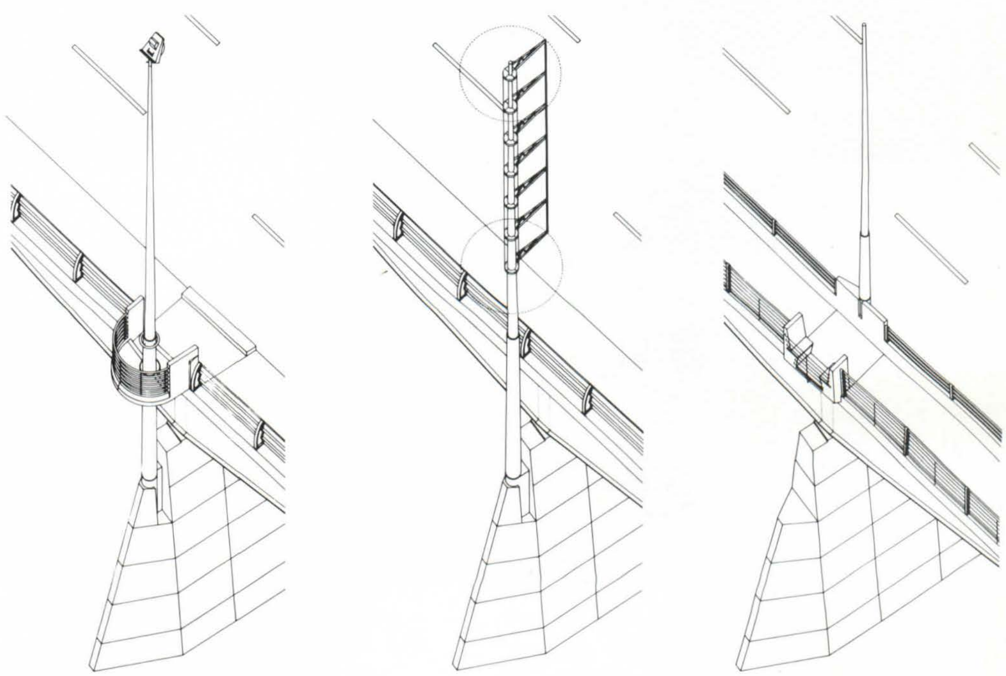
Public Duty of Infrastructure

A letter to a mayor of a large American city stresses the civic potential of urban services.

Dear Mayor: I am writing to urge you to enhance our city through better designed, better integrated, and better used infrastructure. As the manifestation of public services, infrastructure not only supports and defines cities, but it also has the ability to establish a sense of place. Historically, its symbolic role has been celebrated through monumental walls, gates, bridges, and parks. Paris's sewer system and New York's Brooklyn Bridge, for example, have inspired artists, attracted tourists, and fostered civic pride, in addition to serving functional roles. By integrating multiple uses and providing well-designed public spaces and monuments, infrastructure can help build a high quality of life, attract new residents, and support businesses. Given today's challenges to the collective life of the city, can you afford to demand less of infrastructure?

Sadly, contemporary infrastructure is rarely elevated to the level of cultural icon. As we have come to take city services for granted, infrastructure has become mundane, as ubiquitous and banal as the concrete barriers that border our highways. We expect state-commissioned designs to be undistinguished, formulaic solutions. We accept them for their presumed rational efficiency, yet we have all seen the devastating social consequences of reducing urban infrastructure to purely functional criteria: the bypassed neighborhoods and inaccessible waterfronts, whose blight, though contained, is exacerbated by their ghettoized isolation.

Federal regulations for construction materials, methods, and performance further promote an uncritical approach to infrastructure design. For example, designs for bridge railings are limited to solutions that have been crash tested. To date, however, only the New Jersey barrier has been tested—hence its maddening ubiquity. State agencies are nonetheless sensitive to public opinion and, in my experience, are willing to deviate from these formulas when adequately pressured.



CHARLOTTESVILLE BRIDGE: Studies of piers by Dunham-Jones and LeBlanc Architects for Free Bridge in Virginia.

But even when a city decides to honor itself with something more distinguished than standard, state-issue design—or is forced to by a 1 percent-for-art program—the results are often unsatisfying. The usual approach is to build a utilitarian, engineered object and then hire an artist to tack on a piece of public art as a means of humanizing, estheticizing, and particularizing an otherwise undistinguished project. While there have been some remarkable collaborations resulting from this approach, the art does little to integrate the overall structure into the fabric of the city, or to engage more people for more uses. This is a lost opportunity we can no longer afford.

Entrepreneurial outlook

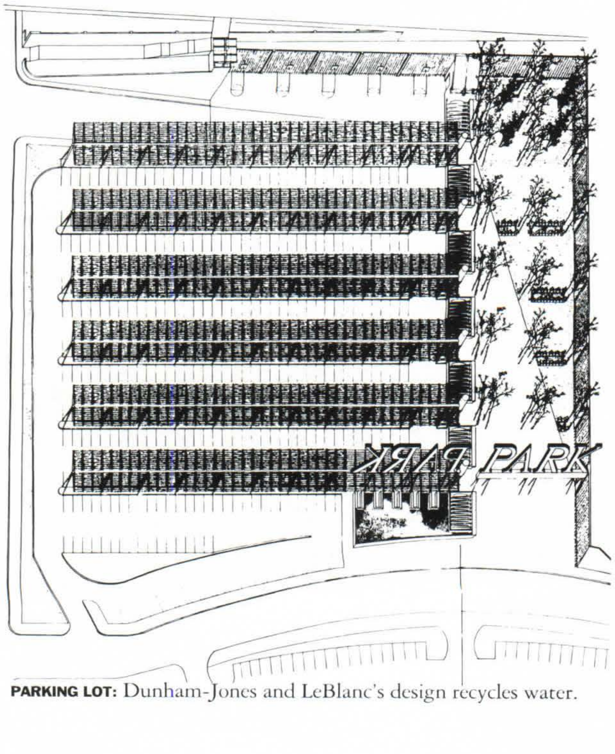
Broadening the scope of infrastructure requires a similar opening up of its design process. You need to bring in creative thinkers who are skilled in rallying public support for projects. Who can reconceive of infrastructure in this expanded way? Architects.

Architects are visionaries. We love to speculate about what ought to be rather than accept unconsidered conventions. At the same time, we're well prepared to synthesize multiple agendas into a coordinated whole. Like you, architects are used to making decisions based on many disciplines, particularly engineering and urban design. We are also used to working with diverse clients and community groups. Unlike engineers, who are trained more to solve specifically defined problems, architects work with others to jointly discover the possibilities within a situation. Our training in place-making, our skills in communicating ideas through design, and our entrepreneurial outlook eminently qualify us to help you turn infrastructure problems into public amenities.

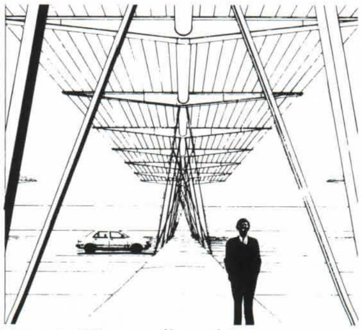
Creative solutions

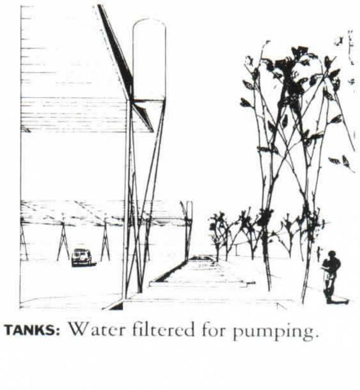
The success of some of our profession's more creative proposals for infrastructure come from their ability to find striking possibilities in places and programs usually dismissed as unworthy of attention. Architects Machado & Silvetti have consistently brought this kind of scrutiny to bear on their work: Their 1987 proposal for the Porta Meridionale in Palermo, Sicily, effectively transformed a highway cloverleaf into a spectacular walled gateway to the city. In 1988, also for Palermo, they proposed a municipal harbor conceived as a water courtyard for a public palazzo. Though unbuilt, these projects reconceive infrastructure as grand civic places defining the city. Swiss architect Herzog & deMeuron's European warehouses and switching station, Ellerbe Becket's striking cooling plant in Minneapolis, and the Energy Services Facility at the University of California at Los Angeles by the San Francisco firm Holt Hinshaw Pfau Jones similarly elevate the utilitarian to urban landmarks.

As a registered architect and engineer, Santiago Calatrava designs infrastructure through an innovative interdisciplinary practice (pages 72-81, this issue). His 1988 Bach



PARKING LOT: Dunham-Jones and LeBlanc's design recycles water.


TRELLIS: Water collected in gutters.


TANKS: Water filtered for pumping.

de Roda-Felip II Bridge in Barcelona connects two streets and two parks on either side of railway lines. Flared arches lean against vertical arches to support public balconies that extend from the pedestrian walkways across the bridge. The dramatic, cable-framed piazzas unify the disparate parks into a larger whole, subordinating engineering to urban design. It is precisely this kind of interdisciplinary approach that you need to encourage to reap similar benefits for our city.

Environmental infrastructure

This collaborative approach to designing infrastructure can be used to benefit the environment. The need for clean air and water, in particular, has taken on great public importance because it cuts across social and racial boundaries. Various proposals in recent years, many of them conceived by artists and architects, have explored methods of transforming infrastructure into both systems for supporting biodiversity and places for people to reconnect with nature.

Sewage and waste treatment plants have prompted some of the most radical rethinking (pages 58-65, this issue). Ecological Engineering in Marion, Massachusetts, has pioneered the development of solar aquatic wastewater treatment and recently convinced the town of Harwich on Cape Cod to convert to their system. These sweet-smelling greenhouses of reed beds and aerated acrylic tanks filled with mini-ecosystems of snails, sucker fish, frogs, many flowering plants, and, most importantly, decay-eating micro-organisms make visible the recycling and cleaning of water in attractive and cost-effective facilities.

Another project that invites us to contemplate our position within the ecosystem is architect and artist Patricia Johanson's *Endangered Garden*, commissioned to enhance public reception of a new pump station and sewage holding tank at San Francisco's Candlestick Cove. The 1987 project provides the public with a linear series of bay walks, overlooks, and earth mounds while providing habitats for a number of locally endangered plants. Nancy Holt's design for *Sky Mound*, now under construction in the New Jersey Meadowlands, similarly transforms a stigmatized industrial site into a viable public amenity. This 57-acre, modern-day Stonehenge rises from a landfill with a central, naked-eye observatory; a storm-retention reflecting pond; and various mounds. Arched methane collection pipes are arranged to reflect the sky and frame the sun, moon, and particular stars at the equinox.

It is no coincidence that so many of these examples transform infrastructure into parks or public spaces. They demonstrate the degree to which infrastructure has reentered the public agenda. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 annually pledges $20 billion of federal funds to projects like highways, bridges, and wastewater treatment plants. Accompanying "enhancement" funds recognize the need to link the planning and design of urban infrastructure to larger social and ecological concerns.

Architects' participation

As an architect and a citizen, therefore, I am asking you not only to take better advantage of this legislation, but also to demand that infrastructure actively shape our public realm. And you will actually save money by integrating the city's public services. The public hearings now required for all projects receiving ISTEA funding make obsolete the technocratic, "no frills" engineering approach of the past. Communities are demanding, and rightly so, that any undesirable development be compensated for with amenities. In the end, the city—and its citizens—benefit.

I urge you to call on the local chapter of the American Institute of Architects. If they haven't already held a brainstorming workshop about infrastructure projects in your city, you should encourage one. Architects are eager to apply their talents toward improving the social and environmental conditions of the city; they realize they can revitalize the public realm more today through infrastructure than through housing or institutional buildings. They want their city's civic identity to be associated with more than cost effectiveness, and they know they can help. Yet, under the current system of infrastructure development, architects are left out of the loop. Invite us to impress you. You can help begin a dialogue among architects, engineers, and community groups in our city and determine the direction of infrastructure—and of our city—in the 21st century.

Sincerely,

Ellen Dunham-Jones
Assistant Professor of Architecture
Massachusetts Institute of Technology
Boston, Massachusetts

Circle 27 on information card

Architect: C.W. Fentress J.H. Bradburn and Associates, P.C. Engineer: Severud Associates Consulting Engineers P.C. Photographer: Robert Reck.

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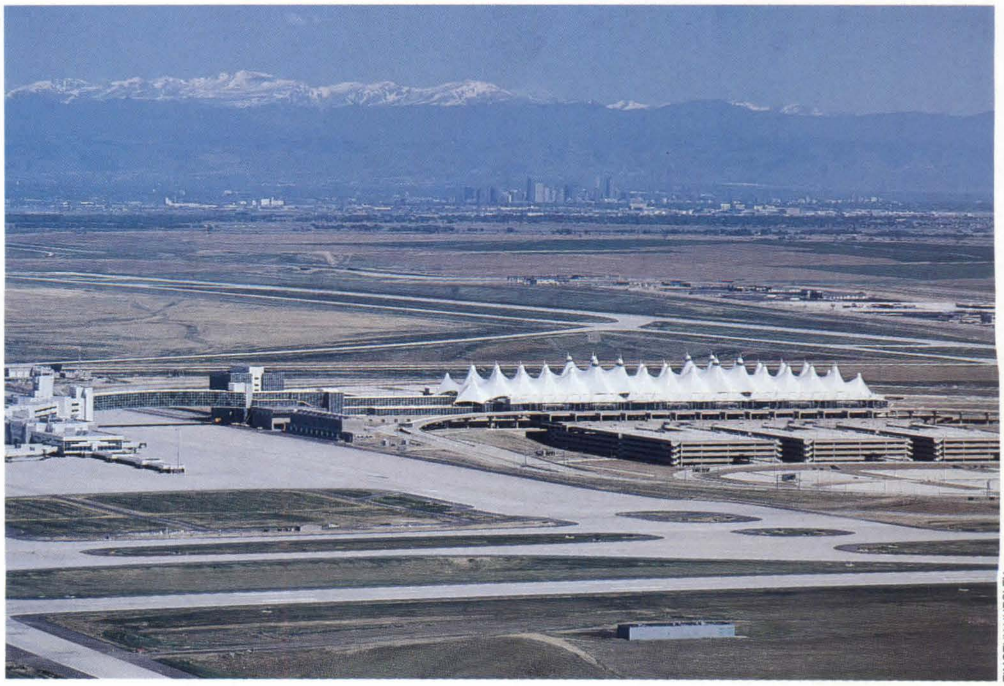
ARCHITECTURE

RETHINKING URBAN INFRASTRUCTURE

This issue features projects that capitalize on the civic potential of urban infrastructure. As modern gateways to cities, train stations, airports, and even toll booths should create a sense of urban identity. The most powerful example of infrastructure's potential is the Lyon-Satolas Airport Railroad Station, designed by Santiago Calatrava with Jean-Marie Duthilleul: Its metal structure springs from a flat plain like the carcass of a prehistoric bird. In Colorado, C.W. Fentress J.H. Bradburn and Associates' design of the Denver International Airport establishes a memorable crossroads beneath the world's largest enclosed tensile fabric roof. A mundane toll plaza at Chicago's Midway Airport is elevated through a crisply delineated canopy by A. Epstein and Sons International.

Opportunities to reconsider the role of infrastructure are not limited to transportation projects. Architect Jordan Woodman Dobson conceived an Oakland, California, shipping berth as a beacon for Pacific Rim traders; and in San Francisco, the Oceanside Water Pollution Control Plant by Simon Martin-Vegue Winkelstein Moris creates a sustainable landscape that benefits the city.

RIGHT: Denver International Airport elevates banal form of transportation to a public rite of passage with peaked fabric roof reminiscent of Rocky Mountains.



TIMOTHY HURSLEY

PEAK PERFORMANCE

Elrey Jeppesen Terminal
Denver International Airport
Denver, Colorado
C.W. Fentress J.H. Bradburn
and Associates, Architect

THESE PAGES: Teflon-coated fiberglass roof tops Denver's Elrey Jeppesen Terminal, named for a Colorado pioneer in the field of aviation.

NICK MERRICK, HEDRICH BLESSING

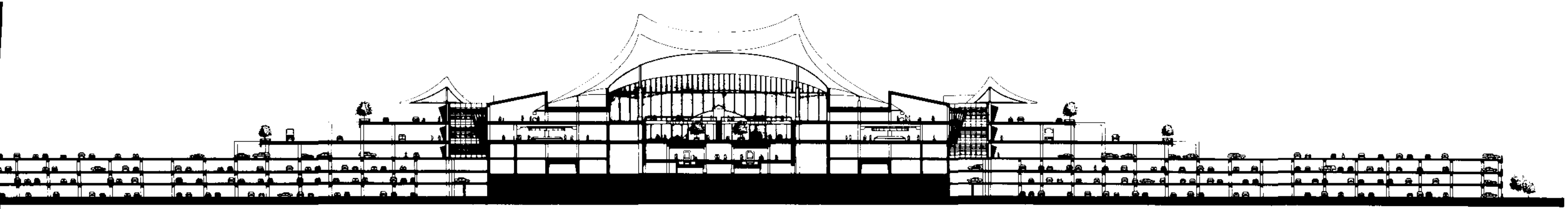
TOP: Nine-hundred-foot long Jeppesen Terminal is arranged along a north-south axis, with three linear, east-west concourses to the north.
ABOVE: Concourse A (foreground) is linked by bridge to administrative office building at north end of terminal.
ABOVE RIGHT: Fiberglass peaks echo snow-capped Rockies in the distance. *Runways are arranged in pinwheel* scheme around airport to take advantage of changing wind direction.
SECTIONS: Spaces for 12,000 cars flank terminal. Hotel tower (left) will be built atop bridge to first concourse.

Denver's new international airport is the largest in the country, covering 53 square miles and incorporating five runways, a passenger terminal, three concourses reached by high-speed trains, and parking for 12,000 cars. Under the gargantuan tent of its Elrey Jeppesen Terminal—the largest enclosed tensile-roofed structure in the world—a projected 72 million air travelers and countless vendors will make the $3.2 billion complex one of the largest economic enterprises in the United States. If the Denver International Airport (DIA) were a nation, it would have a higher gross domestic product than several European countries.

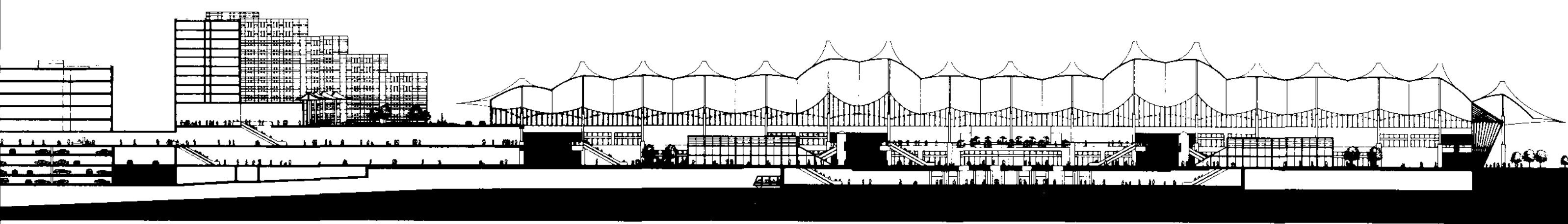
Economics were precisely the reason for building a new airport 18 miles beyond Stapleton International, a 65-year-old complex just a $12 cab ride from downtown Denver. Though several of Stapleton's concourses were new or recently renovated, the old airport lacked a large enough site to support expansion. In the mid-1980s when DIA was planned, Denver air traffic was predicted to rise from 34 million passengers a year to 55.6 million by 1995. Planners and politicians—among them former Denver Mayor Frederico Peña, now U.S. Secretary of Transportation—conceived DIA as an economic engine like the new airports at Atlanta and Dallas-Ft.Worth, which drove substantial regional development in the 1980s. Who would have guessed that, upon DIA's completion in 1994, one of its original three major airline anchors would be bankrupt; its state-of-the-art, automated baggage system would crash; and air travel would be waning?

In June, the airport's high-tech baggage system appeared so hopelessly glitched that Denver Mayor Wellington Webb refused to set an airport opening date after four postponements. The delay, which reportedly cost the city more than $12,000 a day, meant that only groups of touring Denverites, for whom the city understandably launched an aggressive public relations campaign, have experienced the architecture of the new terminal firsthand. Though not a match for Eero Saarinen's Dulles International Airport, C.W. Fentress J.H Bradburn and Associates' billowy-roofed terminal is similarly expressive, and its broad expanses of mullioned glass recall Saarinen's 1958 design. Conceived to echo the snow-capped Rockies, the tentlike structure resembles a high-tech Sioux encampment, mysteriously tethered to the plains. Inside, however, marble floors, skylights, and $7.5 million worth of art create a mammoth luxury shopping mall in the middle of the prairie. "We've created a stage set for meeting and greeting," admits architect Curtis Fentress. North of the terminal, an office building by Fentress Bradburn and concourses by Allred, Seracuse, Lawler/TRA are understated glass boxes that bear little relationship to the terminal, but at least allow the tented structure to play center stage.

If the airport lacks architectural excitement, it overcompensates with high-tech systems for the future. DIA is big—massive

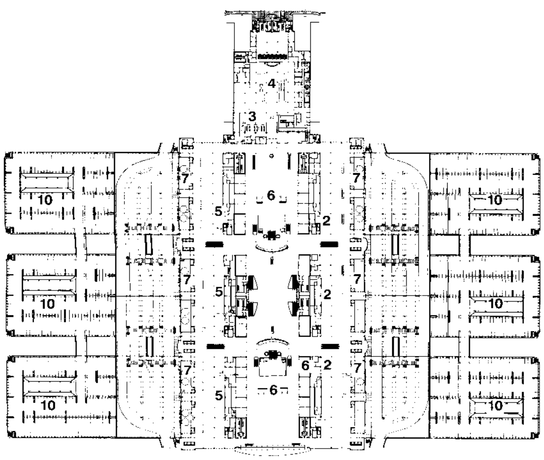


EAST-WEST SECTION



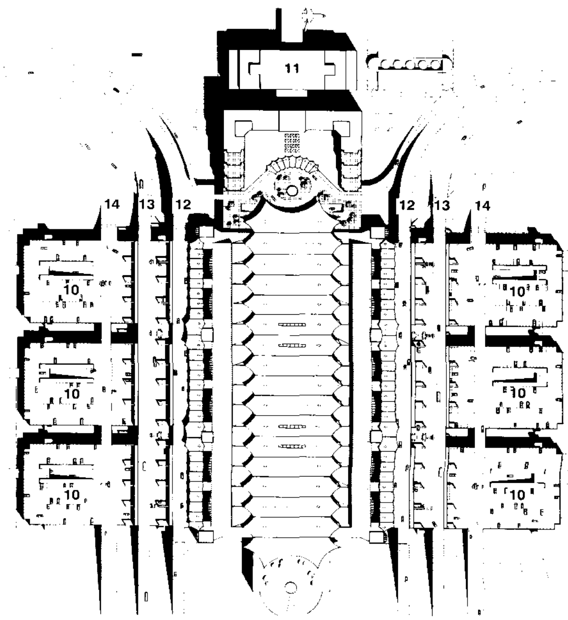
NORTH-SOUTH SECTION

60'/18m

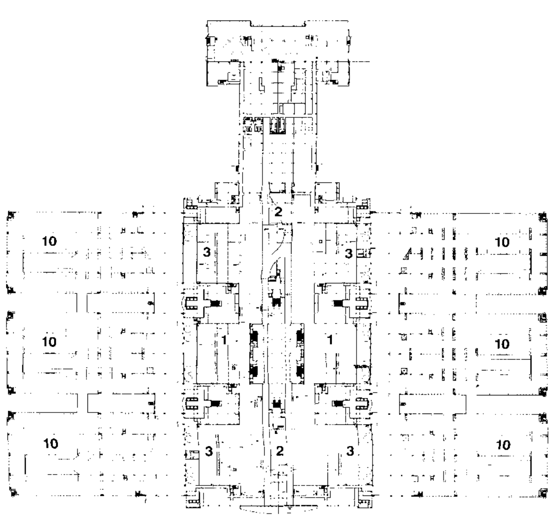


LEVEL 5-BAGGAGE CLAIM

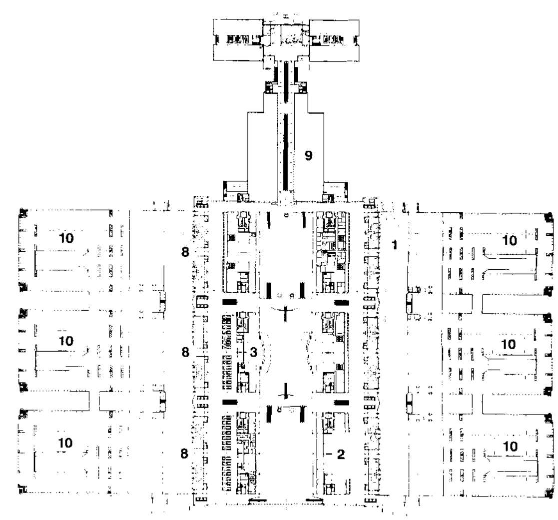
1 TRAIN PLATFORM
2 TRACK
3 MECHANICAL
4 INTERNATIONAL BAGGAGE CLAIM
5 DOMESTIC BAGGAGE CLAIM
6 AIRPORT SECURITY
7 RETAIL / OFFICE
8 TICKET COUNTER
9 WALKWAY TO INTERNATIONAL SECURITY AND CONCOURSE A
10 PARKING
11 AIRPORT ADMINISTRATION
12 PASSENGER DROP OFF
13 COMMERCIAL VEHICLES
14 PASSENGER PICKUP



ROOF PLAN



LEVEL 4-TRAIN STATION



LEVEL 6-TICKETING

150'/45m

NICK MERRICK / HEDRICH-BLESSING

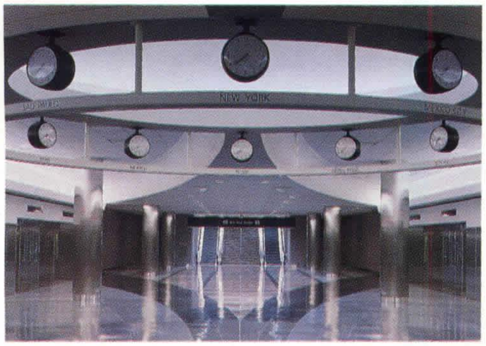
enough today to handle 30 million passengers and built to more than double that volume of traffic. Its state-of-the-art airfield allows more planes to touch down in bad weather than can land at Stapleton on a sunny day. Terminal and concourses are arranged for efficient hubbing, enabling Denver to become, like Chicago, another great, midnation transfer point for trans- and intercontinental flights. Concourses can be added; vehicular access lanes widened; and the terminal itself is designed to grow southward. A sixth runway is under construction, and six more are envisioned.

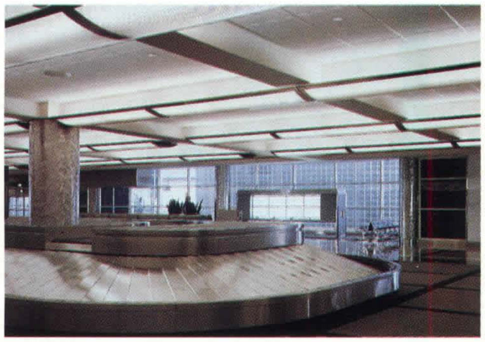
Though vast, the new airport's straightforward, easily understood plan should soothe anxious travelers. Passengers are ticketed in the main terminal and delivered to planes via an underground train, whose rail corridor forms the north-south spine along which terminal and linear concourses are arranged. Layered vehicular access avoids congestion: Commercial vehicles drop passengers at the fifth level; private cars deliver at the sixth. Arriving passengers are ticketed and check luggage at level six; they proceed to a mezzanine of restaurants overlooking the main volume under the tent, known as the Great Hall. From this vantage point, they can visually locate everything they need on level five below: phones, ATM machines, gift shops, security, and escalators to the trains on level four. One of five trains zips passengers out to the concourses every 90 seconds, and travelers arriving by plane will likewise take the train into the Great Hall, where they will find rental car vendors, transportation information, and, if the $193 million automated baggage system is working, their bags.

Flawed baggage delivery may not be the worst of the new airport's problems. Conceived during the heyday of hubbing, DIA's completion unfortunately coincides with a slump in the airline industry. Upstart airlines such as Southwest are claiming the skies by employing old-fashioned, city-to-city transport. Due to high lease fees, expensive airports are especially endangered when large airlines trim costs: Continental has already cut ties with Denver, leaving United the new airport's only large carrier. And although Colorado has begun a slow climb out of the recession, air traffic in 1994 was only about 22 million, far below original predictions.

DIA may be off to a rocky start, but regional forecasters predict that Denver, whose most important industries are technology and tourism, is poised to grow in the 21st century. Acres of land abutting the airport's new access road are slated for development. Although the new complex may lack the architectural grace of Renzo Piano's recently opened Kansai Airport in Japan, no one doubts that DIA's state-of-the-art systems, once they work, will eventually generate growth and improvements. "Part of our challenge," admits Fentress, "was to create a background building with enough flexibility to accept the changes aviation will see over the next century."—*Heidi Landecker*

FACING PAGE: Fiberglass canopy shields south facade of terminal. Window is supported by cable trusses.
ABOVE LEFT: Top-level access road is designated for private vehicles only. Glass-enclosed vestibules accommodate waiting passengers.
TOP: Peaked roof shields clerestories in the largest enclosed tensile-roofed building in the world.
ABOVE: Canopy shelters passenger side of arriving cars, protecting travelers from the elements.





NICK MERRICK / HEDRICH-BLESSING PHOTOS

PRECEDING PAGES: Glassy south wall of terminal looks out upon vacant prairie where, planners hope, new airport will generate development.
TOP: Train depot in main terminal features clocks showing time in cities around the world.
ABOVE: Glass block walls bring daylight into international arrivals area, with large baggage carousels.
ABOVE RIGHT: Fiberglass roof over Great Hall is light enough for plants.
FACING PAGE: Waiting areas in Great Hall are defined by green oases. Crows' nests on each column house lighting and ventilating equipment. Clerestories and fiberglass roof make the terminal bright enough for sunglasses on sunny days.

ELREY JEPPESEN TERMINAL
DENVER, COLORADO

ARCHITECT: C.W. Fentress J.H. Bradburn and Associates, Denver, Colorado—Curtis W. Fentress (principal-in-charge of design); James H. Bradburn (principal-in-charge of technology); Thomas J. Walsh (project manager); Michael O. Winters (project architect); Barbara Hochstetler (director of interior design); John Salisbury, Galen Bailey, Todd Britton, Rick Burkett, James Carney, James Carpenter, Brian Chaffee, Garrett Christnacht, John Gagnon, Katie Galvin, Mike Gengler, Greg Gidez, Warren Hogue, Doris Hung, Charles Johns, Anthia Kappos, Michael Klebba, John Kudrycki, Lauren Lee, Robert Louden, Mike Miller, Gary Morris, Jack Mousseau, A. Chris Olson, Brian Ostler, Teri Paris, Fred Pax, Brit Probst, Robert Root, Tim Roush, Amy Solomon, Joseph Solomon, Les Stuart, Dave Tompkins, Sam Tyner, Mark A. Wagner, John Wurzenberger, Jun Xia (design team)
ASSOCIATE ARCHITECTS: Bertram Bruton & Associates; Harold Massop Associates; Pouw & Associates
ENGINEERS: Abeyta Engineering Consultants, Black and Veatch, Riegel Associates, Roos Szynskie, Swanson Rink (mechanical/electrical); CTL/Thompson (geotechnical); HDR (civil); Hesselberg Keesee & Associates (elevator); Martin/Martin, S.A. Miro (structural/civil); Severud Associates Consulting (structural)
CONSULTANTS: Aerospace Services International (security); Architectural Energy Corporation (daylighting/energy); Carl Walker Engineers, Parking Dynamics (parking); Heitmann & Associates (curtain wall); Howard M. Brandston & Associates, LAM Partners (lighting); Rolf Jensen & Associates (code); RWDI (air quality); Shen, Milsom & Wilke, David L. Adams Associates (acoustics); Thomas Ricca Associates (food service); TKD (graphics); TRA (signage)
GENERAL CONTRACTOR: Western Industrial Contractors
COST: $3.2 billion
PHOTOGRAPHER: Timothy Hursley, except as noted

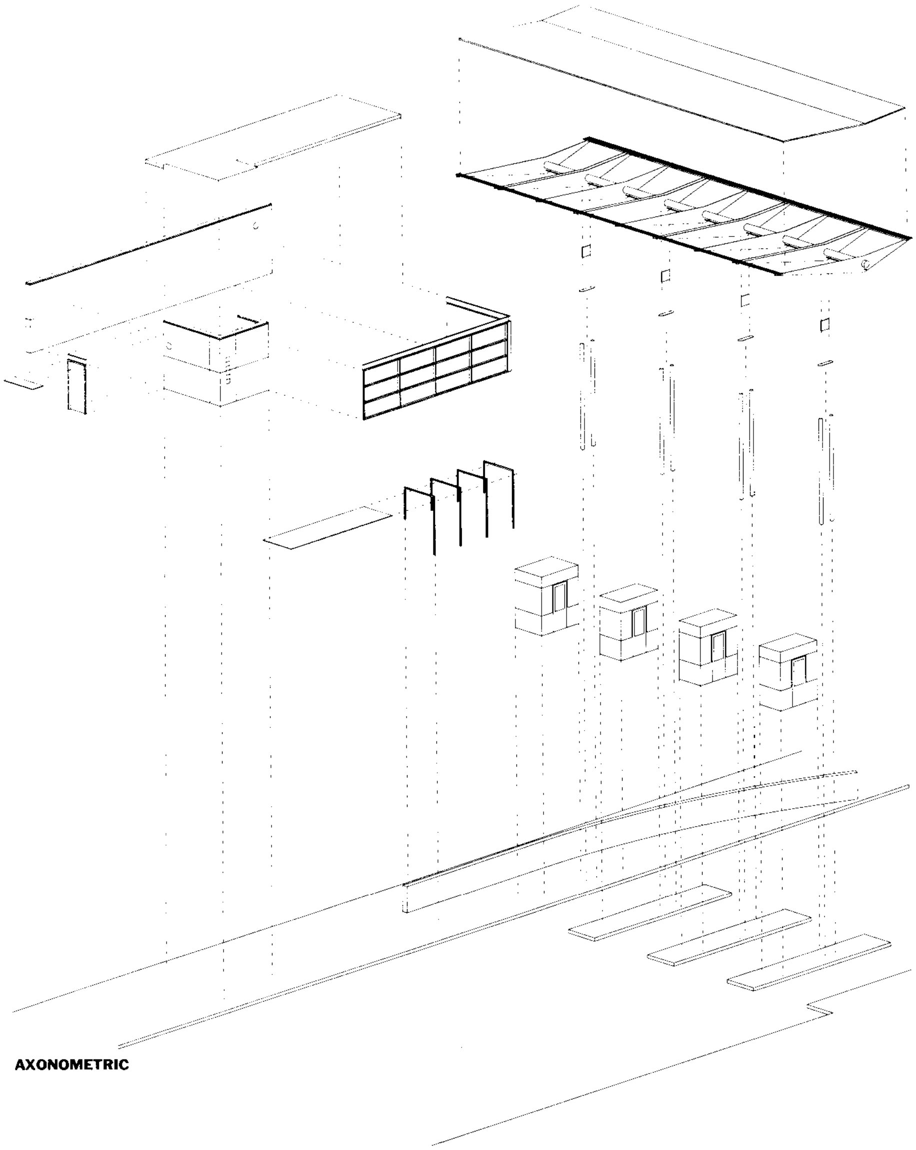

↓ to all Concourses ↓
to all
Concourses
Baggage
Claim
Ground
Transportation
Parking

Midway Airport Exit Toll Plaza
Chicago, Illinois
A. Epstein and Sons
International, Architect

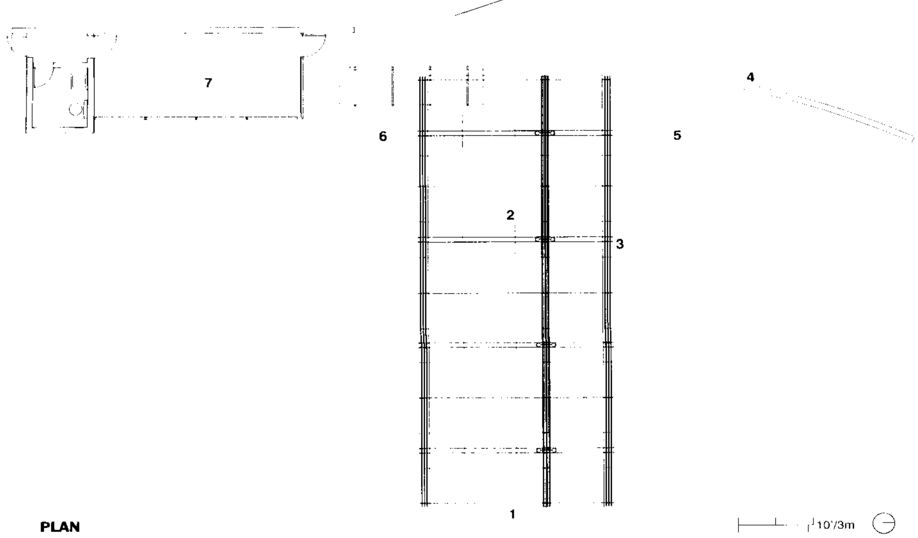
URBAN GATEWAY

SCOTT MCDONALD / HEDRICH-BLESSING

THESE PAGES: At night, cantilevered canopy of Midway Airport functions as a reflector to illuminate toll booths and guide motorists to exit. **LEFT:** L-shaped composition includes vehicular canopy, four toll booths, small pedestrian canopy, and an office wing of stucco-clad concrete block and aluminum-framed windows.



AXONOMETRIC



PLAN

1 LARGE CANOPY
2 TOLL BOOTH
3 ISLAND
4 GARDEN WALL
5 WALKWAY
6 SMALL CANOPY
7 OFFICE

The relentless residential grid of Chicago's South Side has strangled any expansion of Midway Airport; the only way to grow is up. That's the design direction followed by architect Andrew Metter for the airport's new toll booth plaza. Aloft in V-shaped formation, its tapered canopy projects into space like the spiky tail fins on a 1950s Cadillac. Metter, who is a vice president of A. Epstein and Sons International, has created a canopy that functions as signage, weather protection, and urban gateway—Chicago's panoramic skyline instantly attracts motorists as they leave the airport.

The canopy is scrupulously detailed in the manner of other Chicago-based metal maestros, from Mies van der Rohe to Skidmore, Owings & Merrill. Four pairs of pipe columns provide support, because Metter decided that two slender pipes instead of a massive column would de-deemphasize visual bulk and help stabilize the canopy's asymmetrical cantilevers against uplift loads. One column is in tension, the other in compression. At each double column, two pairs of structural steel Ts meet to form a V and conceal a downspout. Intermediate single Ts are supported by a horizontal pipe, a visually articulated spine-like element that holds the design together.

The vehicular canopy is only the most dramatic component of four standard-design toll booths: Clad in steel panels with flush windows, the booths have metal-halide light fixtures on their roofs to illuminate the canopy's underside. An office wing of stucco-clad concrete block shields the toll plaza from a parking lot to the west. In the office box, an aluminum window wall of translucent glass partially obscures office detritus; panes of clear glass permit supervisory personnel to observe the toll booths.

A small pedestrian canopy slides under the larger vehicular one, visually connecting office and toll booths. The awning of the pedestrian canopy is plastic-coated fabric held in taut tension by turnbuckles attached to a pergolalike structure of steel pipes. Metter notes that the different structural strategies of the two canopies reflect what happens as function changes and scale diminishes: Materials become lighter, and tension plays a greater structural role than compression.

The Midway Airport Exit Toll Plaza is especially noteworthy because its client is a city agency. But Chicago is no ordinary city when it comes to buildings, and designers like Metter are the most recent wave of civic-minded Modernists to lift the city's architectural spirits.—*Donald Albrecht*

LEFT: Larger side of canopy cantilevers 18 feet, 4 inches over tapered steel Ts supporting metal-deck roof and is feathered at ends by steel pipes. **CENTER LEFT:** Pedestrian canopy slips under vehicular one. Plastic-coated fabric awning stretches via turnbuckles to welded pipe structure. **BELOW LEFT:** White stucco wing includes glazed office and opaque bathroom, with pedestrian canopy at left.

MIDWAY AIRPORT EXIT TOLL PLAZA
CHICAGO, ILLINOIS

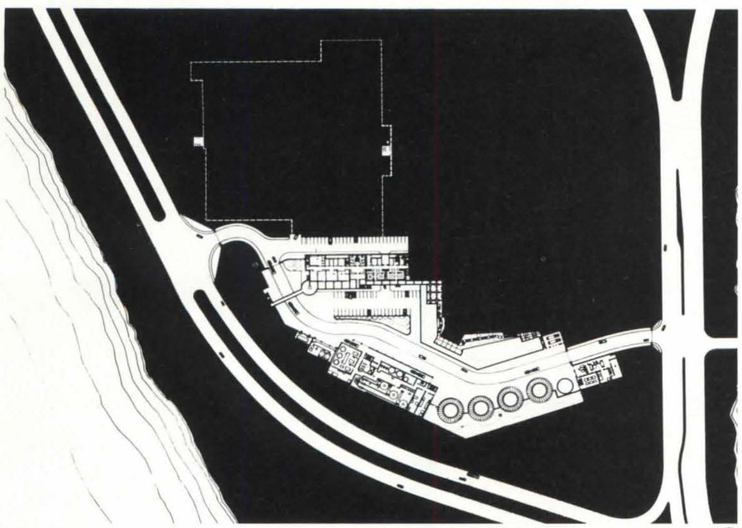
ARCHITECT: A. Epstein and Sons International, Chicago—Andrew Metter (principal designer/project architect); Michael Damore, John Talbot (design principals); Gary Alden (project manager); Steve Beck, Marek Mietka, Jack Naffzinger, Boris Vukovic, Perry Georgopoulus (design team)
LANDSCAPE ARCHITECT: Nancy Hannick
ENGINEERS: Rubinos & Mesia (structural); A. Epstein and Sons (mechanical/electrical/civil)
GENERAL CONTRACTOR: Mellon-Stuart
COST: Withheld at owner's request
PHOTOGRAPHER: Barbara Karant, except as noted

Oceanside Water Pollution Control Plant
San Francisco, California
Simon Martin-Vegue Winkelstein Moris, Architect

ECOLOGICAL CONTROL

PRECEDING PAGES: San Francisco's new pollution control plant is located at the western edge of the Golden Gate National Recreational Area.
BELOW: The wastewater treatment plant shares land with the San Francisco Zoo and abuts the National Guard Armory. Built two-thirds underground, it surrounds a man-made canyon and is concealed by a berm.
SITE PLAN: Compact plant layout, at the southernmost edge of the site, is as far away as possible from the zoo. Two-story north facility (top) comprises administration, lab, and exhibit space, as well as water treatment tanks. Three-story south facility (bottom) contains treatment processes.
FACING PAGE: Anaerobic digesters (left) and stacks stand free within the canyon, but are not visible from either the zoo or highway.

AERIAL IMAGES SFCA



SITE PLAN 100'/30m

Sewage water treatment plants tend to rank high in the "not in my backyard" category of public facilities because they often smell, look bad, vibrate, make noise, and swallow up vast waterfront acreage that citizens would rather see used for some more attractive public purpose, such as recreation. Essential as sewage facilities are, it is becoming more and more difficult to build them unless they are odor- and fume-free, almost invisible, silent, and partially buried underground to support usable land on the roof. San Francisco's new Oceanside Water Pollution Control Plant, constructed for and managed by the San Francisco Department of Public Works (DPW), meets these criteria. Otherwise, the massive industrial facility, which serves the western half of the city, would not have been built.

Credit for the technological success of the project goes to the civil engineering firm CH_2M Hill, the prime consultant for the plant. The firm's environmental engineering innovations include enclosing the plant processes to capture odors and constructing four egg-shaped anaerobic digesters to take the place of conventional odorous cleaning procedures. It is as a work of architecture, landscape design, and site planning, however, that the water treatment plant is most notable.

In its role as consultant to CH_2M Hill, San Francisco architect Simon Martin-Vegue Winkelstein Moris (SMWM) effectively reconfigured and rearranged the huge interconnected water treatment plants to minimize their collective footprint and buried all but the digesters along the perimeter of a 1,000-foot-long man-made canyon, open to the sky.

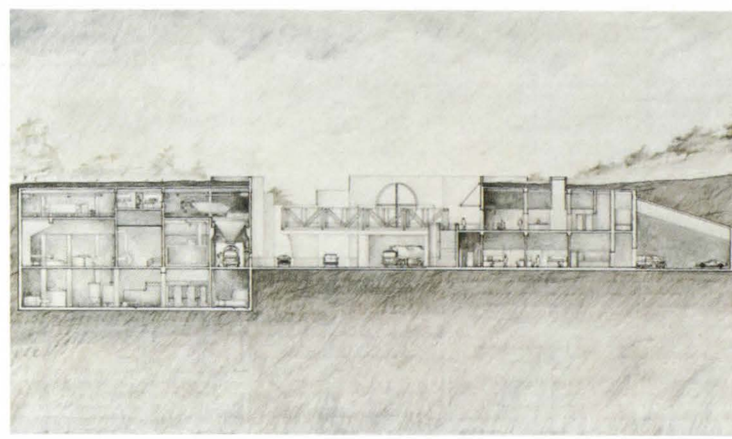
This dramatic engineering and architectural effort was demanded because of the ecologically and recreationally fragile environment of the treatment plant. The conveniently vacant 43-acre site chosen for the wastewater treatment plant borders Ocean Beach along the Great Highway at the western edge of the Golden Gate National Recreational Area and is typical of the Northern

FACING PAGE: Sloped, planted berms and terraced walkways follow northern perimeter of canyon. Checkerboard insets in concrete retaining wall will contain flowering plants.
BELOW: Extensive plantings, not yet mature, will soften canyon facades. Bridge connects pedestrian walkways between north and south facilities.
SECTION: Final process facility (left) and combined treatment plant and administration wing (right) enclose canyon.

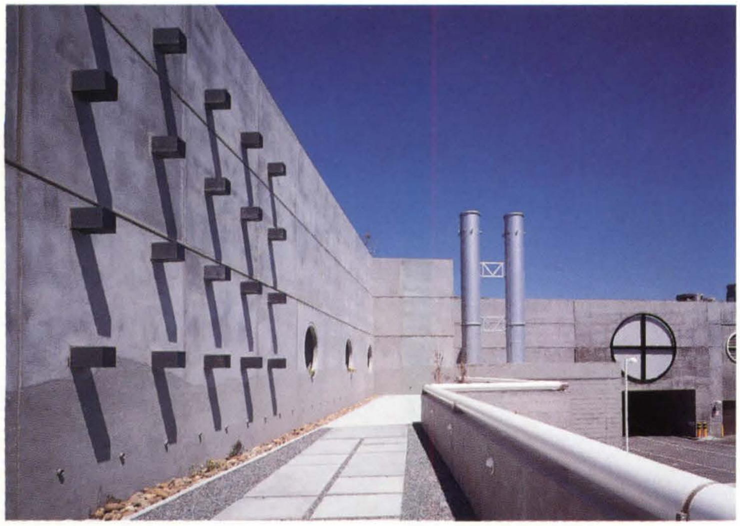
California Pacific Coast—a broad, flat, moderately sloping terrace atop a continuous low cliff bordering the beach and highway. To the north it adjoins, and is an extension of, the city's world-class zoo, a 105-year-old institution with more than 1.2 million visitors annually. Bordering the site to the east is fresh water Lake Merced, a popular spot for boating and fishing. To the south is historic Fort Funston. The citizens of the largely middle- and upper-middle-class residential communities surrounding this immense and vital aggregation of public recreational space had clout in dealing with the DPW and knew how to use it. So did the zoo.

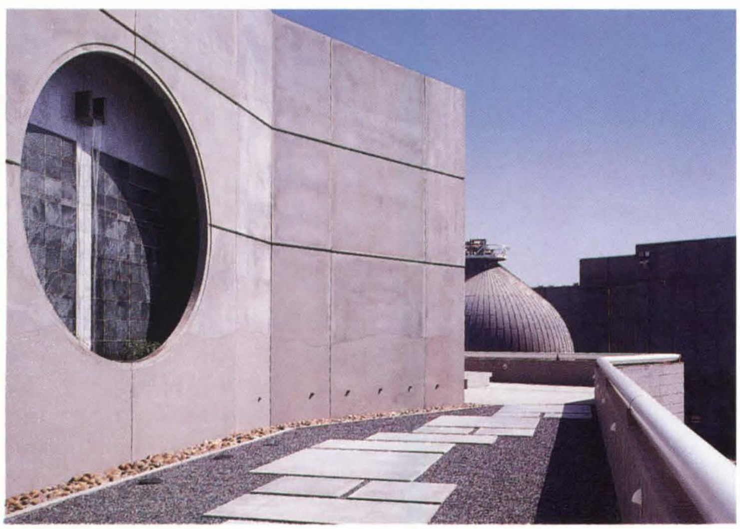
All the parties involved, including the zoo, community groups, and the San Francisco Recreation and Parks Department, voiced serious reservations about the environmental impact of joint use of the site by the wastewater treatment plant and the zoo. The DPW created a joint-use task force that included all the environmental players, as well as consultants CH_2M Hill and SMWM. Throughout the design and construction processes, each group participated in decision-making and monitored the implementation of mitigative measures. During construction, dust and noise were controlled, zoo animals were protected, and the experience of zoo visitors remained unaffected.

The design criteria for the plant required that it not be visible from the zoo or the Great Highway. A minimum of two-thirds of the building area had to be constructed underground, and 75 percent of the site had to be available for joint use by the zoo. The state-of-the-art sewage technology, which removes approximately 90 percent of the pollutants in the waste stream finally discharged into the Pacific, begins in the north facility that contains an extensive series of underground tanks for primary and secondary water treatment; chlorine contact basins; as well as offices, labs, and public viewing and exhibit spaces. The south facility contains the remaining process buildings. There, the pre-



BELOW: Paved visitor walkways will eventually be lined with trees. Wall projections will support plants.
BOTTOM: Concrete cutout frames a wall of water flowing down marble face.
FACING PAGE: Egg-shaped anaerobic digesters are visible from the canyon floor and its walkways.





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OCEANSIDE WATER POLLUTION CONTROL PLANT
SAN FRANCISCO, CALIFORNIA

ARCHITECT: Simon Martin-Vegue Winkelstein Moris, San Francisco—Cathy Simon (design principal); Alan Stiles (project architect); Linus Stempuzis (project manager); Bob Diaz (administration); John Long, Mark Zall, Keith Wilson, Ann Hawkinson, Bob Jochnowitz, Katherine Anderson, Robin Severns (design team)
LANDSCAPE ARCHITECT: Royston, Hanamoto, Alley & Abbey
ENGINEER: CH_2M Hill (structural/electrical/mechanical)
CONSULTANT: S. Leonard Auerbach & Associates (lighting)
GENERAL CONTRACTOR: Olsen-Ohbayashi
COST: Withheld at owner's request
PHOTOGRAPHER: Jane Lidz, except as noted

treatment and energy recovery buildings are organized in a linear path. In the canyon between the north and south complexes are roadways, parking, and four egg-shaped anaerobic digesters, which are positioned in a manner that sets them off as handsome freestanding industrial objects. Used extensively in Europe, these digesters are among the first to appear in the United States.

SMWM's compact site plan places the plant as close as possible to the southern boundary of the site to maximize its distance from the zoo and to take advantage of the favorable slope for drainage at that location. The canyon is entered and exited by tunnels. Architect Cathy Simon explains that the building facades and retaining walls that enclose this immense outdoor room "build on the metaphor of a canyon, carved into the earth over time by natural forces." Surfaces are banded horizontally as though subsequent geological layers have been exposed, and the horizontal stratifications identify the various layers of activities that take place within the plant. The plant roof is designed to carry a 6-foot overburden of drainage rock, soil, ground cover, shrubs, and trees, plus a 300-pounds-per-square-foot live load to accommodate the large, hoofed zoo animals that will range across it.

One of the most important attributes of the new San Francisco plant is that, although virtually invisible from the outside, its interior is open to visitors. The canyon, when the plantings mature, will form a walled, terraced, semipublic garden. Cathy Simon hopes the public, on conducted tours of the waste treatment process, the labs, and exhibits, will learn a lesson that the plant's well-organized and focused architecture will help teach. In her words, "At the end of the 20th century, an ecologically responsible building project can also be a resonant public place, capable of interpreting an industrial process of great importance to people's lives." May we build more of them, now that we know how.—*Mildred F. Schmertz*

Berth 30
Port of Oakland, California
Jordan Woodman Dobson

SHIP TO SHORE

TOP: Maintenance/repair building (left) is connected to administration building (right) by a truss bridge. The tip of one of the terminal's two cranes can be seen in the background.
ABOVE: Four sets of pilotis are spaced to allow two-lane truck roadways to pass under administration block.
FACING PAGE: Curvilinear double-height control and observation room overlooks the wharf.

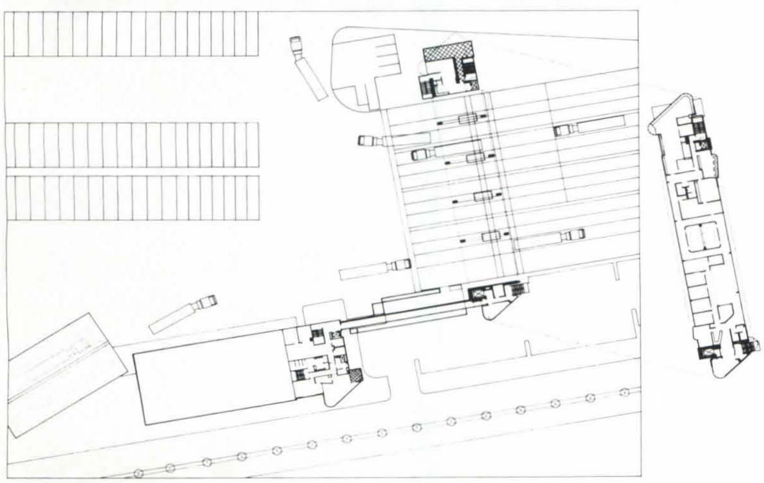
Pacific Rim refers to the geographic setting of the global trade launched from the necklace of vast marine terminals located in such places as San Francisco, Vancouver, Tokyo, Hong Kong, and Singapore. Anyone lucky enough to visit the new terminal, Berth 30, in the port of Oakland will have seen one of the most technologically advanced and beautifully designed port facilities on the rim. This terminal, for which the architecture and engineering firm Jordan Woodman Dobson provided complete services, was built for Trans Pacific Container Service Corporation (TRAPAC) and Mitsui O.S.K. Lines (America) Inc. (MOLAM) at a cost of $75 million that includes a wharf, two cranes, storage yard, and three buildings.

The client wanted a flexible site that would work efficiently from the start and allow future conversion to high-density container storage with little reconstruction. The building solution was to convey a memorable corporate image to the public. The architects gave the clients a magnificent high-tech transportation infrastructure, designed for 21st-century computer- and video-controlled methods of exporting and importing container freight. The first to open in Oakland since 1982, the terminal regulates, handles, and loads onto ships containers filled with fresh fruit and vegetables from California, chilled beef and pork from the Midwest, automobiles from Detroit, and countless other products manufactured in the United States. Containers of Asian products for our markets are simultaneously unloaded.

The 34-acre Berth 30 terminal site includes a 14,960-square-foot administration building, a 14,900-square-foot maintenance/repair structure, and a 5,200-square-foot marine operations building. The first functions as a command and computerized control center for the terminal's truck gate, container yard, ship, and information systems. The second, connected to the administration building by a truss bridge, houses facilities to maintain trucks and other equipment. The marine


TraPac
TraPac
FIRE HYDRANT

PRECEDING PAGES: Opposite ends of the administration building are accented by curvilinear elements oriented for control and views. Exposed steel stairs and truss bridge share the high-tech esthetic of the cranes.
BELOW: Control room, yard, ship, containers, and truck chassis can be seen from visitors' balcony.
PARTIAL SITE PLAN: Maintenance/repair building (lower left) is connected by bridge to administration building (right) spanning truck lanes. Third floor plan of administration block is shown at right. Site incorporates vast container storage yard (upper left).
FACING PAGE: Control room projects north toward the water. Administration building is skinned in porcelain-enameled metal panels.



PARTIAL SITE PLAN

40'/12m

BERTH 30
PORT OF OAKLAND, CALIFORNIA

ARCHITECT: Jordan Woodman Dobson, Oakland—Richard A. Woodman, Frank A. Dobson (principals-in-charge); Carl Groch (managing architect); Clifford Chang (design architect); Sugiarto Loni, Sara Anne Towery, Constance MacAdam, Bruce Cameron, Eugene Gatison, Jr., Gille Wilbanks, Wilson Tsang (design team)

LANDSCAPE ARCHITECT: Singer & Hodges
ENGINEERS: Liftech Consultants (structural); McCracken & Woodman (mechanical/plumbing); Belden (electrical/lighting)
CONSULTANTS: Pei Shang Yu & Partners (interior design)
GENERAL CONTRACTOR: OC America Construction
COST: $75 million
PHOTOGRAPHER: Tom Paiva

operations building, located by the wharf, allows vessel and wharf operations to be monitored and controlled, and dock container cranes to be repaired. The rest of the site comprises a vast container storage yard with truck entry and exit lanes.

Jordan Woodman Dobson (JWD) gave the trio a slick, machined image with structure and function clearly expressed to match the technological beauty of the port's industrial equipment—the stately cranes slowly moving back and forth as they lift and lower the containers; fork lifts scuttling from ship to truck to container pile; and scores of trucks hauling the containers in and out.

Clifford Chang, a young JWD associate who served as design architect for the structures, took his cues from the Modernist manner of Richard Meier. Pushing Meier's style to a level of elegance that the master himself strives for, Chang designed the metal-paneled administration building as the showpiece of the three structures. Supported on pilotis, it bridges over the truck entry and exit lanes to conserve yard space and give the terminal staff and operators a better view of surrounding operations. This position makes the building more visible from the street.

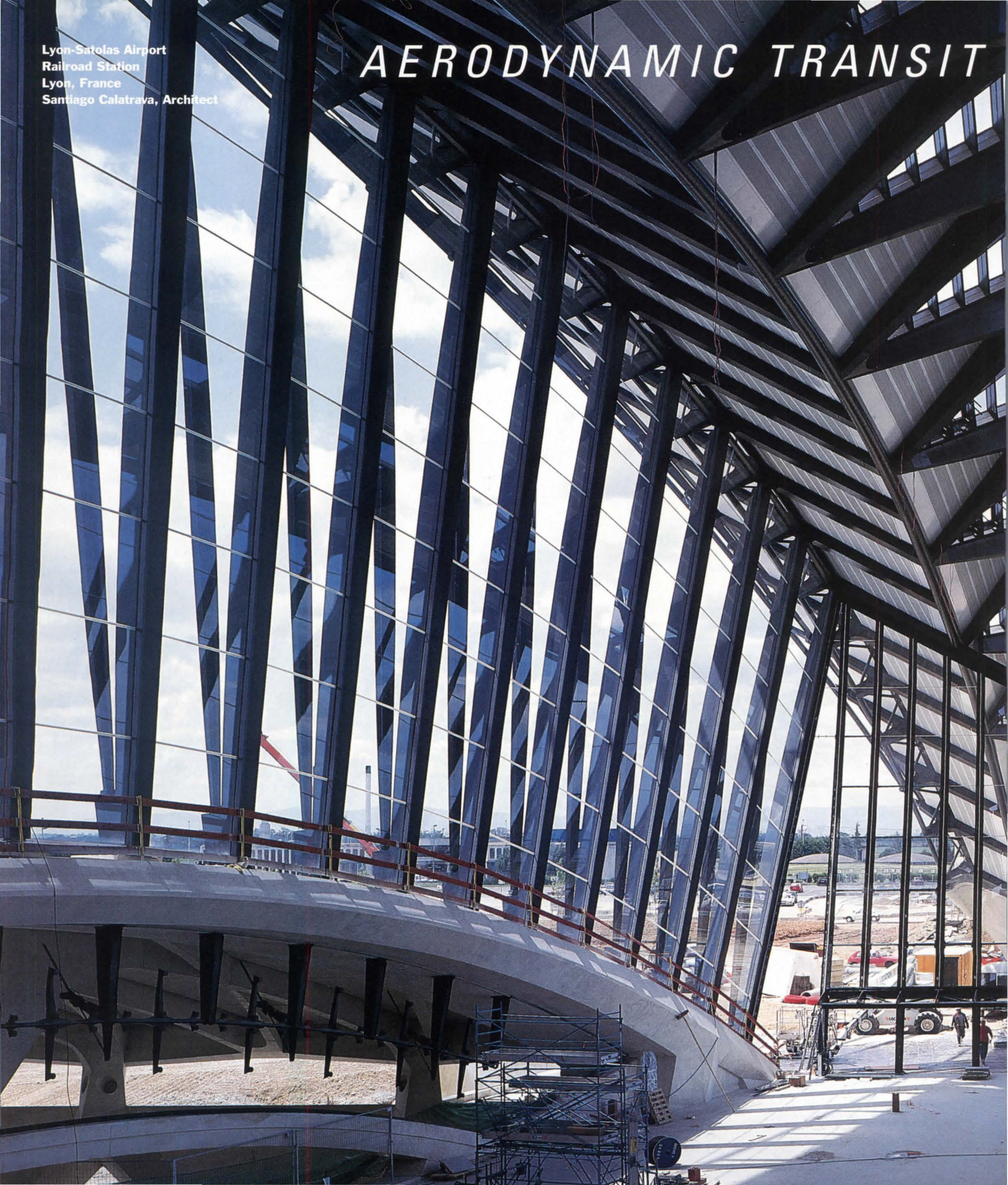
Chang explains that the columns supporting the building above the truck lanes were designed to be movable to change the number or configuration of the lanes. Three-storied curvilinear forms cantilever at both ends of the structure and abut exposed steel stairs. Exposed steel-braced frames and the large free-span truss bridge share the high-tech image of the adjacent container cranes.

The maintenance/repair and marine operations buildings, more industrial by type and function, utilize a tilt-up concrete system with steel frame. The concrete, painted white, is finished in a groove pattern that matches the administration building's porcelain panel module. All three buildings incorporate curvilinear cantilevered elements clad in metal panels and oriented toward views. These curving forms have standardized, identical radii affording economies of fabrication.

Al Melvin, district manager of Mitsui O.S.K. Lines, the parent company of TRAPAC and MOLAM, believes state-of-the-art Berth 30 to be the company's "best sales tool." Melvin views the buildings as designed in such a way as to educate customers about how cargo in containers moves intermodally from train to truck to ship in the shortest time possible. As he notes, "One hour visiting Berth 30 is a real lesson in international trade."—*Mildred F. Schmertz*

Lyon-Satolas Airport
Railroad Station
Lyon, France
Santiago Calatrava, Architect

AERODYNAMIC TRANSIT

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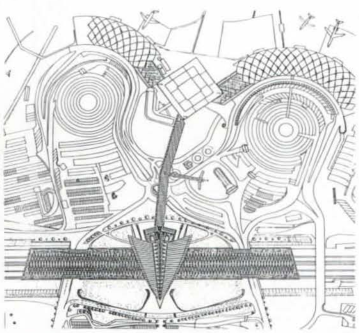


SITE PLAN

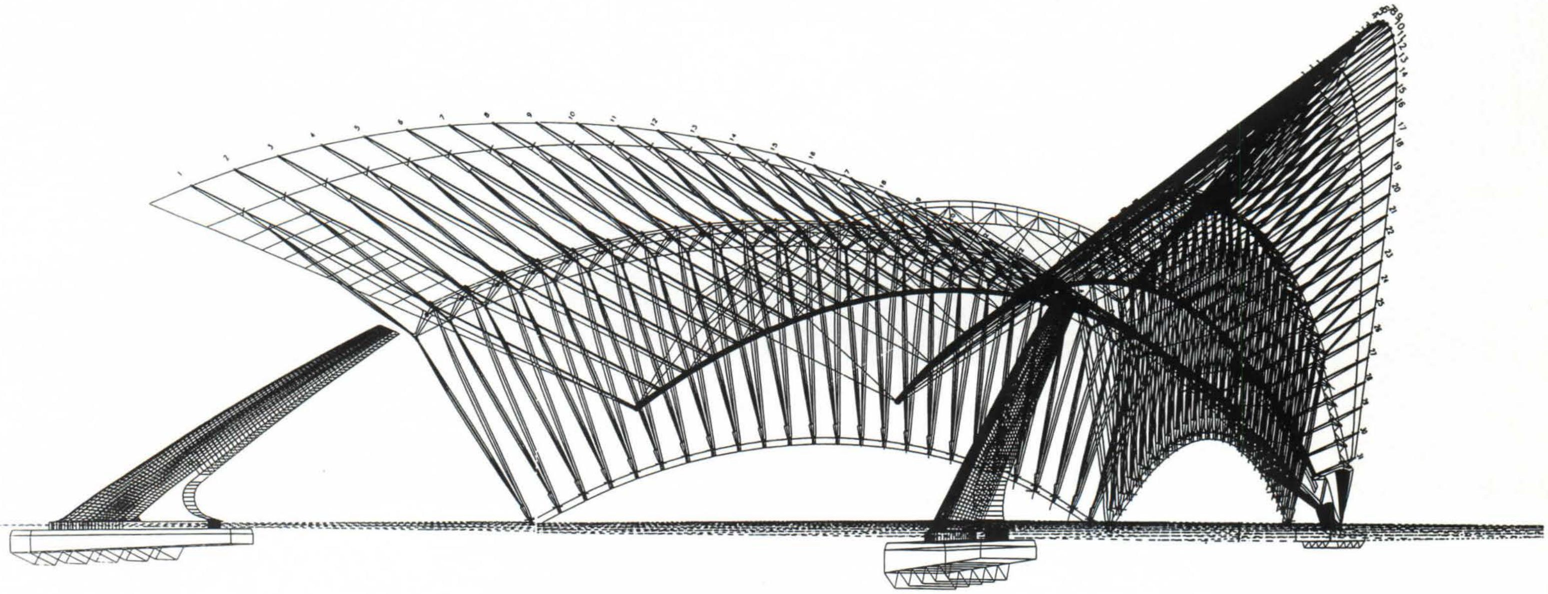
PRECEDING PAGES: Steel structure of central hall spans concrete base. **SITE PLAN:** Pedestrian bridge (center) links airport (top) to station (bottom). **BELOW:** Aluminum roof and metallic structure of pedestrian bridge to airport echo vocabulary of central hall. **BOTTOM:** Concrete buttresses support metal stair to pedestrian bridge. **BELOW RIGHT AND FACING PAGE:** Wings are clad in reflective aluminum. **DRAWING:** Torsion ring trusses at center of wings are buttressed by concrete.

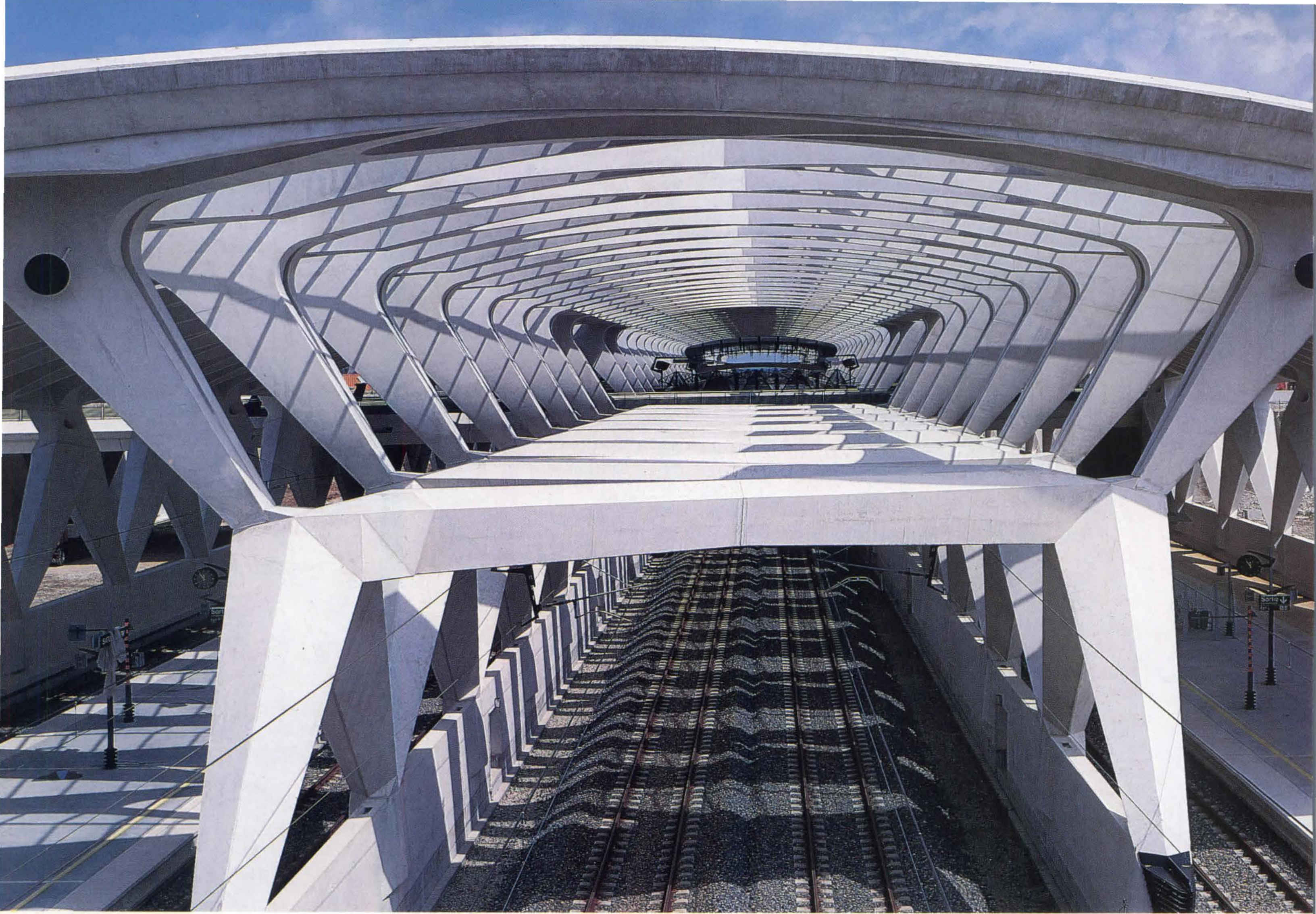
France may still be a land of old-fashioned artisanry, but it is also a world leader in high-tech infrastructure. The new high-speed, 300 km/hour *Train Grande Vitesse* (TGV) train system—linking the provincial capitals of France to the rest of Europe—is the most salient example. The development of TGV trains in the early 1980s led the *Societe Nationale de Chemin de Fer* (SNCF) to rethink the entire fabric of tracks and train stations, the stations' imagery, and their integration with other transportation systems and surrounding environment. The modern train station should be a gateway, the SNCF insisted, maintaining its visual identity despite often indistinct borders.

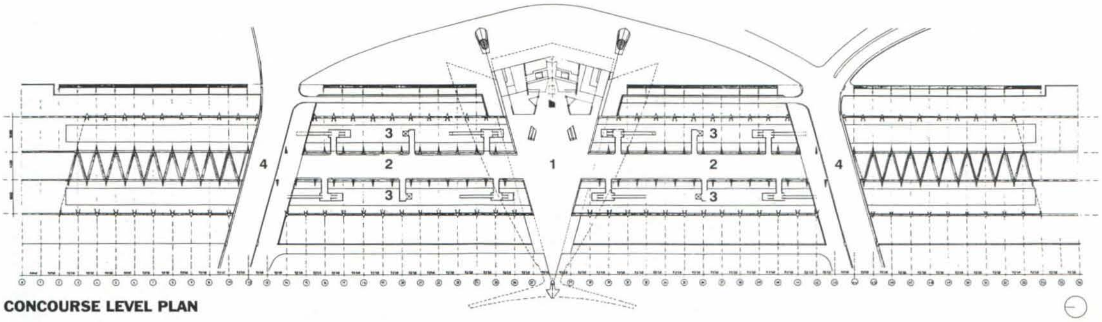
The tremendous revolution in thinking at the SNCF was largely the result of dynamic forces unleashed by its Director of Development Jean-Marie Duthilleul, a 41-year-old engineer and architect trained at the Ecole Polytechnique and Ecole des Beaux-Arts in Paris. Since he began working with SNCF in 1986, Duthilleul has turned an immense bureaucracy on its head, enabling politicians, technocrats, bankers, and engineers to see train transportation afresh and innovate clear solutions to the infernally complex problems of high-tech modern transportation.

One example is the new train station located at the Lyon-Satolas Airport. Designed in 1968 by French architect Guillaume Gillet, the airport features two semicircular airside buildings and repetitive pyramidal concrete roof forms, separated by a square office building. The new Satolas Airport TGV station, begun in 1987 and opened last month, offers the first direct connection for passengers and freight between high-speed planes, trains, and cars: The French call it a "multimodal platform." Located to the west of the airport complex on the main line between Paris and Lyon, the station incorporates full-speed through-trains.

Designed by Santiago Calatrava in collaboration with Duthilleul, the station is visually

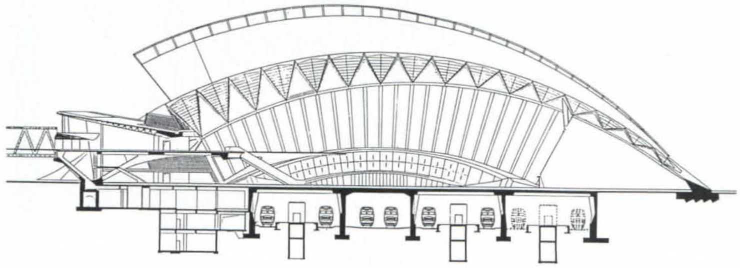






CONCOURSE LEVEL PLAN

1 MAIN HALL
2 CONCOURSE
3 PLATFORM
4 ACCESS ROAD TO AIRPORT



EAST-WEST SECTION THROUGH CENTRAL HALL AND TRACKS

EAST-WEST SECTION THROUGH TRAIN SHED

organized to orient people approaching in all directions. Gone are endless, sightless corridors down which people grope molelike, and mazes of approach roads that bear no relation to their objective. At Satolas station, tracks are constantly revealed; the approach roads pass across and under the rail canopy.

Calatrava, a Spanish architect and an engineer who maintains offices in Paris and Zurich, follows in the great Spanish creative structural tradition of Antoni Gaudí, Eduardo Torroja y Miret, and Felix Candela. Despite their similarities in training and age, the 42-year-old Spaniard and SNCF's Duthilleul brought quite different and complementary skills to the Lyon airport project. Calatrava admits to being disinterested in plans ("Beauty is in the section," he says) and prefers to have them handed to him. Duthilleul and his team are masters of planning that responds to complexity and contradiction and fulfills high-tech requirements. Their ability to turn an intricate program into a clear parti freed Calatrava to concentrate on what he does best: sculpting articulate structures with brilliant technical ingenuity.

Apart from his elegant Maillart-like suspension and cantilevered bridges, Calatrava's main structural obsessions are folded plates and girders, and torsion (spiraling stress) rings. These are statically determinate structures, forms generated from moment diagrams.

At Lyon, Calatrava stitches together a sampler of his main motifs. The 500-meter-long nave over the train tracks is formed from highly refined white concrete, poured-in-place to create 53-meter-wide vaults of slender ribs on a 9.3-meter structural bay. This lamellalike mesh is similar in geometry to a folded-plate membrane with maximum material removed, leaving only the folds. By reducing the surface of the canopy to linear elements, light can be let in at will. Some panels are glazed, others closed by white concrete panels, others left open, creating diffused light and a mystical spatial quality.

Unfortunately, Calatrava has hidden all this lacy beauty from the outside, covering

FACING PAGE, TOP: View into train nave shows through-train enclosure below promenade deck (center) and accessible train platforms (left and right). **BELOW LEFT:** Edge of train nave reveals concrete buttresses, aluminum ribbed roof, and pyramidal skylights. **BELOW:** Steel roof structure is exposed on cantilevered wings of central hall. **BOTTOM AND FOLLOWING PAGES:** Concrete structure of train nave contrasts with steel construction of central hall.


3
5


4
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BELOW: Buttresses in train nave support latticelike, concrete vaulting with glazed sections.
BOTTOM: Concrete wall in Lyon-Satolas station separates through-train tracks from passenger platforms.
BELOW RIGHT: Steel clocks are among new standard furnishings that were specified for TGV stations.
FACING PAGE: A pedestrian overpass bridges between promenade deck and concrete stair to train platform.

the long, central barrel vault of the train station with hangarlike ribbed aluminum, from which pyramidal glazing structures jut toward the sky. Passengers buy tickets at the center of the station in the glass-enclosed, 40-meter-high central hall, where metal torsion-ring structures support an aluminum roof and winglike cantilevers. Spanning astride the center of the train nave, it theoretically touches the ground at three concrete support points only. The link from the train hall east to the airport is a 200-meter-long, double-span metal bridge employing Calatrava's asymmetrical cantilever techniques.

The main hall has been likened to Eero Saarinen's birdlike TWA terminal: Its main rationale is to create a visual image for the complex from the ground and air. Alas, approaching from land, the arched profile of the main hall appears more like a bristling porcupine than a bird. Its structural metal is black, against infill panels of white, and its exposed outer ribs form projecting spines, rather than delimiting a volume. From within, the heavy, closely set black members seem overstructured, earthbound, too dense. These oversized members obscure the relationship between the structure of the roof and the support of the glazing.

Additionally, the spines that hang suspended over air in Calatrava's elegant engineering drawings rest on a massive concrete arch, one on each side. These arches bear most of the weight, rather than the three "bearing" points where the upper metal arches meet the ground.

Nonetheless, the Lyon-Satolas Airport Railroad Station well justifies its existence on functional grounds: Calatrava and Duthilleul have synthesized and resolved the competing spatial requirements of an existing airport and new train station. The project best succeeds in the train station's nave, where the technical constraints of the program were greatest. There, Calatrava has turned great structure into art.—*Barbara Shortt*

LYON-SATOLAS AIRPORT RAILROAD STATION
LYON, FRANCE

ARCHITECT: Santiago Calatrava, Paris, France—Santiago Calatrava (principal); S. Mémet (project architect, track canopy); A. Bourrat (project architect, main hall); P.O. Comarteau, P. Deyris, P. Videgrain (design team, track canopy)
ENGINEERS: BEIT (track canopy); Serete (main hall)
CONSULTANTS: Léon Grosse (concrete superstructure, track canopy); GTM Group (concrete infrastructure, track canopy); Beretta-Girardet (glazing, track canopy/main hall); E.I. Group (aluminum, track canopy; concrete, main hall); Eiffel (metal structure, main hall)
COST: $150 million
PHOTOGRAPHER: Luc Boegly

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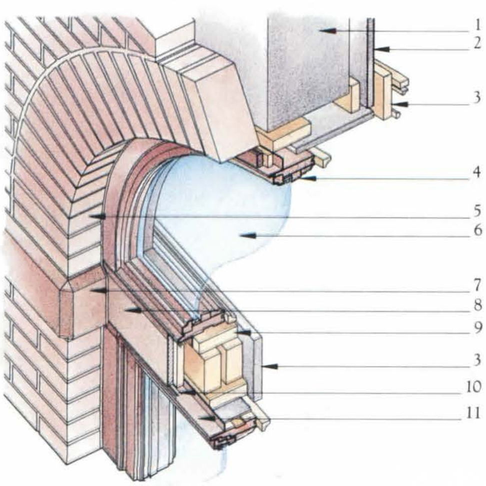

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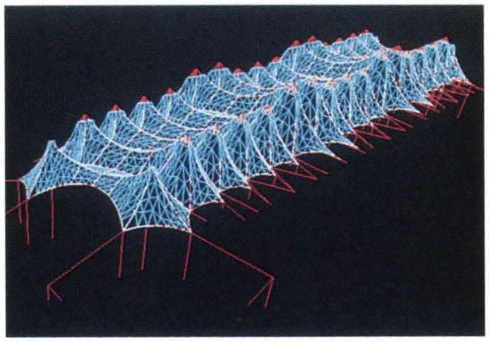
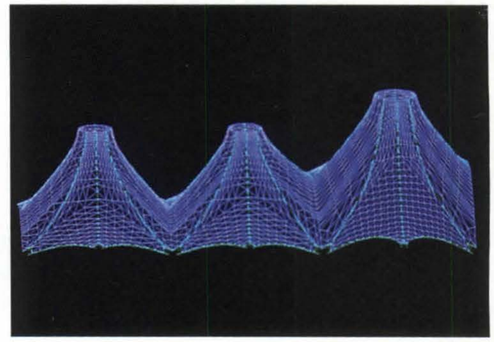
Technology & Practice





RON JOHNSON

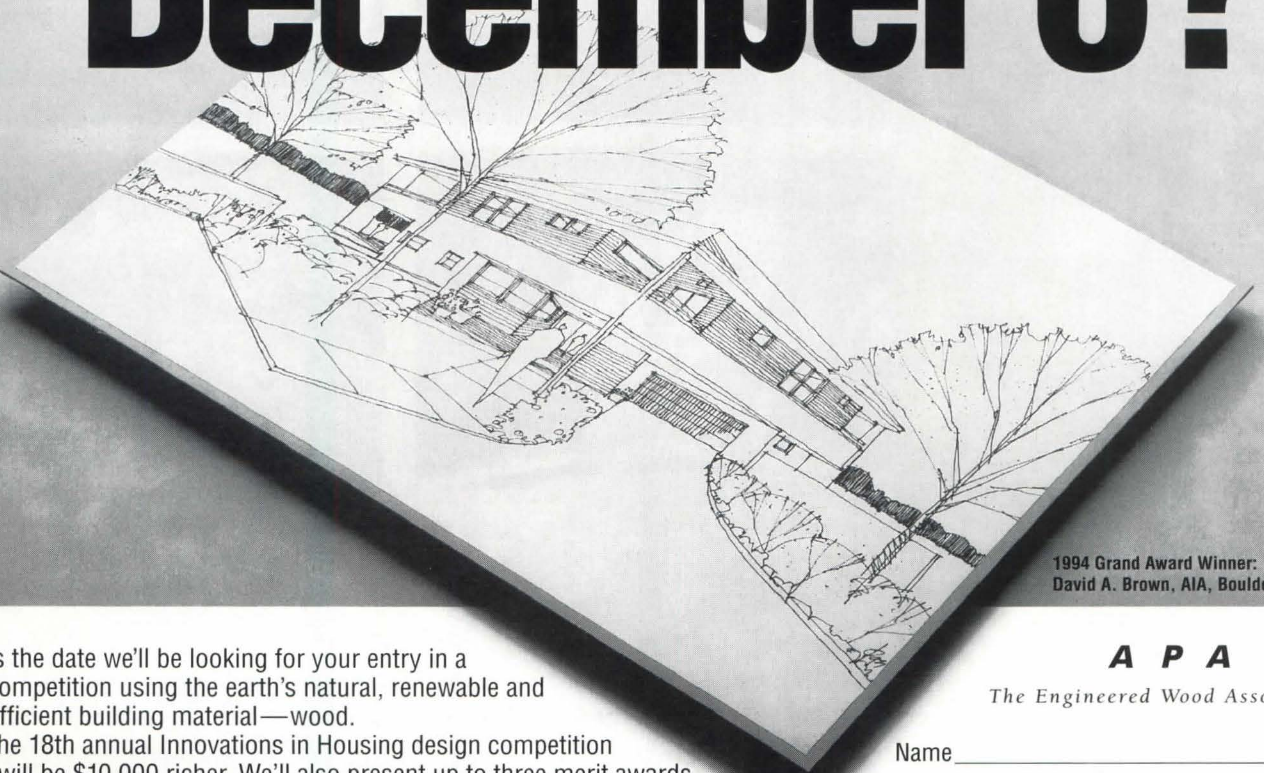
This month's Technology & Practice section focuses on the transformative power of design: fabric systems that are tensioned into sculptural roofs; new software that helps architects to generate complex, irregular building geometries; and the conversion of military bases into new civilian uses.

Architects have only recently begun to explore the form-making potential and environmental benefits of **tensile fabric roofs**. A feature on the new fiberglass roof over the Denver Airport reveals the latest developments in this innovative technology.

Sophisticated software is liberating architects from the constraints of rectilinear buildings, allowing them to explore **complex geometries** on the computer. These inventive programs enable architects to generate intricate forms in the earliest design stages. By sharing electronic data with the building trades, the cost of constructing such elaborate forms can be kept surprisingly low.

Firms of all sizes are tapping into the new large-scale urban design opportunities created by dozens of **military base closings**. Architects are proposing new uses for the facilities, including research complexes, housing, and airports, while advising local and regional leaders on how to reintegrate these isolated enclaves into surrounding communities. Such transformations challenge architects to apply a range of skills—from building preservation to community planning.

Do you have plans for December 6?



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Denver's Tensile Roof

The world's largest enclosed fabric roof demonstrates new structural possibilities.

BOTTOM RIGHT: Covering 250,000 square feet, the airport's distinctive roof is constructed of a Teflon-coated, woven fiberglass membrane stretched between 17 pairs of masts.

From its very inception, the innovative tensile fabric roof atop the main hall of the new $3.2 billion Denver International Airport (this issue, pages 44-53) faced public skepticism: A political cartoon once depicted former mayor Frederico Peña grabbing hold of a roof section being blown off the terminal in a wind gust. The caption dismissed the tentlike structure as Peña's "Barnum & Bailey airport." But the terminal's roofing system, designed by architects C.W. Fentress J.H. Bradburn and Associates of Denver in collaboration with New York City-based structural engineers Severud Associates, is a far cry from a circus tent. The 1,000-foot long, lightweight woven fiberglass roof that lends the building its signature form allows for greater spans than traditional roofing systems, decreases maintenance and construction costs, and increases durability. And even in Denver's climate of heavy snowfall and cold temperatures, the tensile fabric enclosure promises an energy-efficient roofing solution.

Roofing alternatives

Charged with creating a roof that would serve as an architectural symbol for the city of Denver, partners Curt W. Fentress and James H. Bradburn initially considered traditional steel and concrete roofing systems for the new terminal; both materials could be sculpted into expressive profiles such as the concrete roofs of Eero Saarinen's Dulles International Airport (1958-62) and TWA Terminal at New York's JFK Airport (1956-62). But the architects turned to a tensile fabric system, not only to evoke the snow-capped Rocky Mountains or a native Indian tent encampment through a peaked form, but also to meet a tight construction schedule. Because a tensile roof could be erected quickly, with less on-site work than other systems, construction could begin sooner on the interior. Tensile structures also offer an economy of materials: The fabric membrane acts as both primary structure as well as enclosure. And while most roofing systems must be replaced every 10 to 15 years, a Teflon-coated fiberglass roof can last upwards of 30 years, according to Amherst, New York-based manufacturer Birdair.

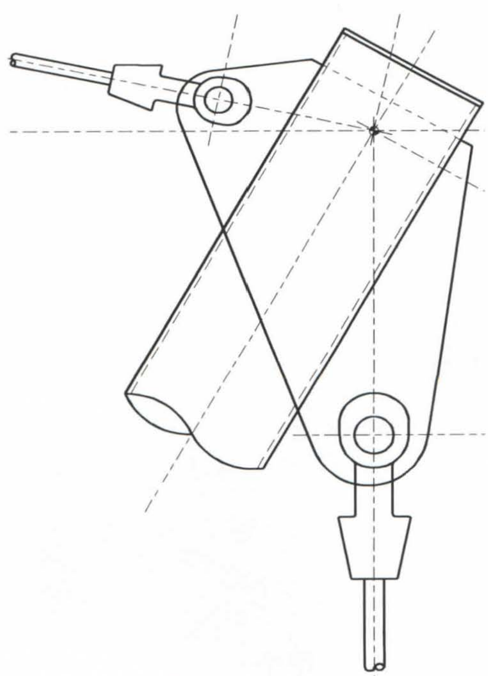
Site conditions

Fentress and Bradburn also chose fabric over steel and concrete because of existing site conditions. Composed of expansive clay, the top layers of the soil on which the airport is built do not absorb lateral or seismic loads well; these loads must instead be carried down 20 feet to 50 feet below grade to the more structurally stable soil known as "Denver blue bedrock." Because a tensile structure flexes in response to changing forces, lateral loads are absorbed primarily by the building itself. In addition, the roof's aerodynamic shape helps deflect wind and minimize its load on the building. The loads transferred into the ground are therefore significantly less than those of a steel or concrete structure.

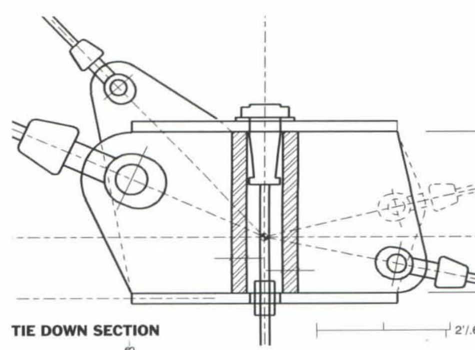
TIMOTHY HURSLEY

RIGHT: Airport's 900-foot-long roof structure is tied down by combination of cables and angled masts.
BOTTOM: Detail drawings illustrate tie-down, anchor, and mast assemblies.
FACING PAGE, LEFT: Concrete pylons transfer building loads into ground.
FACING PAGE, CENTER: Mast reorients tensile forces at 12 degree angle.
FACING PAGE, RIGHT: Angled masts at north and south ends transfer loads from pairs of steel cables.

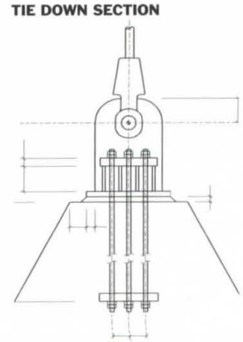
TIMOTHY HURSLEY



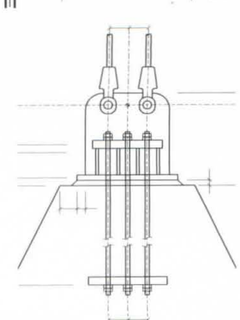
ANGLED MAST SECTION 2'/.6m



TIE DOWN SECTION 2'/.6m



PYLON SECTION 1'/.3m



PYLON SECTION 1'/.3m

"The dynamism of tensile fabric systems," asserts Bradburn, "is that the whole structure is designed to move and flex."

Supporting structure

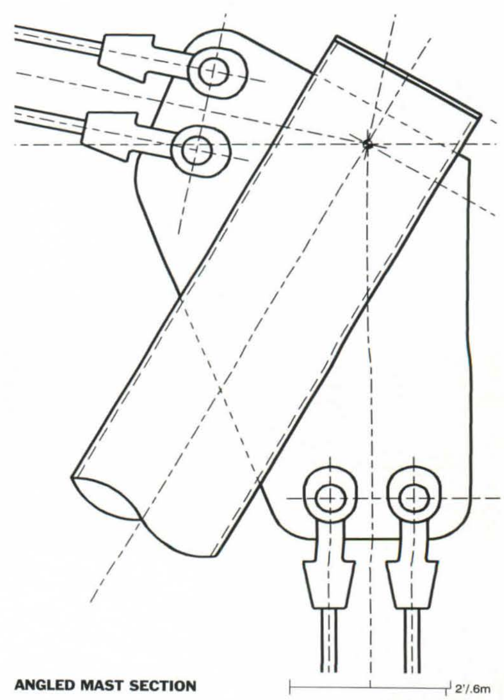
The structural plan of the airport's 210-foot-by-900-foot Great Hall—a vast interior volume roughly three times that of New York City's Grand Central Station—resembles a medieval cathedral nave. The roof's compressive loads are carried by 34 masts, lined up 60 feet on-center and placed in two rows, 150 feet apart. The masts are constructed of steel columns clad in fiberglass-reinforced plastic and range in height from 105 feet to 125 feet. Eight of the masts' fiberglass tops are capped by skylights framed by elliptical steel trusses that stretch the membrane uniformly. The Great Hall is flanked on the east and west by administrative offices and 80-foot-wide ticketing areas; these perimeter spaces are covered by sloped reinforced-pvc roofs with clerestory windows. Outside, tensioned-fabric canopies, much smaller in scale than the main roof but echoing its same vocabulary, cover the departure roadways and curbside drop offs. "If you extend the analogy that the roof resembles the Rocky Mountains," explains Fentress, "the entry canopies are the foothills of those mountains."

Lightweight layers

The fiberglass of the roof itself weighs only 2 pounds per square foot, roughly $^1/_{15}$ of a steel-framed roof structure and only $^1/_{40}$ of a concrete roof. Atop the Great Hall, the roof comprises two layers separated by an airspace ranging from 16 inches to $5^1/_2$ feet. The outer layer is constructed of woven fiberglass coated with Teflon, which protects the fabric from ultraviolet radiation and helps keep snow and alkaline-based pollutants from accumulating. Inside, a thinner membrane—also composed of Teflon-coated fiberglass—creates an acoustical barrier, provides thermal insulation, and conceals the exterior panel seams.

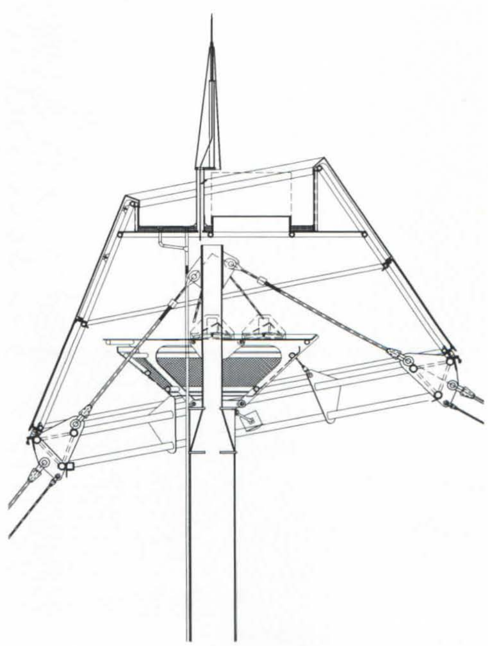
The fabric is tensioned by means of two cable types stretched parallel to one another: ridge cables and valley cables. The ridge cables, similar to those of a suspension bridge, are draped between mast pairs and extend to the rigid steel-framed roof above the ticketing halls, where they are anchored 6 feet beyond the clerestory windows by means of vertical tie-downs and anchor cables. These structural members resist downward forces such as snow loads and the structure's own dead weight. The valley cables, meanwhile, are shaped like arches and carry upward and outward loads such as wind suction. These cables are similarly fastened to tie-downs and anchors just outside the clerestory windows. For increased rigidity, the edge of the fabric stretched between the tie-downs of the two cable types is shaped like a catenary curve. Together, the precisely calculated forms of the ridges and valleys create a structurally stable shape capable of sustaining loads up to 20 times the roof's weight.

TIMOTHY HURSLEY PHOTOS



ANGLED MAST SECTION

RIGHT: Tensile roof membrane is supported by 34 masts capped with fiberglass tops and skylights.
BOTTOM LEFT: Large mast incorporates exhaust fan.
BOTTOM RIGHT: Reinforcement cables on large masts are attached to membrane through a fabric sleeve.
FACING PAGE, LEFT: Typical mast of Great Hall features top vent.
FACING PAGE, CENTER: Typical roof bay features enclosed mast top.
FACING PAGE, TOP RIGHT: Smaller masts top entry canopies.
FACING PAGE, BOTTOM RIGHT: Canopies extending along airport's east and west sides incorporate smaller peaked forms.



SKYLIT MAST SECTION

TIMOTHY HURSLEY PHOTOS

For additional support, reinforcement cables are stretched perpendicular to the ridges and valleys, roughly 40 feet apart. If the outer fabric rips and must be removed, these cables take up stresses normally handled by the tensioned membrane itself. The cables are attached to the outer membrane and encased by means of fabric sleeves.

Truss-supported walls

The tensile vocabulary of the terminal's roof structure is echoed in the design of the triangular clerestory windows along the east and west facades, and in the two larger truss walls framing the north and south ends of the building. The architects wanted to minimize the thickness of the mullions and framing of these walls to diminish their presence and allow even more light into the terminal. Trusses were therefore necessary to provide lateral stability and rigidity.

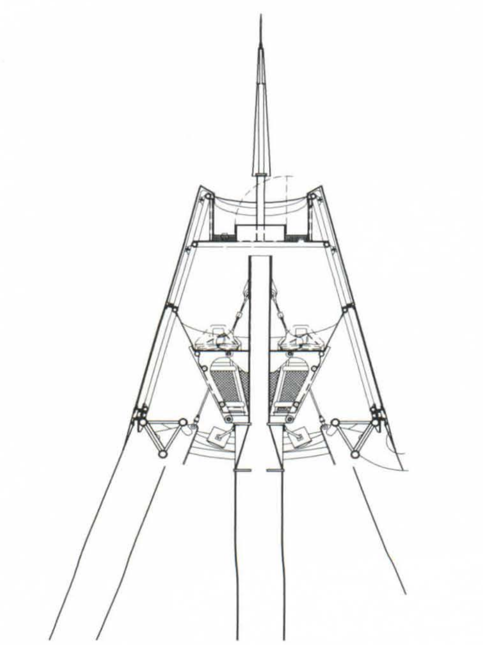
The 60-foot-high south wall spans a length of 220 feet. A symmetrical double-bowstring cable truss is framed into the wall 37 feet above its base and serves to uniformly distribute the lateral load throughout its length. The vertical members, varying in depth according to the shape of the horizontal bowstring truss and the height of the wall, are spaced 15 feet apart. A cantilevered bay of the main roof shades these large glazed expanses from direct sunlight. The structure of the walls can be detached and reassembled to accommodate future growth.

While the walls are structurally rigid, the fabric roof is designed to flex in response to movements and load changes. The two enclosure systems therefore must operate independently of one another. To negotiate these differences, air-inflated tubes, which expand or contract as the membrane moves, were installed between the two roof layers to effectively seal the edge between roof and wall. The roof sustains deformations of up to 3 feet under wind and snow loads, but the deflection above the glazed wall is only 3 inches.

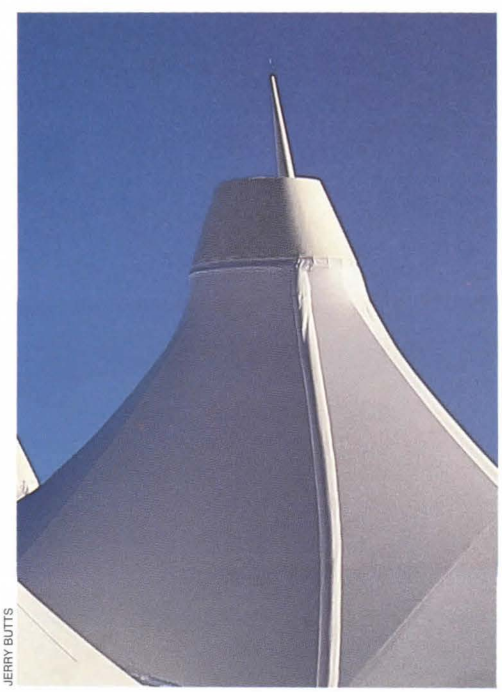
Providing clerestories along the terminal's east and west walls was important to the architects, so that travelers could see the sky from the interior. "The feeling of being inside a giant pillowcase, which is typical of many fabric structures, was something we wanted to eliminate," asserts Fentress.

In the Denver terminal, the sky is always visible through the clerestories, which enhance the feeling of being outdoors and visually separate the delicate fabric roof from the heavier building base. The triangular clerestory windows inserted between the roof's ridge and valley cables are framed in a combination of white tubular steel frames and vertical cable trusses.

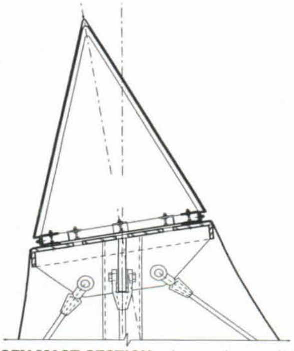
The glazing specified throughout the terminal is paralytic low-e glass, whereby the filtered coating is applied to the glass itself instead of as an interlayer. This glass helps to eliminate roughly 66 percent of the low-emissivity ultraviolet rays transmitted into the space. Due to Colorado's high altitude,



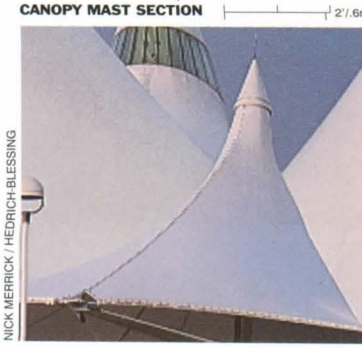
TYPICAL MAST SECTION



JERRY BUTTS

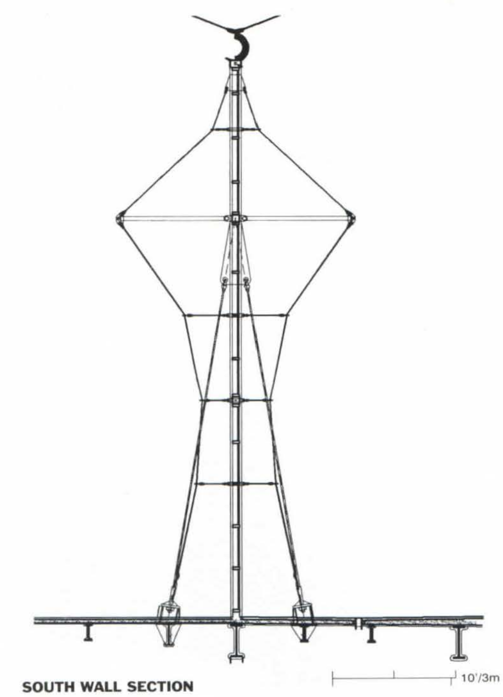


CANOPY MAST SECTION

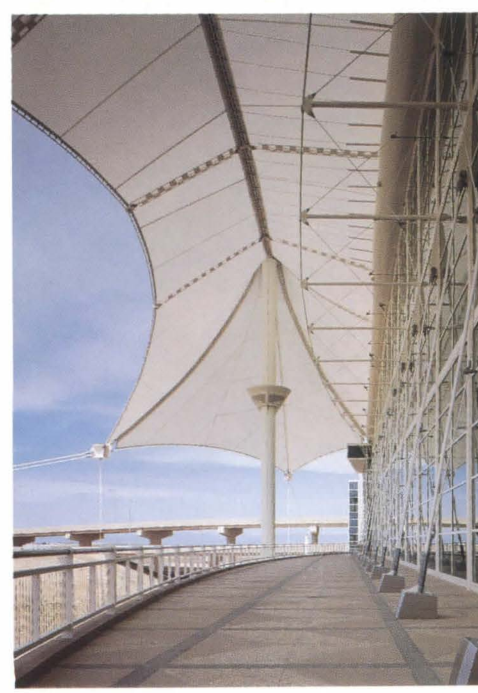


NICK MERRICK / HEDRICH-BLESSING

RIGHT: Airport's glazed south wall is braced by horizontal bowstring trusses.
BOTTOM LEFT: North-south section through south truss wall.
BOTTOM RIGHT: Roof bay shades truss wall from direct sunlight.
FACING PAGE, LEFT: South-north section through north truss wall.
FACING PAGE, RIGHT: Trusses provide rigidity and lateral stability to large expanses of glass.



SOUTH WALL SECTION



NICK MERRICK / HEDRICH-BLESSING PHOTOS

the ultraviolet radiation in Denver is much greater than at sea level, so low-e glass is essential to protect interior finishes against degradation and fading. The low-e coating also helps reduce some of the heat gain caused by the infiltration of infrared rays.

Computer-based analysis

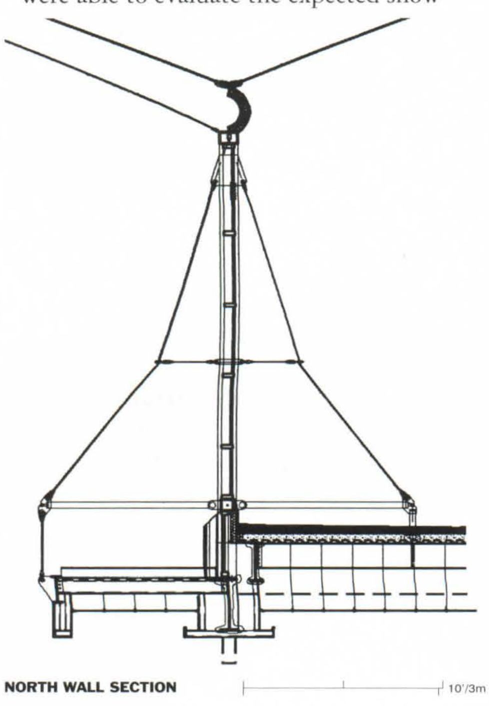
The roof's structural engineers, New York-based Severud Associates, generated computer models to perform structural analysis and determine fabrication details, as well as to refine construction plans. The Guelph, Ontario-based research firm Rowan Williams Davies and Irwin (RWDI) also tested models of the roof and generated computer simulations to analyze the effects of wind and snow on the structure. Wind tunnel tests were undertaken to determine wind suction loads. Using available weather data for Denver over a 25-year period in conjunction with model testing that simulates drifting, researchers were able to evaluate the expected snow loads on the roof and the resulting stresses on the fabric structure.

Severud Principal Edward M. DePaola generated three specific types of computer models. He created overall models representing the entire roof system to understand the structural behavior of the roof, devise its geometric configuration, and determine how prestress forces would balance applied loads to produce the intended form. To study portions of the roof at various stages of construction, he also set up computerized installation models. In conjunction with small-scale physical mock-ups, these computer models helped determine the proper rigging and temporary support systems necessary during installation of the 250,000-square-foot roof.

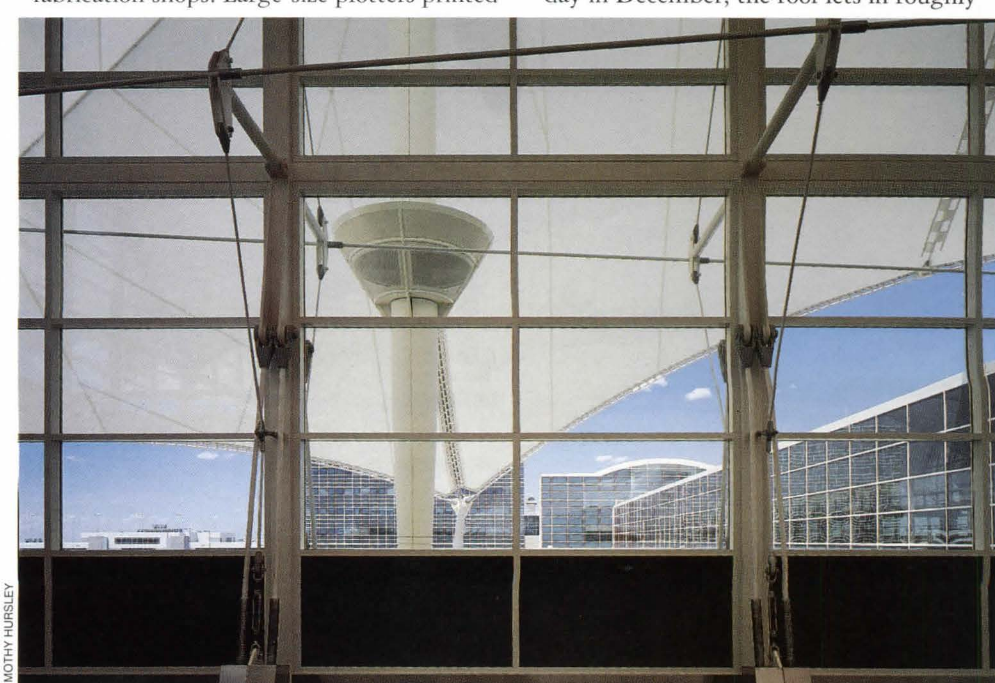
Once the fabric and cable geometries were finalized, precise pattern models were generated for individual bays of the airport. Birdair translated 3D models into 2D drawings and then transferred the data electronically to its fabrication shops. Large-size plotters printed full-scale templates—typically 2 feet wide by up to 100 feet long—onto sheets of paper; the panels were then cut from rolls of fabric and the tension wires cut from rolls of steel cabling. The panels were heat-welded together in the shop and then individually rolled or folded and packaged for shipment to the site.

Interior daylighting

The reliance on natural lighting to illuminate the interior is a central feature of the airport's roof system. The white-colored fabric of the roof immediately reflects 70 percent of sunlight. Of the remaining light, 20 percent is reradiated as infrared heat, while the rest is transmitted through the roof and into the terminal. Bradburn describes the abundance of natural light: "At its most intense—on a bright, sunny day in June—the sky above Denver has about 10,000 foot-candles; 1,000 foot-candles are therefore transmitted through the roof." But even on an overcast day in December, the roof lets in roughly



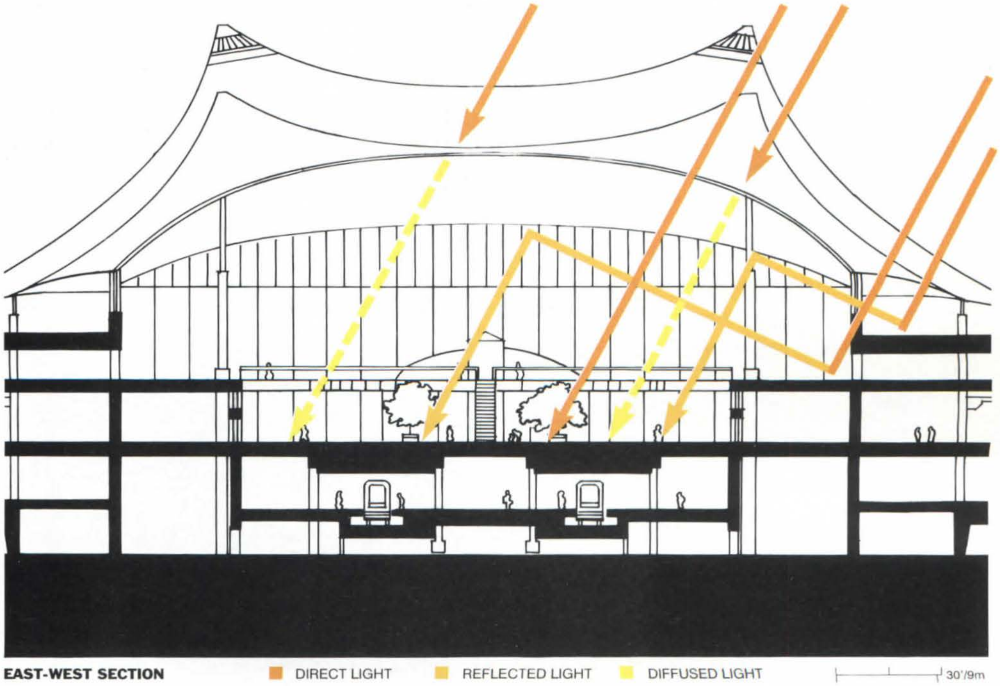
NORTH WALL SECTION



TIMOTHY HURSLEY

RIGHT: At night, artificially illuminated terminal hall glows through translucent roof membrane.
BOTTOM RIGHT: Section through Great Hall reveals illumination by direct, diffused, and reflected sunlight.
FACING PAGE, LEFT: Skylights atop large masts allow sunlight into terminal.
FACING PAGE, CENTER: Sconces wrapping columns conceal fixtures that reflect light against fabric ceiling.
FACING PAGE, RIGHT: Architects designed canopies incorporating artificial lighting for below-ground spaces.

TIMOTHY HURSLEY



EAST-WEST SECTION

200 foot-candles, which is up to four times the illumination in a typical office building interior. With additional daylight streaming in through the clerestories and reflected by the fabric roof, there is no need for artificial illumination during the day.

At night, the terminal hall is illuminated by uplights contained in sconces that wrap the large masts. This solution provides evenly diffused light throughout the space by bouncing light off the inside surface of the fabric roof. To simulate some of the highlights created by patches of sunlight penetrating the skylights atop the masts, the architects clustered downlights near the tops of several columns.

Reduced energy consumption

One of the Denver roof's greatest benefits is its energy efficiency. The fabric roof eliminates the energy consumption in both powering lights and cooling the space from the heat generated by the lights. In winter, because the ratio of its surface area to interior volume is low, heat loss through the fabric membrane is minimal. In fact, the architects anticipate heating the space a total of only two to three weeks a year despite Denver's cold winter temperatures. The remainder of the time, the terminal will be heated by solar energy transmitted through the roof and glazed areas, and by heat gain from internal sources such as computers, artificial lights, people, and baggage conveyor equipment.

Despite initial worry over heat loss through the fabric, the architects did not specify insulation in the interstitial space of the roof assembly and were therefore able to minimize future maintenance costs. "These big buildings end up with more energy than they need," notes Bradburn. "They're actually exporters of energy." Installing insulation between the fabric layers would not only decrease the amount of daylight transmitted into the space, but would also cause condensation problems. Bradburn cites Calgary's Saddledome Stadium, where insulation between the fabric layers of its roof results in "major maintenance problems with condensation." He explains that the insulation caused condensation to occur between the layers of fabric and insulation, trapping moisture in the roof. As the insulation grew wet and mildewed, it began to sag, creating blotchy areas of light and dark inside the stadium.

As the roof atop Denver's new airport demonstrates, tensile-membrane technology has moved away from its earliest incarnations as sheltering world's fair pavilions to become as successful as conventional steel or concrete roofing systems. For architects, Denver's roof underscores the increased form-making possibilities of fabric roofs, as well as their cost savings and environmental benefits. "We've really harnessed this technology and taken it further," Fentress asserts. "Hopefully, the airport will become a new laboratory where architects can see this tensile technique and learn from it."—*Raul A. Barreneche*

TIMOTHY HURSLEY

NICK MERRICK / HEDRICH-BLESSING

NICK MERRICK / HEDRICH-BLESSING

Military Base Conversions

Architects begin returning sequestered defense complexes to their urban surroundings.

ABOVE RIGHT: Model of Boston's Charlestown Navy Yard (foreground), shows mixed-use infill conforming to original street plan.

Converting 130 military bases nationwide into new civilian uses promises architects a wellspring of work on a scale unseen since 1960s urban renewal. While few of the bases decommissioned by Congress since 1988 have closed completely, the transition has begun at many sites; most should close by 1997. Architects and urban designers are seizing these historic opportunities for epic-scale urban design, advising local and regional leaders on renovating vast military complexes and reintegrating them into their largely metropolitan surroundings.

Complications of conversion

Sixty-six percent of bases closing today lie in densely populated urban areas, in contrast to mostly rural base closures in the 1960s and early '70s, according to the National Commission for Economic Conversion and Disarmament (ECD) in Washington, D.C. Heavy economic dependence on such bases makes conversion more urgent—and more complicated—than in rural areas. Financing base conversions is harder than in the past because public investment is scarce. Federal aid to regions hit hard by base closures has dropped 79 percent since 1978, the ECD reports. Massive toxic-waste problems on bases, from weapons and fuels, further darken prospects for productive reuse.

Architects also are discovering that diverse constituencies surrounding vacated bases are often sharply divided over conversion plans, and political battles often overshadow routine questions about sites and structures. Federal agencies take first priority for occupying former military bases. Last in line are state and local authorities. The AIA has criticized the Department of Defense for this low priority given to local groups, urging Congress to offer former bases to localities at discount prices and to establish a protocol ensuring comprehensive urban design.

Optimists find opportunity

Despite the obstacles, architects find optimism in conversion models such as Boston's 135-acre Charlestown Navy Yard, the birthplace of the U.S. Navy, which closed in 1974. The Boston Redevelopment Authority, which maintains strict control over the yard's redesign, has extensively rehabilitated historic structures while developing 105 acres as a high-technology research campus, and 1 million square feet of mixed-income housing.

Many pre-World War II military bases possess carefully articulated town plans worth saving, such as San Francisco's Presidio (following pages). Sprawling postwar bases, such as Williams Air Force Base near Phoenix, stand to benefit from infill. Some air bases can be revamped as commercial airports, like Bergstrom Air Force Base near Austin, Texas. And as the products of two recent design charettes illustrate, architects eyeing the dividends of defense cutbacks should approach regional base-reuse authorities armed with grand visions—and profound tenacity.—*Bradford McKee*

Presidio of San Francisco
San Francisco, California

Because of its public amenities and close proximity to the city of San Francisco, the Presidio represents the most controversial of U.S. base closures—attracting a raft of unofficial claims on its future by windsurfers; golfers; descendants of aboriginals; and advocates for the homeless, who view the Presidio's 1,184 units of housing as a community resource. This fall, the Army vacates the wooded, 1,480-acre fortress, established in 1776, and turns it over to the National Park Service, which envisions an international center for scholarship and recreation, managed as a federally chartered partnership at an operating cost of $25 million per year.

The Park Service plans to preserve the 510 historic buildings on the site. Building styles range from Mission to Mediterranean to Colonial Revival, with such idiosyncratic details as artillery shells deployed as finials on the porch of an officer's house. However, the Army in many instances adulterated the simple floor plans of structures and incorporated low-quality materials in its renovations, notes Richard Beard, principal of Backen Arrigoni & Ross of San Francisco, which began working for the Park Service in 1992 to assess buildings for code compliance and to design an addition to the police/fire station at the Presidio's heart. "The Army kept up the buildings' cosmetics," Beard maintains, "but they're falling apart on the inside. It's a lot of paint holding together rotten wood."

Under separate contracts, the Architectural Resources Group (ARG) of San Francisco has completed an inventory of the Presidio's buildings and is now developing design guidelines for new buildings on the site. ARG also is rehabilitating an 1880s water-treatment complex near Baker Beach, reengineering the treatment process and seismically improving the structure.

AERIAL IMAGES

EXISTING CONDITIONS: Presidio's 1,480 acres will become national parkland and center for scholarship.

PRESIDIO PLAN: Master plan integrates separate design strategies for 13 distinct regions (examples, facing page).

LETTERMAN COMPLEX: Modern concrete buildings will house education center.

GOLDEN GATE/FORT POINT: Coastal defense fortification defines head of historic trail.

MAIN POST: Army development includes Colonial and Mission Revival buildings.

PUBLIC HEALTH SERVICE HOSPITAL: Historic structure planned as conference center.

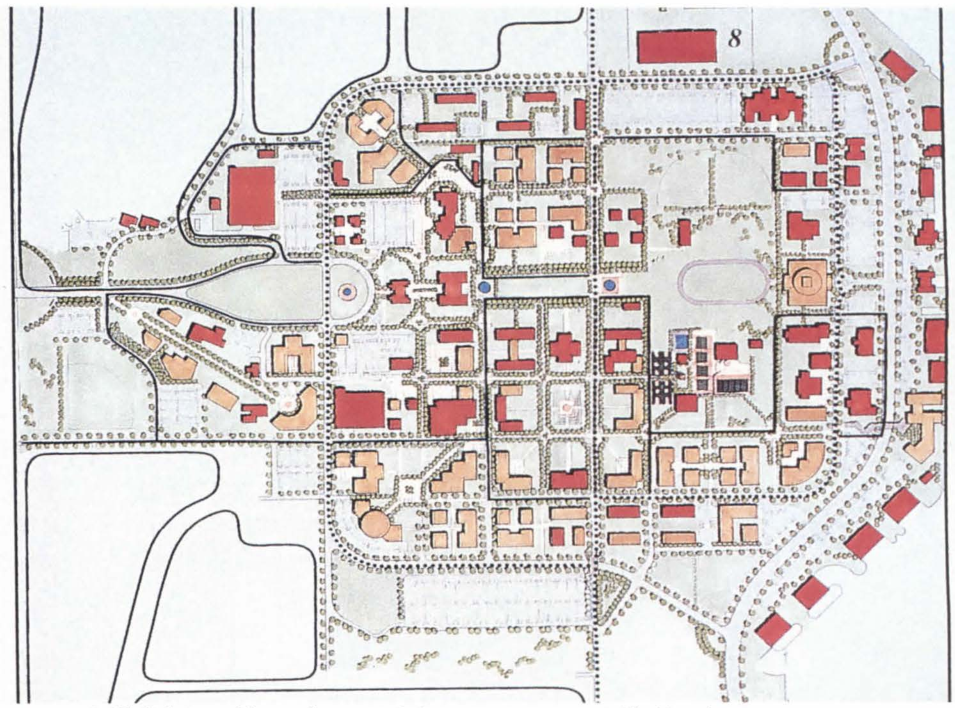
Williams Air Force Base
Mesa, Arizona

The Air Force vacated Williams Air Force Base in September 1993, leaving behind a 4,042-acre installation—replete with utilities, an airfield, and a major railroad—on the outskirts of Phoenix, which is expected to grow by 1 million people before 2010. The local Williams Redevelopment Partnership retained the planning and urban-design firm EDAW to identify key buildings among Williams' 200 structures for civilian adaptation.

The Williams site is divided into two parts: an airfield on the east with three 150-foot-wide runways, and a 1,023-acre training campus on the west. Redevelopment authorities envision a commercial-scale airport to relieve Phoenix's Sky Harbor 17 miles to the northwest. However, Thomas Keith, EDAW's principal-in-charge of the Williams reuse plan, notes that the design team found "not very sophisticated" sheds and hangars requiring costly improvements. "Small-scale airfield operations would be suitable," Keith contends, "but to go beyond that would require major investments."

Plans for the western training area—which includes 700 units of housing, a golf course, and medical center—call for an educational complex housing a consortium of schools, including Arizona State University and regional colleges.

Early in the conversion process, EDAW suggested future building patterns for the central campus. The campus has a serviceable layout in place with a strong axial entrance, Keith maintains, but buildings are scattered and still bear the stamp of the military, which calls for cosmetic changes to create a more collegiate appearance. "We focused at the outset on what could be done with very little cost," Keith contends. "It's important to get activity going early to show that a base is a viable site, not someplace people have abandoned."



SITE PLAN: Infill (light) would complement existing campus structures (dark) and preserve open space.

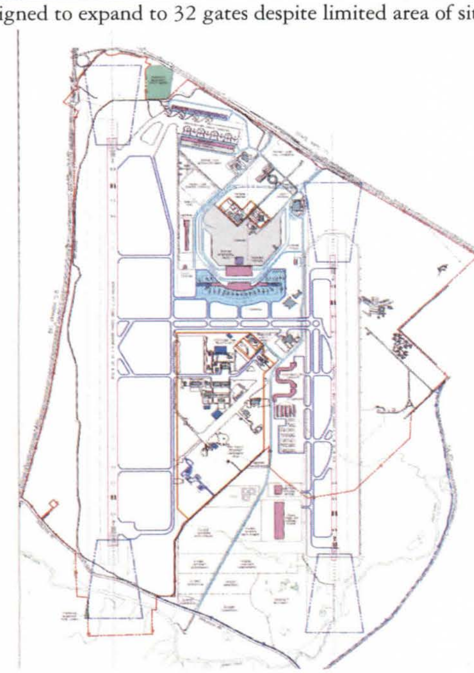

WILLIAMS AFB: View to east shows axis of training ground, which abuts airfield (background).

AUSTIN TERMINAL: Crescent form of 24-gate facility is designed to expand to 32 gates despite limited area of site.

TERMINAL INTERIOR: Amenities above support areas.

BOB DAEMMRICH

EXISTING AIRFIELD: Plan preserves apron and buildings.



SITE PLAN: Proposed new runway (right).

Congress decided to close Bergstrom Air Force Base in July 1991. By August, the City of Austin—which had been trying to replace Mueller Municipal Airport since 1975—elected to build its new airport at Bergstrom, which contains one commercial-caliber runway, 322 support buildings, 719 housing units, and 17 dormitories. Austin aviation officials analyzed master plan alternatives based on a forecast of air-traffic demands through the year 2012: Within that time, Austin's 1991 volume of peak-hour passengers, cargo, and aircraft arrivals and departures would more than double.

Planning authorities first weighed 12 layout schemes for the airfield, primarily judging six options for building a second major runway. Officials favored a 9,000-foot runway parallel to, and 6,700 feet east of, the existing, 12,250-foot stretch—preserving the apron pavement and support buildings, as well as the field's smallest runway.

Austin's aviation authority also evaluated three schemes for the terminal's design and three for its location. The new terminal will occupy the north side of the airfield to cut new construction costs and reduce aircraft taxiing time. Architects Page Southerland Page of Austin serve as project managers, executing the conceptual design for the passenger terminal. Gensler and Associates designed the 465,000-square-foot main terminal building, the east and west concourses, and a parking structure. Of three proposals, planning officials chose a "frontal gate/atrium" concept to provide a compact, central area for passenger amenities on the upper level, and all airline, baggage, and maintenance operations below. The crescent-shaped, 24-gate terminal, planned to open in 1998, can expand to 32 gates—totaling 564,000 square feet—over the next 20 years. Construction begins in 1995.

Sand Point Naval Station Charette
Seattle, Washington

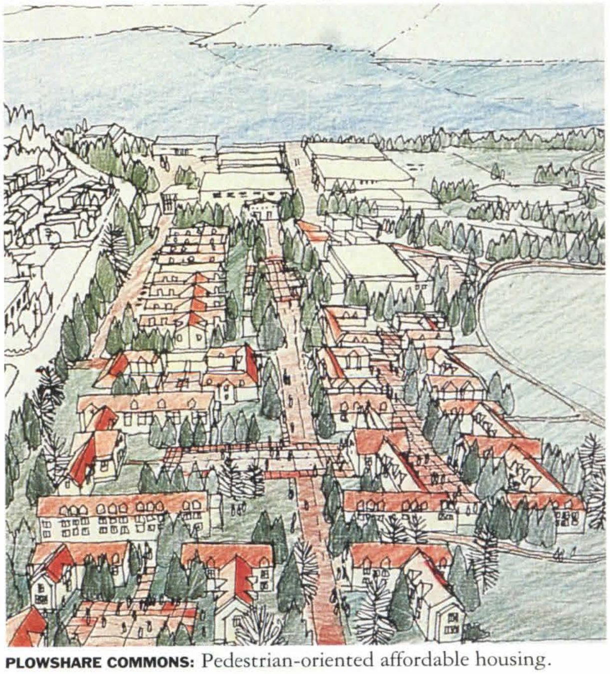
At the behest of the City of Seattle, the University of Washington's (UW's) Department of Architecture devoted its 1993 student charette to conversion of Sand Point Naval Air Station. The 151-acre base, with 1.5 million square feet of building space, lies adjacent to 150-acre Magnuson Park on Lake Washington, six miles northeast of central Seattle. Next year, the city acquires the former reserve base, closed by Congress in 1990.

Four student teams, each led by three practitioners, based their concepts on the city's official Sand Point Community Plan document; two of these proposals proved informative to city planning officials.

The team led by Doug Kelbaugh, professor and chair of UW's architecture department; landscape architect Stacy Moriarty; and Michael Pyatok, professor of architecture at UW, developed a residential scheme called Magnuson Park and Village, creating six types of mixed-income housing, including live-work spaces for home-based businesses, and converting hangars to streetside markets for arts and industry. The team also interspersed expanses of formal open space—parade grounds and commons—to contrast with the wetlands at the peninsula's edges.

A second team comprising educator Jorge Andrade of Mexico City; Daniel Glenn, lecturer at UW; and Linda Jewell, professor of landscape architecture at the University of California at Berkeley, proposed linking the Sand Point site to Seattle with a diagonal boulevard and extending Seattle's street grid from the south and west. The scheme, called Plowshare Commons, would intermingle 1,200 units of new, affordable housing with pedestrian-accessible commercial and retail centers. The plan would provide greater shoreline access, wetland restoration, and a large recreation center for new residents.

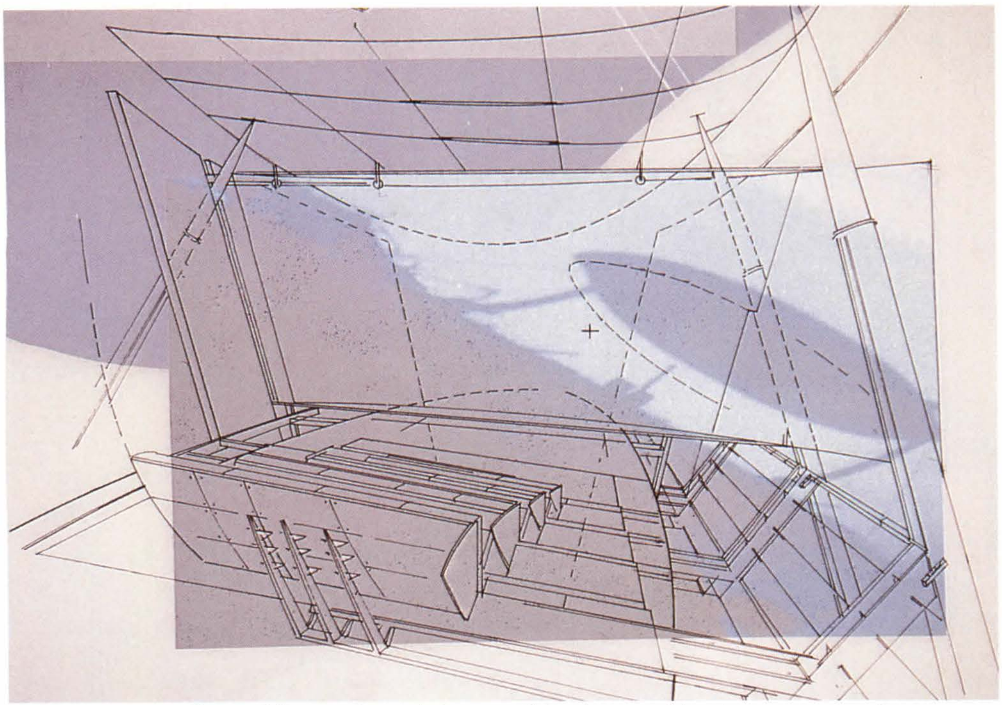
MAGNUSON VILLAGE AND PARK: Housing connects to main street, community services, and commercial outlets.



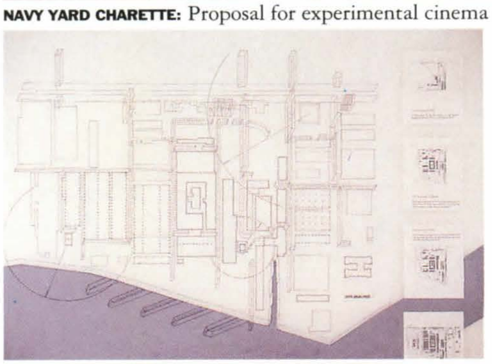
PLOWSHARE COMMONS: Pedestrian-oriented affordable housing.

MAGNUSON PLAN: Parade grounds.

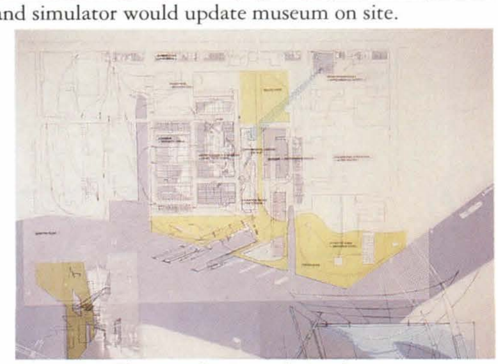
PLOWSHARE PLAN: Diagonal entrance.



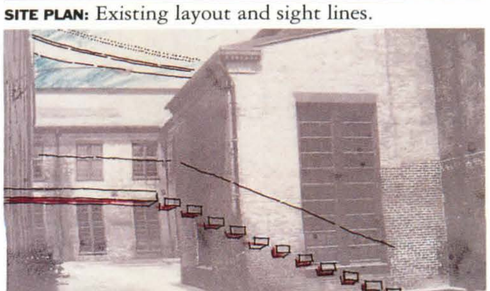
NAVY YARD CHARETTE: Proposal for experimental cinema and simulator would update museum on site.



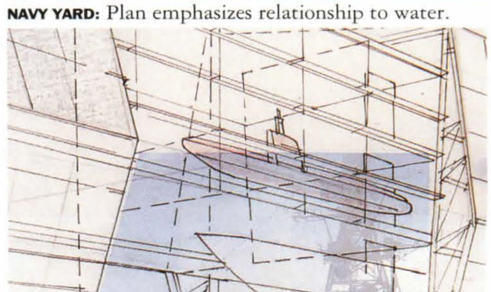
SITE PLAN: Existing layout and sight lines.



NAVY YARD: Plan emphasizes relationship to water.



INFILL: New circulation links existing structures.



IMAGERY: Shipbuilding hardware evokes site's past.

This May, the International Forum of Young Architects' U.S. Director Uwe Drost organized a charette to study the Washington, D.C., Navy Yard. Forty-two participants from the United States, Europe, and South America devised idealistic concepts for the reuse of the 100-acre site on the Anacostia River in the city's southeast quadrant. While the base is not slated for closure, the charette attempted to generate prototypical developments for converting urban military posts.

The most sober and plausible of seven schemes was calculated by a team of architects comprising Heinz Jirout of Berlin; Chris Sharples of New York; Mario Gooden of Gainesville, Florida; and Wojciech Oktawiec of New York. The team's plan pays tribute to the Navy Yard's tradition of providing training and education for young adults. The scheme would establish an athletic field on the site of the former shooting yard, place an experimental cinema for high-tech optics near the existing naval museum, and set up a vocational education center for people in the base's economically depressed urban environs.

As a prototype for converting urban military bases, the team's proposal contains concepts that apply universally to such disused sites and have worked especially well at Boston's Charlestown Navy Yard: institutional elements that anchor the site to the surrounding community; green, open landscape that relieves the base's battery of heavy masonry buildings; clearer connections among the inner regions of the base; and a rehabilitated waterfront. Also, as in the Presidio plan, which preserves aspects of its original character by keeping historic structures intact, the remnants of heavy industry—gangplanks, roof trusses, and catwalks—would remain largely in place to evoke the shipbuilding character of the past.

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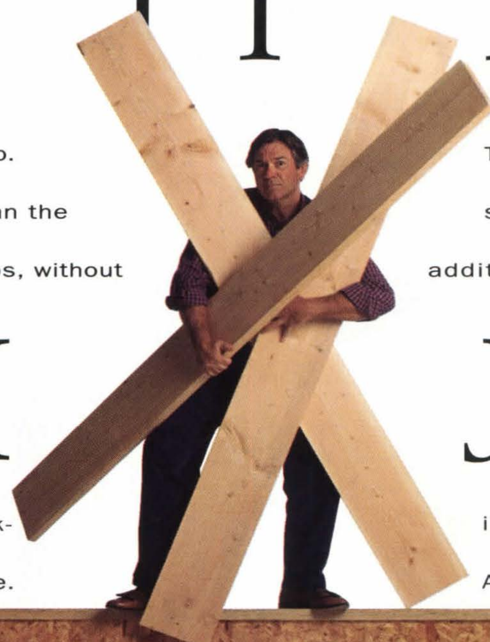

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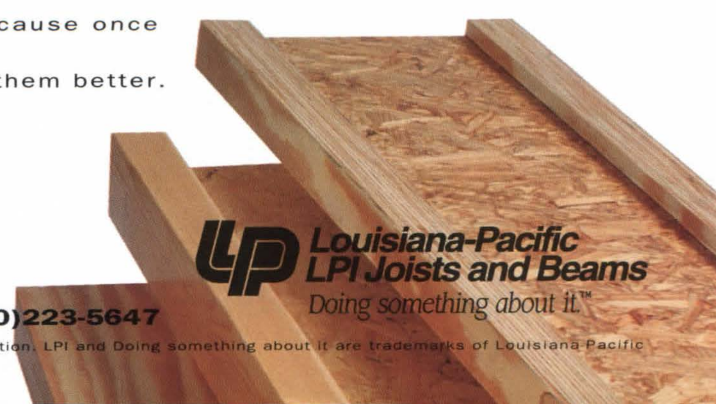

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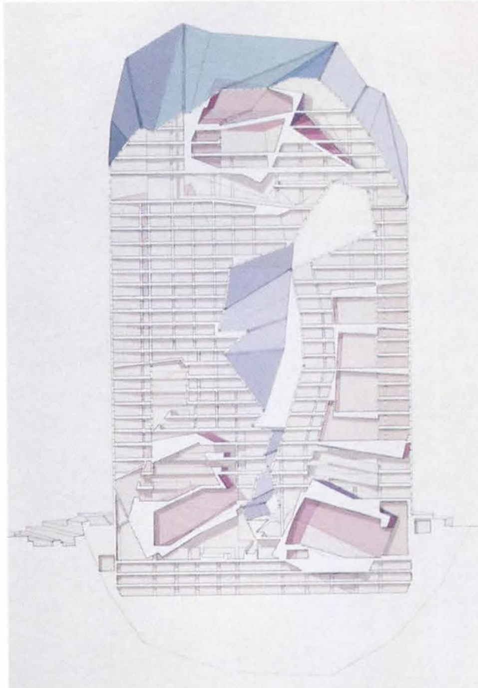
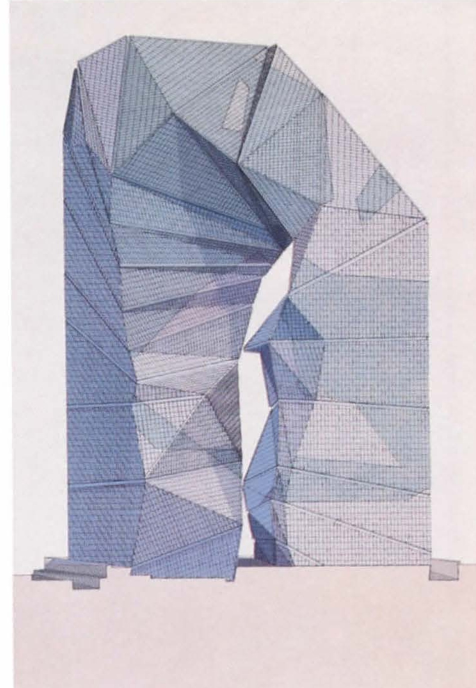




ABOVE LEFT AND RIGHT: For the Max Reinhardt Haus in Berlin, Eisenman Architects executed a sequence of computer modeling procedures to move a site-shaped element along a Mobius strip-shaped path, producing the high rise's irregular form.

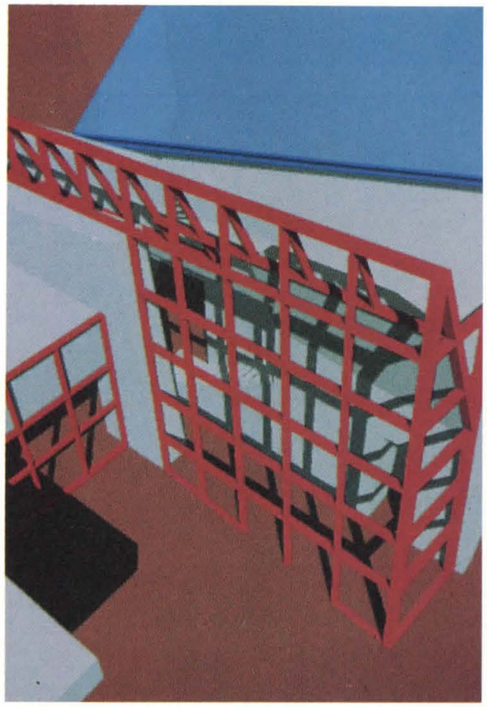
Ever since computers established their role as menial drafters in architecture firms, some have wondered when this technology would make a visible mark on form making. But as long as the machines remained drafting tools, they only changed the process of production, not the appearance of buildings. Now, however, architectural design software has grown in sophistication, and some firms are beginning to create unusual or irregular geometries that would not have been possible to construct without the technology. With these new programs, buildings may be angled in any of three dimensions to respond to view, function, or irregular sites. Complex connections between nonrectilinear geometries can be detailed without figuring out how the disparate forms come together. And sharing the technology with the building trades enables these irregular forms to be constructed at reasonable costs.

Computer-assisted schematic design

For the past few years, New York architect Peter Eisenman has been applying computers to the earliest design phases. In contrast to those who exploit the "hands-on" sculptural capabilities of modeling software, Eisenman Architects begin with a philosophy, express it and transform it mathematically, then let the computer construct the three-dimensional result of that mathematical expression.

For the Max Reinhardt Haus, a cultural center and office building in Berlin, the architect drew on the idea of the Mobius strip. This geometry is defined as a continuous, one-sided surface formed by twisting one end of a rectangular strip 180 degrees and attaching it to the other end. Eisenman subjected the two-dimensional shape of the Berlin site to a series of transformations in response to contextual influences. Through mathematical manipulations within autodessys's modeling software form-Z, he rotated and further transformed the shape as it moved along a path defined by the Mobius strip. Principal George Kewin recalls: "We were trying to get a crystalline form, so we chose certain parameters that stopped it along the path to create planar surfaces." The architects subjected the strip to several hundred iterations, changing parameters each time to obtain new variations. "That shape was derived entirely from the mathematical formulas," explains Kewin. "We didn't obtain a shape and then modify it graphically."

When finally satisfied with the form and convinced that the high-rise building could be engineered, Eisenman Architects exported the computer model to AutoCAD where it was further tested to ensure it could be translated into physical form. The model was then sent electronically to a service bureau, where each surface was laser-cut from colored plastic. The pieces were then assembled into a physical presentation model. When the building permit review process is completed, the mathematical description inherent in the design model will be applied to the construction drawings. "The computer is now integral



ABOVE LEFT AND RIGHT: An angled, skylit gallery bisects a house designed by Samuel Mockbee and modeled by Charles Calvo. The gallery tilts in every dimension, resulting in complex intersections that would have been difficult to work out by hand.

with everything the office does," Kewin asserts. "If you want to represent a philosophy through geometrical relationships, you have to do it by computer."

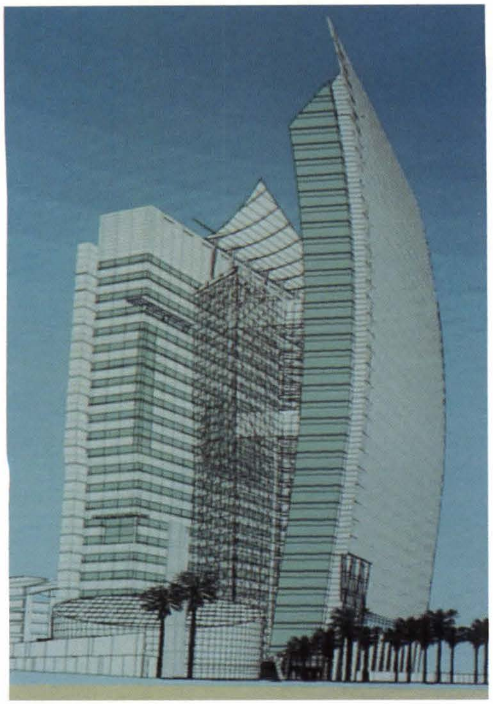
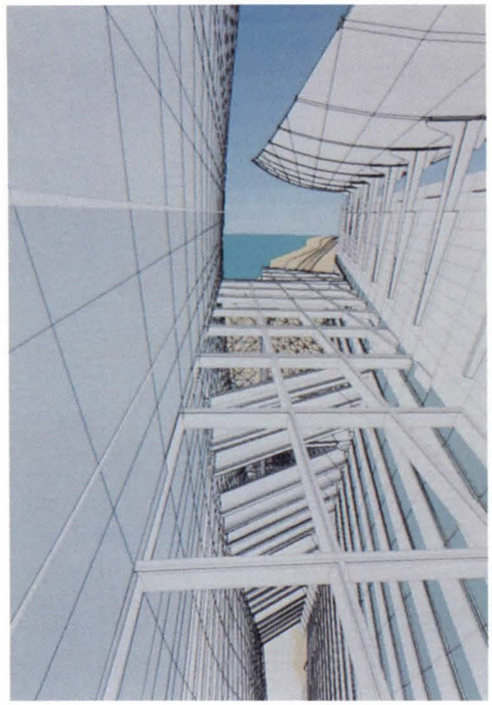
Studying complex intersections

It is still rare for architects to rely on the computer so extensively in schematic design. More commonly, architects develop initial design ideas with traditional media and then move to computers later for design development. A case in point is the Nagoya (Japan) Station Building, by the New York firm Kohn Pedersen Fox (KPF). This 4.8 million-square-foot mixed-use complex will house a high-speed rail station, retail and cultural facilities, a cylindrical hotel tower, and a quarter-circle office tower.

Although schematic design was performed with paper drawings and clay models, KPF's director of computer services, Tomas Hernandez, insists that the design development and construction documents could not have been accomplished without a computer. Large-radius arcs, easy to construct in a CAD system, are tedious if not impossible to reproduce on a drawing board with conventional instruments. In addition, the junction of intersecting planes and cylinders proved geometrically complex. Hernandez explains the challenge: "When you have a sloping plane joining a sloping, curved surface, how do you treat the intersection? You can document some ideas loosely in schematics, but for design development and construction documents, these connections require accurate design decisions, and the computer allows you to be geometrically precise."

KPF Associate Partner John Koga, the building's senior designer, credits the firm's work with Intergraph CAD software for enabling them to study the complex geometric relationships between elements in a logical way. He explains: "We used the computer to zoom in on and study the intersections of the architectural volumes. We could read the resulting complex angles very accurately." In the past, he notes, KPF resolved such intersections by constructing the angles with an adjustable triangle. But that method was approximate, depending on how precisely the adjustable triangle was calibrated. Now, in addition to the technical assistance CAD has provided, Koga feels that the technology has also given the firm "a certain comfort level in knowing that the details can be worked out."

Knowing the computer would eventually come into play during design development also helped architect Samuel Mockbee, principal of Mockbee/Coker in Canton, Mississippi, and a professor at Alabama's Auburn University. For clients with an extensive art collection, Mockbee designed a house on a peninsula jutting into a lake. He envisioned the house as butterfly-shaped in plan, giving each wing a particular view and putting the central gallery on axis with two special trees and the lake. The gallery's skylight was angled to block direct sunlight but admit a certain amount of bounced and filtered light.

ABOVE LEFT AND RIGHT: Ellerbe Becket's design for a corporate headquarters in Jeddah depended on computer modeling to create the dramatically curved shape of the main tower (left) and its irregular connections to the second tower (right) of the project.

After Mockbee had sketched the house on paper, his colleague at Auburn, Charles Calvo, modeled it in form-Z. As difficult as the modeling was, Calvo claims it would have been nearly impossible to work out without a computer. He notes: "The skylight is tilted in plan, section, and elevation relative to the gallery. So the computer was essential to resolve the soffits, parapets, and roofing conditions needed to join the skylight to the gallery. I couldn't have done it without the solid modeling operations that enabled me to join and carve the rotated forms."

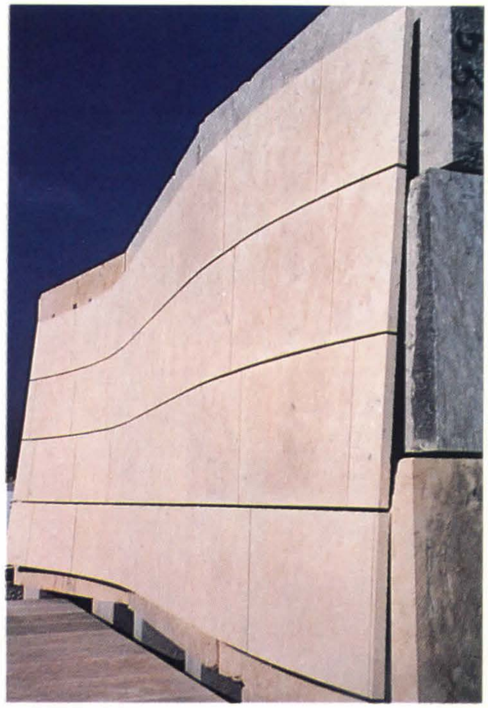
Complexity in section

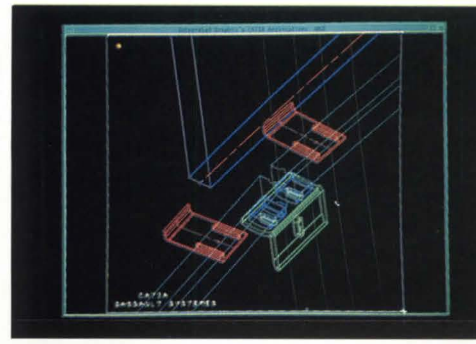
The difficulty of figuring out the connections was further eased by Calvo's practice, impossible with a physical model, of continually changing scales as needed. After he completed the 3D model, Calvo cut sections through the house that became the basis of the working drawings. If, during construction, the contractor decides another section is needed, the architects will simply return to the computer model and cut another section at the point of interest.

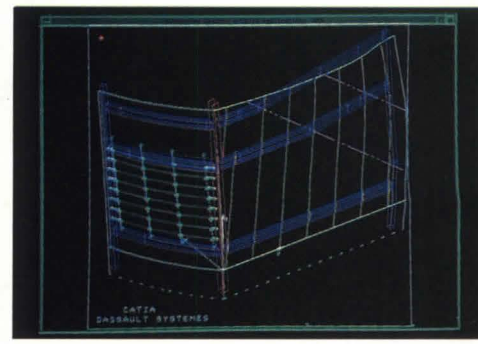
Although Mockbee believes architects will always need pencil and paper to "plug into the muse," he credits the computer with helping to flesh out his design ideas and develop them into reality. "What's so wonderful about the computer is that you can go through several ideas in a couple of hours, where in the past it might have taken several days. And you might have gotten discouraged about trying to discover all the possibilities and maybe given up too easily."

Like Mockbee, the architects at Ellerbe Becket worked first with traditional media in designing a corporate office building on the Red Sea in Saudi Arabia. Design Principal Peter Pran developed a schematic form of two towers, one rectangular and one sail-shaped, connected by horizontal elements at several points throughout the building's height. The design was modeled first in foam, then with IBM's Architecture & Engineering Series (A&ES) software. Project designer Jeffrey Walden describes the process of generating the sail-like form:

In section, he sketched its general shape, then tried to fit a mathematically defined curve to key points along its height. Through repeated reshaping, Walden eventually arrived at a curve that matched the physical model. He then extruded the curved profile to create the seaward face of the building. Because every point on the curving face could be defined and analyzed mathematically, the architects could share precise data with structural engineers and curtain wall consultants. In the past, the architects would have tediously measured points on the physical model, and a structural engineer, constrained by uncertainties, might have erred on the side of caution in determining the building's structural viability. Now Ellerbe Becket can experiment with more daring options, and the entire design team works with more confidence in their data. The computer model







ABOVE RIGHT AND FAR RIGHT: Stonecutting subcontractors for Frank Gehry's Disney Concert Hall submitted samples of limestone walls cut with machines driven by data from the architects' CAD files.
FAR RIGHT, BELOW: Gehry's CAD data is also applied to formulate the design of the stone's support structure.

was also helpful in designing the irregular connections between the two towers and the sail-like foil that shades the central atrium.

In more recent projects, the firm has extended its study of geometry by exporting the A&ES models into Autodesk's 3D Studio rendering software and showing what the buildings look like when rendered with realistic colors, textures, reflectivity, and transparency. "It's one thing to study geometry in the abstract," observes designer Timothy Johnson, "but when you can give these forms the appearance of real materials, you get more valuable feedback from the model that can affect important design changes."

Complexity in plan

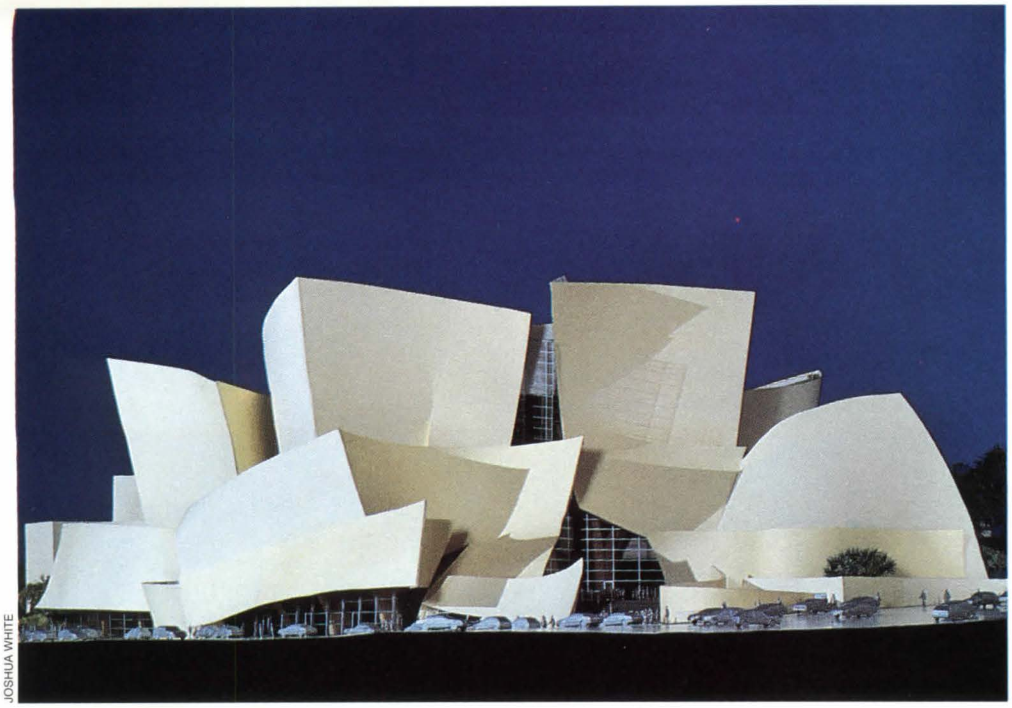
Pressing the computer into service for developing irregular forms is not restricted to high-profile, high-budget structures. In the Steamboat Point low-income housing development, San Francisco architect Backen Arrigoni & Ross took advantage of technology to bring a degree of amenity to a project with a restrictive budget. CAD enabled the firm to conform the housing's footprint to an irregularly curved site. This manipulation allowed the apartments to front the street like traditional town houses; the resulting triangular courtyard added character and created a false perspective that exaggerates the project's scale. The funneling effect of the pedestrian entries into the courtyard formed a sense of welcome often lacking in outdoor spaces around low-income housing.

To achieve these effects, each unit along the curved streets had to be slightly wedge-shaped. Instead of typical 90 degree angles, some rooms had corners with angles ranging from 75 to 105 degrees. According to architect Patrick Mays, Backen Arrigoni & Ross CAD administrator, this variation is barely noticeable for the occupants.

"It was like slicing pieces of a pie to make it go together," Mays recalls. "CAD helped us figure out the center points, radial dimensions, and angles, which changed with every unit. If we had had to draw this manually, we would have constantly needed to readjust our triangles." More likely, he admits, the design would have been more rectangular, thus sacrificing the amenities afforded by the footprint conforming to the curved site.

Instead, the CAD drafters easily determined the angles for each unit and set the software to construct lines at those angles automatically. They also had the computer develop presentation perspectives which, because of the curves, would have been very time-consuming to work out by hand. "Shifting the tedious work to machines," Mays says, "is especially important in low-income housing because the budget for design is already so low." He notes that help from the computer in working with odd angles is also invaluable in renovating historic structures in which old walls have shifted out of square.

While many architects today rely on computers during construction management, few apply the technology as directly as Los Angeles



JOSHUA WHITE

architect Frank Gehry. Although Gehry designed the Disney Concert Hall with traditional modeling methods, translating its dramatically and irregularly shaped stone walls into construction documents required sophisticated CAD software developed for the aerospace industry (ARCHITECTURE, August 1992, pages 105-110). Two years ago, Principal James Glymph explained that the design staff was "rationalizing" the curves into mathematically definable forms within Dassault's Catia software to reduce the number of unique stones, expecting this method to reduce stonecutting costs.

Now, the story is playing out in unexpected ways. As a requirement for bidding, four Italian stonecutting firms constructed sample walls from the architect's CAD files. The winning bidder, Furrer, has come in on budget, "lower than any us of expected," claims Glymph. The architects learned that, because the cutting machines are driven by electronic data, the degree of variation between stones does not affect cost as significantly as once believed. Nevertheless, Gehry will continue to rationalize the stone for other reasons, including seismic stability and to simplify the steel support system for the stone.

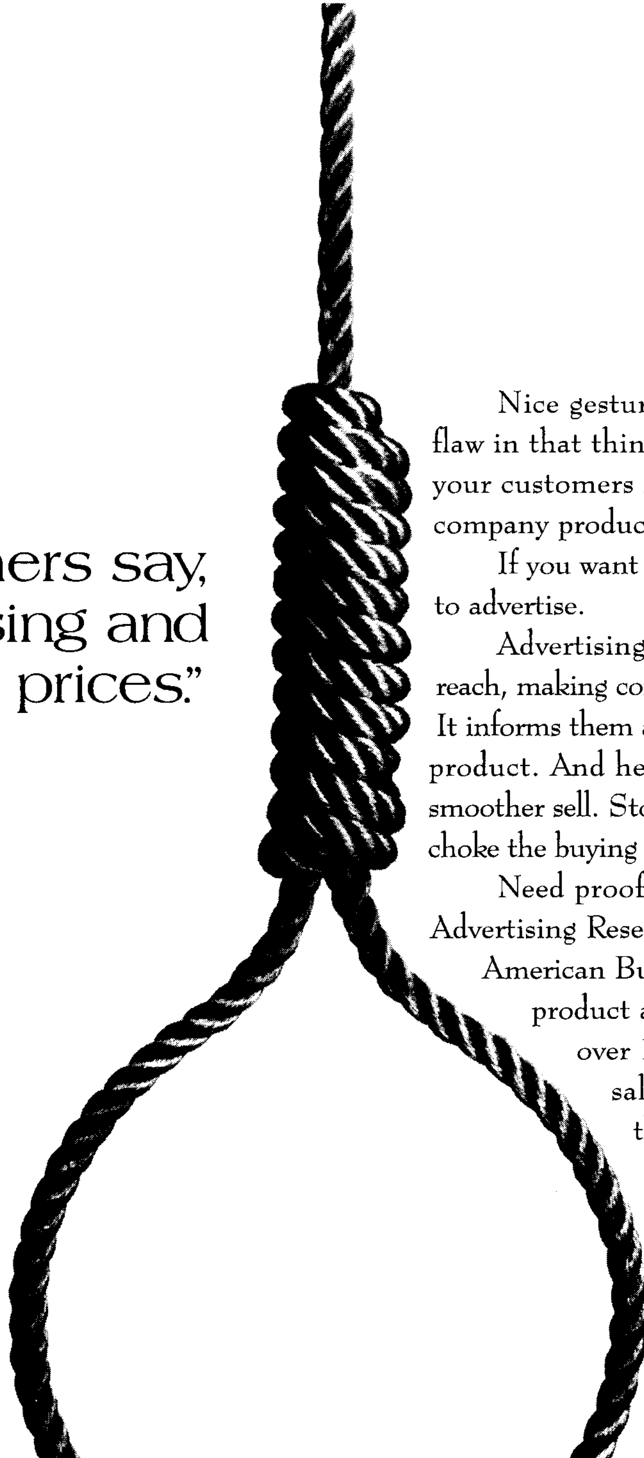
Harmon Contract W.S.A., the subcontractor responsible for coordinating the stonecutting and the fabrication of the steel supports, has also acquired Catia for modeling and engineering. Michael Budd, Harmon's director of sales and engineering of stone products, and his staff have developed computer subroutines to produce the stone fabrication documents. This mathematically defined information about the stones' shapes will be translated directly into the milling machines without the error-prone process of intermediary paper drawings and human interpretations. Harmon is now working with steel fabricators in developing the Catia files into numerically controlled data for constructing the structural steel tubes. "We'll provide a general blueprint showing the intent and visual representation of the pieces," Budd explains, "but the actual fabrication information will be in the computer file."

Liberation from tradition

Glymph acknowledges that the sharing of electronic data between architects and subcontractors has "run up against a lot of traditional relationships." But all the players have learned from the experience, and the architects are already planning their next challenge: modeling concrete forming methods.

As computer technology improves, and as the architecture profession acquires a collective understanding about how to apply it to design and construction, examples such as these pioneering efforts will become more common. They will demonstrate how freedom of form can liberate architects from traditional constraints and allow them to respond more creatively to the urban context and to their own artistic vision. As Mockbee notes: "With computers, you can stretch your imagination further."—*B.J. Novitski*

ABOVE LEFT: Gehry's Disney Concert Hall is now under construction in Los Angeles. Because the shape of each stone was precisely calculated by the milling equipment, there was little cost premium for the diversity of stone shapes within the walls.



AIAOnline Offers New Services

AIA's computerized network aims to increase architects' competitive advantages.

The AIA's new CEO Terrence M. McDermott recently unveiled a plan to reorganize the Institute and improve member communication. To help fulfill this new agenda, the AIA is now offering AIAOnline, the Institute's national computerized network, free as a benefit to AIA members. Members will have to pay only a line-time charge of 15 cents per minute to access the system, which is currently available in Macintosh, DOS, and Windows formats.

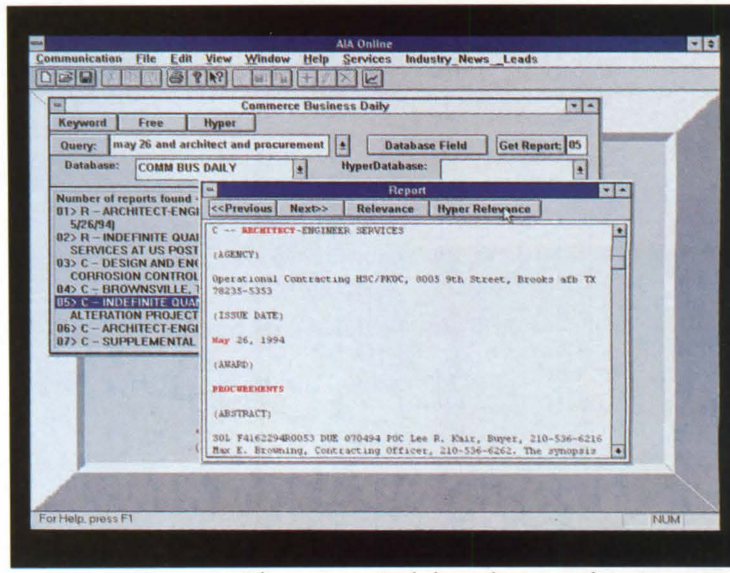
Developed in conjunction with Houston-based Telebuild and first unveiled in early 1993, AIAOnline provides architects with access to news wire services; business leads; product manufacturers; and other resources, such as the AIA Library and Archives catalog (ARCHITECTURE, January 1993, page 83).

Online's electronic mail component (E mail) will facilitate communication among architects and related professionals. Electronic bulletin boards will keep users informed of events such as meetings of the AIA's Professional Interest Areas and allow members to participate in online question-and-answer exchanges with building experts.

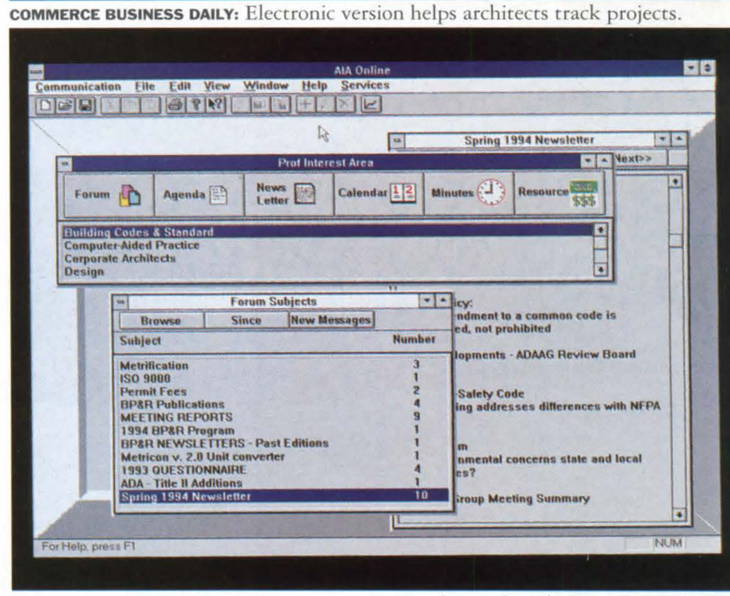
As a new feature, the weekly *Commerce Business Daily* will be offered to Online users a full day before the same information is printed by the U.S. Department of Commerce. The electronic journal will also allow architects who are plugged into the network to electronically scan the entries using keyword searches, giving members a significant competitive advantage in tracking potential projects. The AIA is also working with manufacturers of building products to create CAD files that architects can simply electronically cut and paste into their own computer-generated documents.

By offering Online free to its members, the AIA hopes to significantly increase the number of subscribers to the network from its current 3,000. But while Online offers a number of "revolutionary methods of practicing architecture," according to the AIA's information network director, Ben Silverstein, combating architects' resistance to computer technology and teaching them new skills must be undertaken before the network wins widespread acceptance.

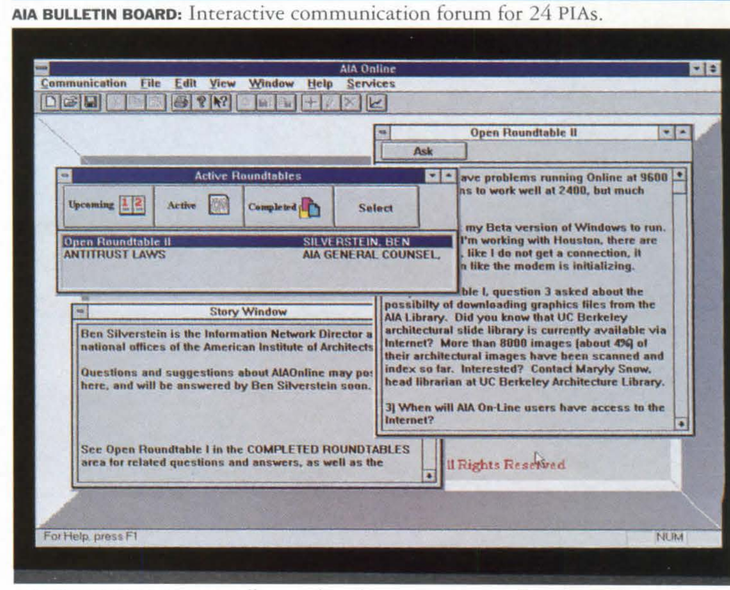
To request additional information, contact (202) 626-7491.—*R.A.B.*



COMMERCE BUSINESS DAILY: Electronic version helps architects track projects.

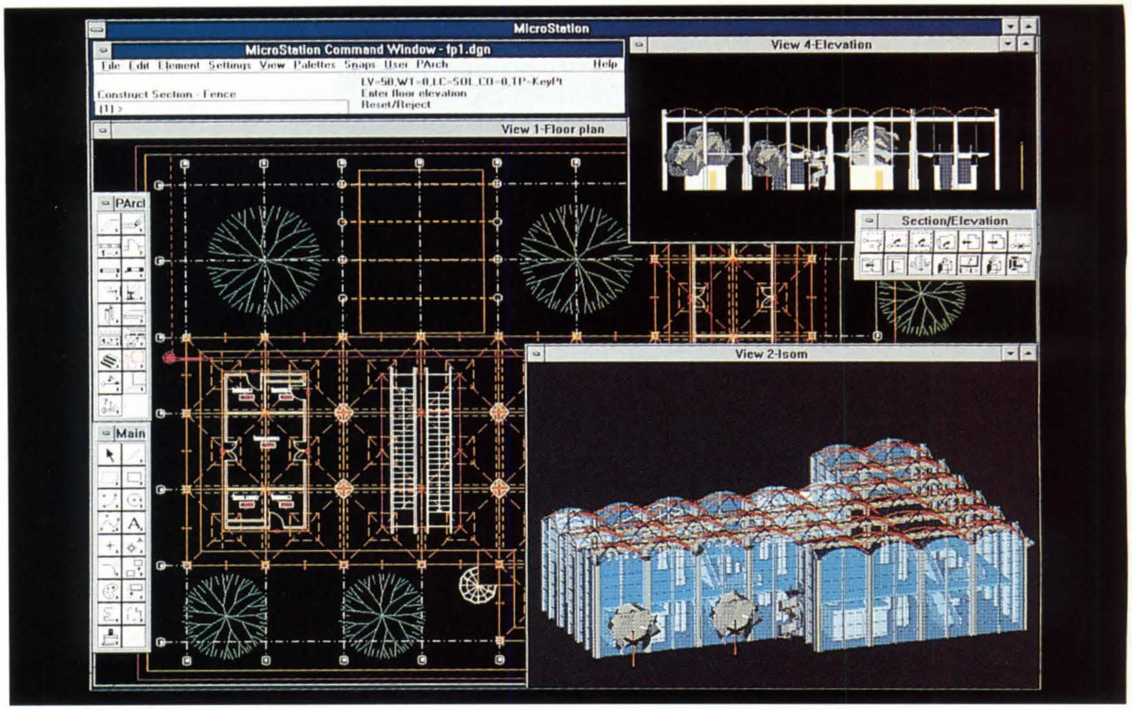


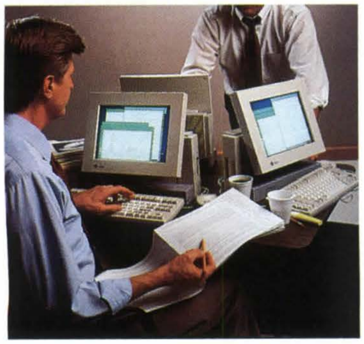
AIA BULLETIN BOARD: Interactive communication forum for 24 PIAs.



ELECTRONIC ROUNDTABLE: Allows subscribers to post questions for AIA experts.

A computer show emphasizes integration of graphic and analytical information.





ABOVE: The SPARCstation Voyager from Sun Microsystems is a high-performance CAD workstation in a notebook computer size, ideal for work in the field or where space is at a premium. **ABOVE RIGHT:** Intergraph's new AEC Desktop integrates CAD, including the high-end Project Architect, with other non-CAD architectural applications on an Intel-based workstation operating Microsoft Windows NT.

A/E/C Show Forecasts New Computer Networks

The theme of A/E/C Systems '94, held June 20-23 in Washington, D.C., was "enterprise workflow," referring to the increasing role of computers not only in drafting and design, but also in every aspect of professional practice, including financial management, marketing, and specifications. As organizer Michael Hough noted: "The firms that will prosper in the future will be the ones that harness all these systems into one seamless network that advances the strategic objectives of the firm."

As an example of how vendors are supporting this concept of enterprise workflow, Softdesk, best-selling AutoCAD application software developer, announced the acquisition of Image Systems and IntelliCADD, thereby extending the company's offerings into the areas of scanned document management and automated mapping/facilities management, respectively. Softdesk also demonstrated its new energy analysis program, which provides quick feedback during schematic design. In combination with existing applications, these programs cover the life of a building, from site analysis, through architectural and engineering design, to construction management and facility management.

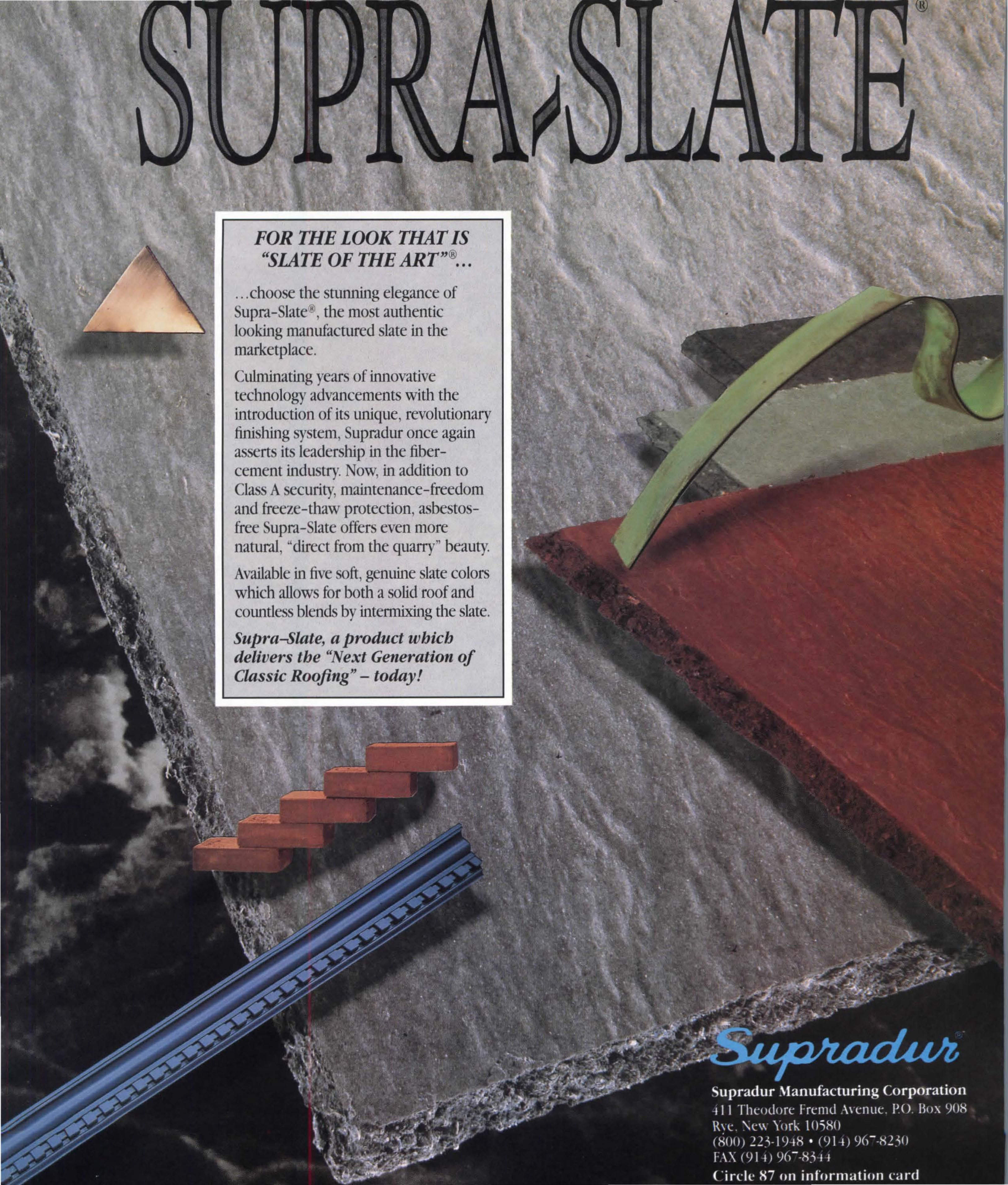
A one-day conference sponsored by Computer-Aided Practice, the AIA's newest Professional Interest Area (PIA), supported the A/E/C Systems' theme. This popular PIA was established to facilitate the exchange of information on automated firm management, design and modeling, financial performance, and communications. The conference, "Computer Tools and Client Demands: New Methods for Architectural Practice," featured speakers Jerry Laiserin, from the Design-Practice-Design Group, of Woodbury, New York; Heinrich Kuhn of Birmingham's KPS Group; and David Chaney and Bobby Anderson of Tulsa, Oklahoma's BSW International. These architects discussed ways of integrating computers within their firms to satisfy the changing needs of clients and to expand the delivery of services without compromising successful practices.

In the afternoon, practitioners discussed the status and future of the AIA's *CAD Layer Guidelines*. Originally published in 1990, these guidelines are widely recognized, although not universally accepted, in the construction industry. Participants did not set a specific new direction, but agreed to work with the new National Institute of Building Sciences' CADD Council to develop industrywide standards.

Meanwhile, the A/E/C show's exhibits abounded with demonstrations of the year's progress in hardware and software. Both IBM-PC-compatible and Apple microcomputers have made major breakthroughs this year, with the Pentium and the Power PC chips, respectively. Faster, sleeker CAD software programs that have kept pace with these low-cost but powerful platforms were highlights of the show.

In the past, most CAD software was for drafting only, without much nongraphic information about the building associated with the lines on the screen. Now more common is parametric design software, in which the architect specifies the size and type of an element, and the graphic representation is generated automatically. Examples of this development were shown by Ketiv and Intergraph.

Also, Jacobus Technologies, known for software that incorporates expert knowledge into CAD models, and Bentley Systems, developer of the number two best-selling CAD software, MicroStation, announced an alliance for joint software development. The fruit of this venture will be a smoother integration between visual representations and automated analyses such as automatic checking for interferences between, for example, structural and HVAC systems or for compliance with building codes. When these systems are implemented, the profession will benefit from more sophisticated tools that enhance design decision making, and, in turn, the built environment.—*B. J. Novitski*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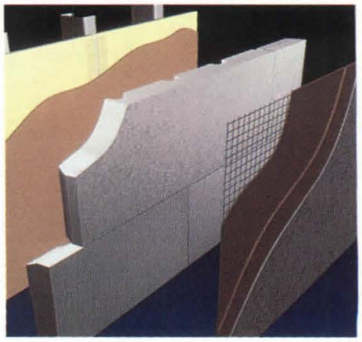
Products

Manufacturers offer resilient and flexible alternatives to conventional roofing systems.



TOP: Newfoundland Slate quarries Canadian slate deposits to produce the company's Trinity Slate line. This hand-crafted stone, available in plum, blue-green, olive-green, black, and varying hues of gray, boasts a life expectancy of over 150 years. Stain resistant, fireproof, and environmentally friendly, Trinity Slate is appropriate for roofing and structural applications—including exterior wall panels, lintels, stair treads, and fireplaces. Uniform lengths and widths are supplemented by custom sizes.
Circle 401 on information card.

ABOVE: Developed by the Innovative Design Research Division of the National Concrete Masonry Association, Roofcap Paver is a prefabricated concrete product designed to secure, insulate, and protect low-slope roofing membranes. Its plastic interlocking system doesn't require mortar or adhesives; modular dimensions eliminate extensive paver cutting. A flared footprint distributes weight evenly over large areas to prevent shear damage to the insulation and roofing membrane. Marketed by Rapid Building Systems of Synthesis International, Roofcap features two-way drainage and can be constructed on metal or concrete roof decks. Roofcap is manufactured in three weight ranges; higher weight versions allow roof surfaces to double as decks.
Circle 402 on information card.

ABOVE: A new series of aluminum roofing products from Alcoa Building Products replicates the appearance of aged metal roofs. The Manor Estate Series simulates bronze, copper patina (above), and weathered wood finishes. Due to their light weight, these aluminum roofing units require little structural reinforcement. They are fire resistant, and a new clear-coat finish protects against ultraviolet rays. Appropriate for both commercial and residential applications, Alcoa's interlocking panel design is purported to increase strength and wind resistance.
Circle 403 on information card.

ABOVE: Two new exterior insulation finish systems are now available from Dryvit Systems. The Infinity systems, including Infinity PE (pressure equalized) and Infinity MD (moisture drainage), are cavity wall designs that combat water infiltration. The Infinity PE system is intended to neutralize the difference between the air pressure on the exterior and interior of a building, a leading cause of water penetration. The Infinity MD system features drainage channels that capture and direct incidental moisture. Each system is constructed of two layers separated by a cavity. A watertight membrane lines the interior wall, adjacent to an insulation board. The outer layer consists of a reinforcing mesh base coat, with a textured and colored resilient elastomeric finish.
Circle 404 on information card.

Watertight skylights
Water infiltration due to snow and ice accumulation on a roof prompted the design of Skylight Roofing Underlayment by VELUX (above). Designed for installations in cold climates, this rubberized material creates a watertight seal between the skylight and roof deck. Installed beneath the flashing, the underlayment replaces traditional roofing felt. The underlayment is packaged in 36-foot-by-9-inch strips.
Circle 405 on information card.

Energy-efficient membrane
Stevens Roofing Systems, a division of JPS Elastomerics Corporation, released a new version of its Hi-Tuff/EP membrane (above) at the 1994 National Roofing Contractors Association convention. Now available in white, the single-ply rubber roofing system reflects the sun's rays, saving energy costs. Heat-welded seams eliminate the need for adhesives. A standard roll measures 100 feet long and 76.5 inches wide.
Circle 406 on information card.

Fiberglass shingles
Georgia-Pacific has introduced the Summit series (above), a line of fiberglass shingles consisting of a two-layer laminate of fiberglass and asphalt. Available in eight colors, Summit shingles feature darker granules placed to emulate the textured effect of shake roofing. For ease of installation, an adhesive strip eliminates the need to nail the first course to the starter strip; built-in nailing lines aid accurate installation.
Circle 407 on information card.

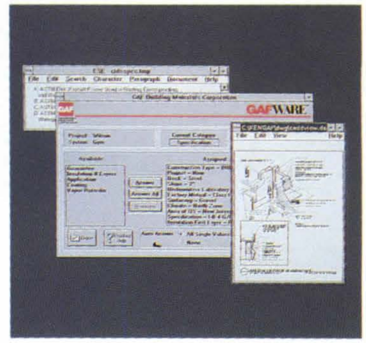
Fiber-cement shingles
To supplement its line of natural cedar shingles, the Clarke Group offers FireFree roofing materials—lightweight fiber-cement products for residential and commercial applications. Available in Rustic Shake, Quarry Slate (above), and Colonial Shingle, FireFree products offer increased resistance to extreme weather conditions. They have a Class A fire rating in accordance with industry standards.
Circle 408 on information card.

Vinyl flooring

Vibrant colors characterize the Fields collection (above), a new line of inlaid sheet vinyl flooring by Mannington Commercial. The granular surface of the Fine Fields pattern is available in 28 colors; the more textured surface of the Random Fields pattern, reminiscent of stone, is available in 12 colors. Felt backing allows installation on all grade levels. The ability to weld seams ensures a continuous, watertight installation.
Circle 409 on information card.

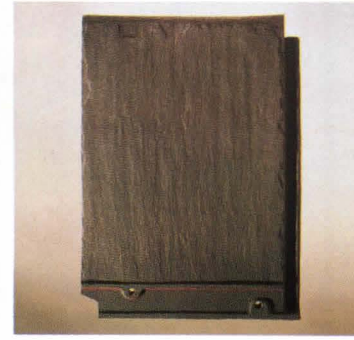
Metal-clad roofs

Petersen Aluminum Corporation has released a complete line of metal roofing products, including the new SNAP-CLAD Metal Roofing Panel (above), available in 24 colors for steel panels, and 14 for aluminum panels. A $1\frac{3}{4}$-inch standing seam connects 10-, 12-, and 18-inch-wide panels; a concealed fastener allows for thermal expansion and contraction. The panels are suitable for roofing and fascias.
Circle 410 on information card.



Specification software

GAF Building Materials Corporation has released GAFWARE (above), a computer software package designed to help architects select and detail membrane and shingle roofs. GAFWARE compiles project information such as construction type and climate and determines the appropriate application. The system operates within Microsoft Windows, and is compatible with AutoCAD, allowing a user to export graphic details.
Circle 411 on information card.



Slate simulation

Released this spring by CertainTeed Corporation, Celadon Ceramic Slate (above) is a fired-clay ceramic roofing product designed to resemble slate. At 580 pounds per square (108 pieces) and with a breaking strength of over 300 pounds, Ceramic Slate is lighter than natural slate and boasts comparable strength. Available in gray, green, red, purple, and black, each interlocking piece measures $10\frac{7}{8}$ inches by $15\frac{3}{4}$ inches.
Circle 412 on information card.

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Cedar solutions

Wet, humid climates exacerbate the decay of cedar shingles. An alternative to wood shingles is Louisiana-Pacific's Nature Guard fiber cement roof shakes, which are purported to resist fungal decay and fire. Lighter than clay, fiber cement requires less structural support. Louisiana-Pacific shakes are available in brown and two shades of gray and are offered in standard widths of 12, 7, and 5 inches.
Circle 413 on information card.

Disposable pail liners

Firestone Building Products Company has introduced a disposable pail liner for roofing adhesives. The first product of its kind offered by a commercial roofing manufacturer, the new liner is a polyethylene shell that is inserted in a clean adhesive pail prior to filling. Easy to remove, the liners provide contractors with an alternative to throwing out each pail and encourage recycling to reduce landfill waste.
Circle 414 on information card.

Retractable roofing

OPENAIRE introduces skylights and enclosures equipped with motorized, retractable roof panels constructed of glass or polycarbonate panels framed in aluminum. Capable of spanning a distance of 75 feet, these panels can cover as much as 50 percent of a given roof area. OPENAIRE manufactures standard-width skylights and freestanding structures, such as swimming pool enclosures.
Circle 415 on information card.

Corner connections

Sarnafil, manufacturer of reinforced, single-ply roofing membranes, introduces SarnaCorner, a 1.5-mm-thick prefabricated corner piece for curb, pitch pocket, and flashing details. Lacquer coated for dirt resistance, it consists of a dark gray backing and colored surface, which matches a roof membrane. SarnaCorners are heat-welded in place and require little or no maintenance.
Circle 416 on information card.

Lightweight roofing

The Variette awning protects decks and patios from sun, wind, and rain; it can be extended or retracted manually, using a gear, or with an electric motor. Manufactured by the Astrup Company, the awning is available in widths up to 22 feet and projections up to 13 feet.
Circle 417 on information card.

Copper details

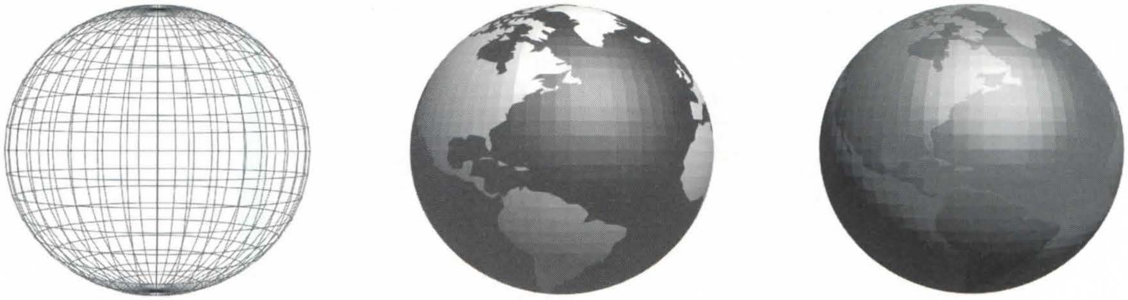
Revere Copper Shingles, from Revere Cooper Products, offer an alternative to conventional asphalt shingles. Weathertight and durable, the shingles can be installed over plywood or solid lumber substrates. Their two-piece construction combines solid copper shingles with a concealed joint pan, to protect against driving rain. Shingles are available in 4-foot lengths.
Circle 418 on information card.

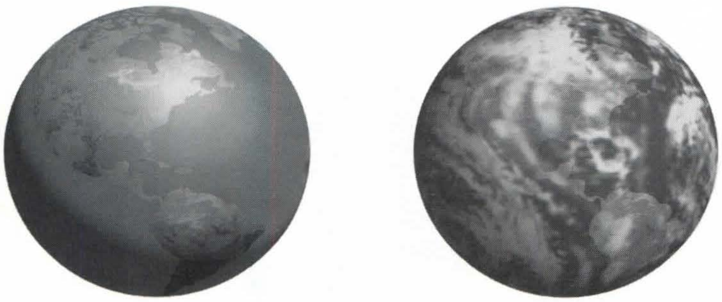
Steel joist guide

The Steel Joist Institute (SJI) is a nonprofit organization whose membership comprises manufacturers and professional engineers. SJI has recently published its *Technical Digest No. 3* to aid in the selection and construction of steel joist roofing systems. The comprehensive digest includes specifications, load and weight tables, and a recommended code of standard practice.
Circle 419 on information card.

Fluid roofing membrane

Polycoat Systems of New York distributes Roof Mate, a new, fluid roofing membrane from United Coatings. Designed to extend the life of a new or existing roof, Roof Mate covers and seals the entire surface, purportedly eliminating leaks. Permanently flexible, the system can be applied over metal, built-up, or concrete roofs, as well as over wood and asphalt shingles.
Circle 420 on information card.





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Roofing

CSI Section 07110

Roof deck waterproofing

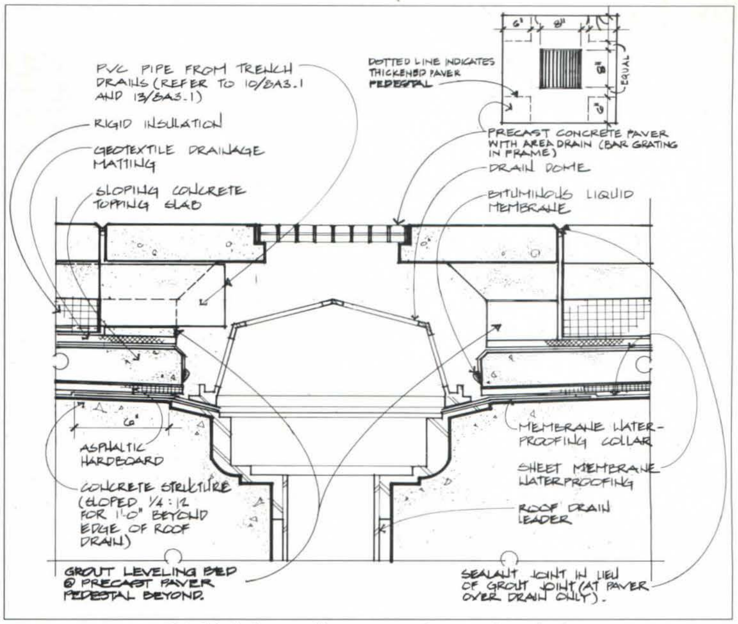
Our design of a corporate headquarters called for locating a prominent pedestrian-accessible roof garden between the two tallest wings of the building. As the garden was to be aligned with floors in the adjacent wings to provide access and comply with ADA requirements, the roof structure supporting the garden needed to be lowered to allow adequate height for materials, proper slopes, and insulation. This height was accomplished by converting the typical, 22-inch-deep, cast-in-place pan joist structure into a 12-inch post-tensioned slab. For ease of construction, this supporting structure was installed flat.

As executive offices were to be located immediately below this roof, an absolutely reliable waterproofing system was necessary. We selected a modified bitumen sheet membrane waterproofing system (detail, above right). An initial layer of membrane was installed on a concrete surface that was cleaned and primed.

To test its impermeability, we specified the membrane to be flooded with 2 inches of water for 24 hours. Flooding was repeated until no leakage occurred, which was verified by an independent testing agency. A geotextile drainage mat was placed on top of the membrane, a protection board laid on top of it, and sloped concrete fill on top of the protection board. A second layer of sheet membrane was installed and flood-tested again to provide extra protection against water penetration. Another layer of geotextile drainage mat furnished a primary path of travel for water. Planter and paver areas were installed on top of the roof system, with paver areas sloped to surface drains.

The basis of this system is to direct water on hard surfaces into surface drains. Water penetrating surface pavers and planter areas drains in the upper layer of the geotextile drainage mat on the sloped surface. Any further penetrating moisture can migrate to drains in the lowest geotextile mat layer. The drains should be numerous and oversized so that no backup occurs, even during severe storms.

Gene Montezinos, AIA
Thompson, Ventulett Stainback & Associates, Architect
Atlanta, Georgia



ROOF DRAIN DETAIL: Multiple layers direct water into surface drains.

Tapered roof insulation

Good roof design demands positive drainage, and the most economical way to achieve this in new construction is to slope the structural roof deck. But in some situations, sufficient drainage may not be possible. The architect may find that the direction of slope needs to be changed at saddles, or that a roof over an older building with a level deck must be replaced. In such instances, tapered roof insulation systems can provide the necessary positive drainage.

Tapered insulation systems are available in all types of common insulation materials: expanded perlite, glass fiber, isocyanurate, expanded/extruded polystyrene, and cellular glass. Tapered insulation is manufactured by many producers of primary roof insulation and by specialty fabricators that taper insulation from stock obtained from the manufacturers. The most popular slopes for tapered insulation measure 1/8 inch, 1/4 inch, and 1/2 inch per foot, with other slopes available. Insulation panels are commonly cut in 2- or 4-foot widths.

In selecting a tapered insulation system, architects should examine compatibility with the proposed roof membrane. Roof warranties, as well, may affect the architect's selection of a specific manufacturer's product. Tapered insulation is relatively expensive. Factors that influence the cost include slope, layout, and type of insulation material. While shop drawings should always be required, basic design of tapered insulation should not be left to the contractor. It is advisable to include a schematic layout of the tapered system on the roof plan showing starting thickness, direction of slope, typical panel layouts, saddles, and crickets. Tapered panels should be laid out perpendicular to each other, and intersections mitred at 45 degrees. The schematic plan should indicate total insulation thickness at all edges so that proper roof terminations can be designed. The schematic also will help in locating roof drains correctly.

Tapered insulation is installed the same way as conventional roof insulation: loose laid for ballasted thermoset and thermoplastic roofs, or laid in hot asphalt for built-up and modified bitumen roofs. Mechanical attachment of tapered insulation and the membranes above them should be avoided because of the logistical and installation difficulties that accompany the variety of required fastener lengths. At steel decks, a base layer of flat insulation can be mechanically attached and the tapered system then mopped to it. Tapered perlite insulation is very dusty, and a top layer of flat stock—laid out with its joints offset from the insulation's joints below—should be used when built-up roofing is specified. In projects where the old roof is being torn off first, a temporary roof under the tapered system provides greater protection to occupied buildings.

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