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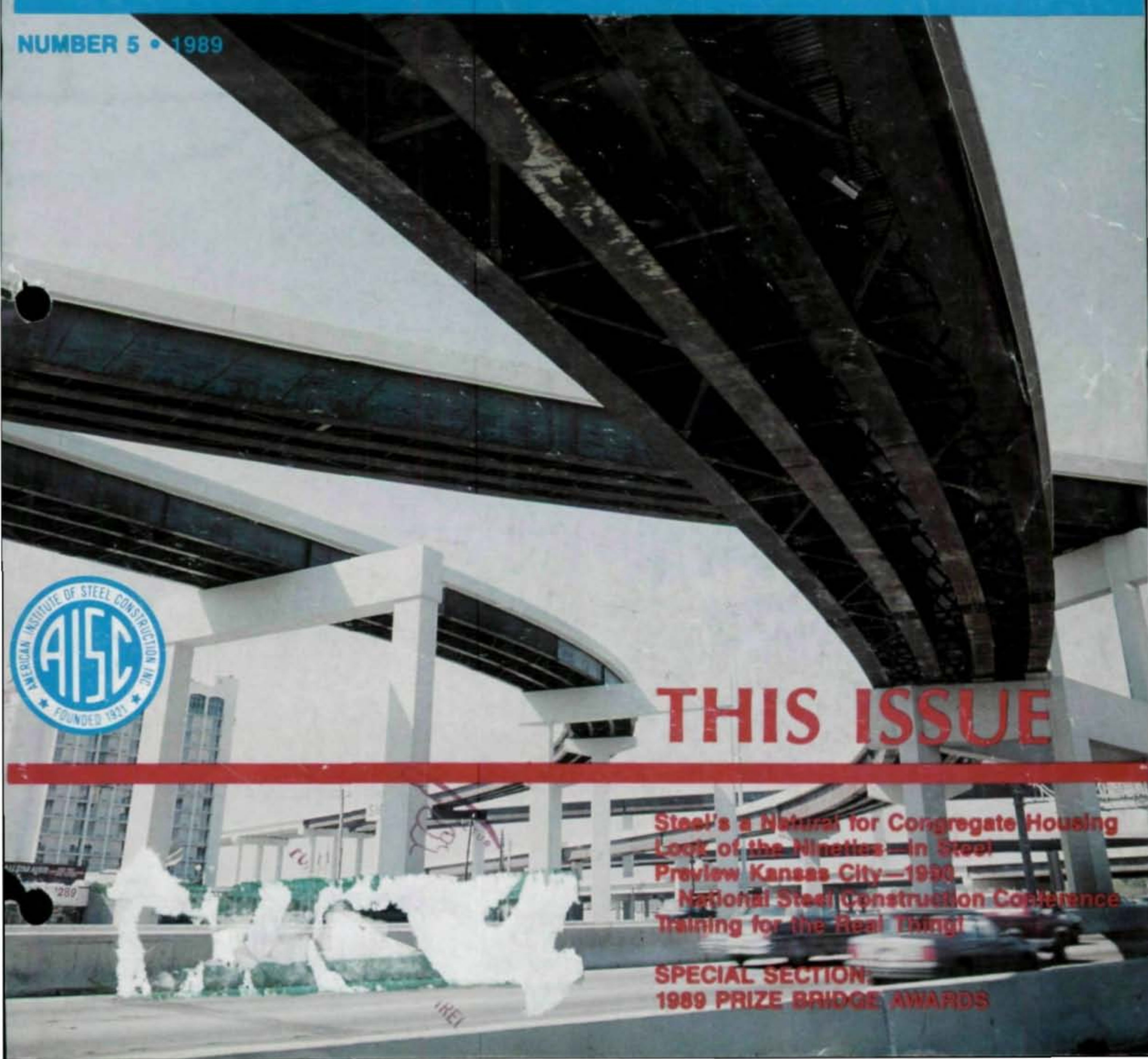
MODERN STEEL CONSTRUCTION

NUMBER 5 • 1989



THIS ISSUE

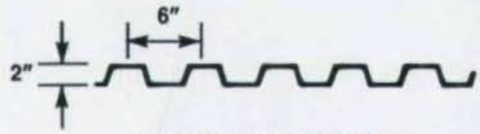
Steel's a Natural for Congregate Housing
Look of the Nineties—in Steel
Preview Kansas City—1990
National Steel Construction Conference
Training for the Real Thing!

SPECIAL SECTION:
1989 PRIZE BRIDGE AWARDS

UNITED STEEL DECK, INC.

DECK DESIGN DATA SHEET

No. 12
FORM DECKS



2" x 6" 30" COVER
EXTRA HEAVY DUTY FORM
UF2X

- Ribs can accept a 3/4" stud
- Available vented (UF2XV) for lightweight fill roofs

SECTION PROPERTIES

GAGE	METAL t	I	Sp	Sn
24	.0239	0.231	0.192	0.206
22	.0295	0.299	0.253	0.270
20	.0358	0.378	0.326	0.346
18	.0474	0.527	0.471	0.497

1 5/16" x 5 1/8" 36" COVER
HEAVY DUTY FORM
UFX-36

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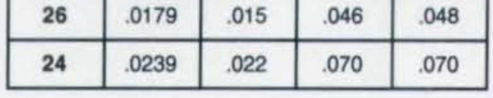
- Available vented (UFXV-36) for lightweight fill roofs

SECTION PROPERTIES

GAGE	METAL t	I	Sp	Sn
26	.0179	.071	.086	.096
24	.0239	.101	.125	.141
22	.0295	.130	.164	.183
20	.0358	.164	.212	.225



9/16" x 2 1/2" 30" COVER
STANDARD FORM
UFS

SECTION PROPERTIES

GAGE	METAL t	I	Sp	Sn
28	.0149	.012	.036	.039
26	.0179	.015	.046	.048
24	.0239	.022	.070	.070

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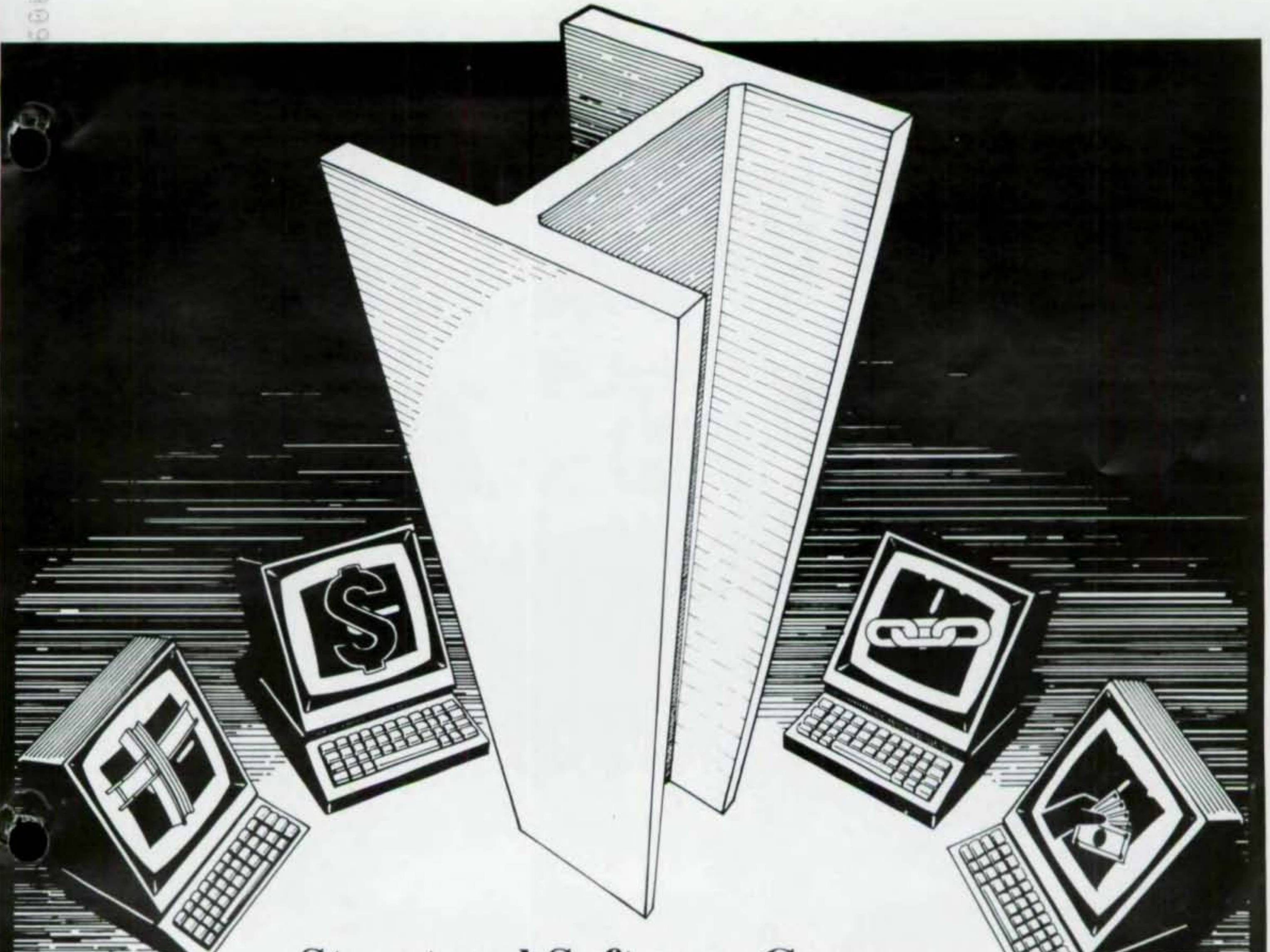

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MODERN STEEL CONSTRUCTION

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SEPTEMBER-OCTOBER 1989

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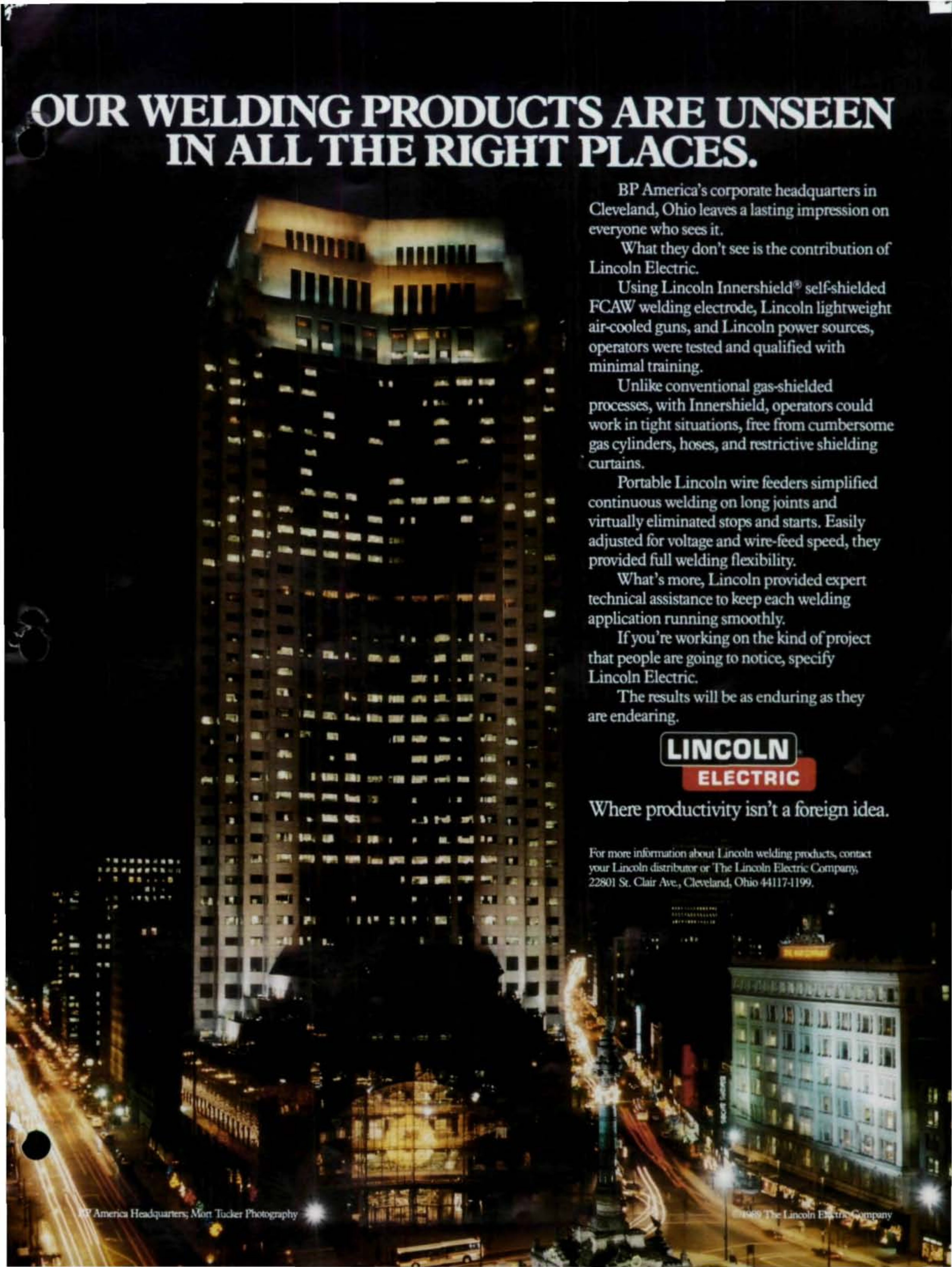
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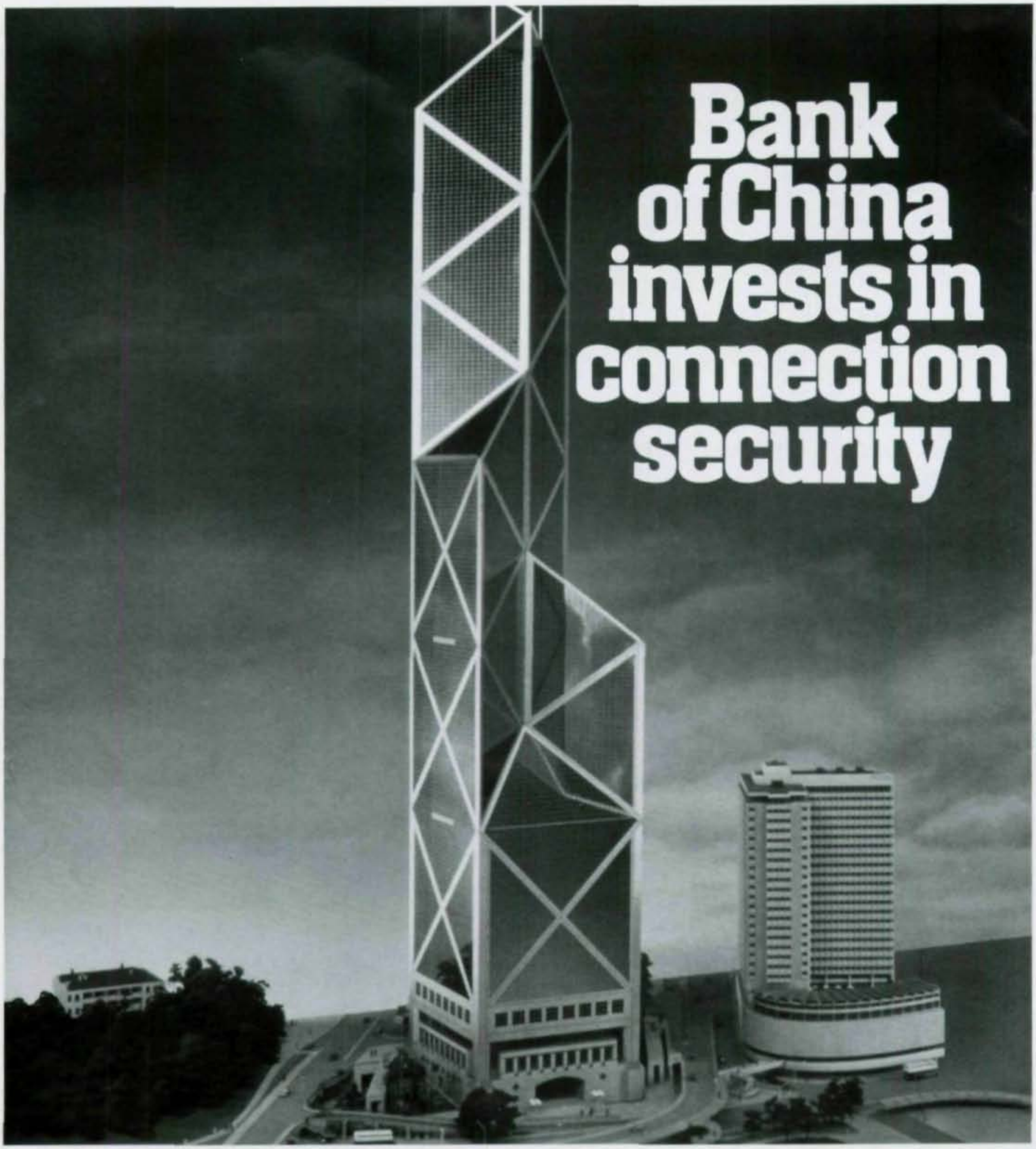

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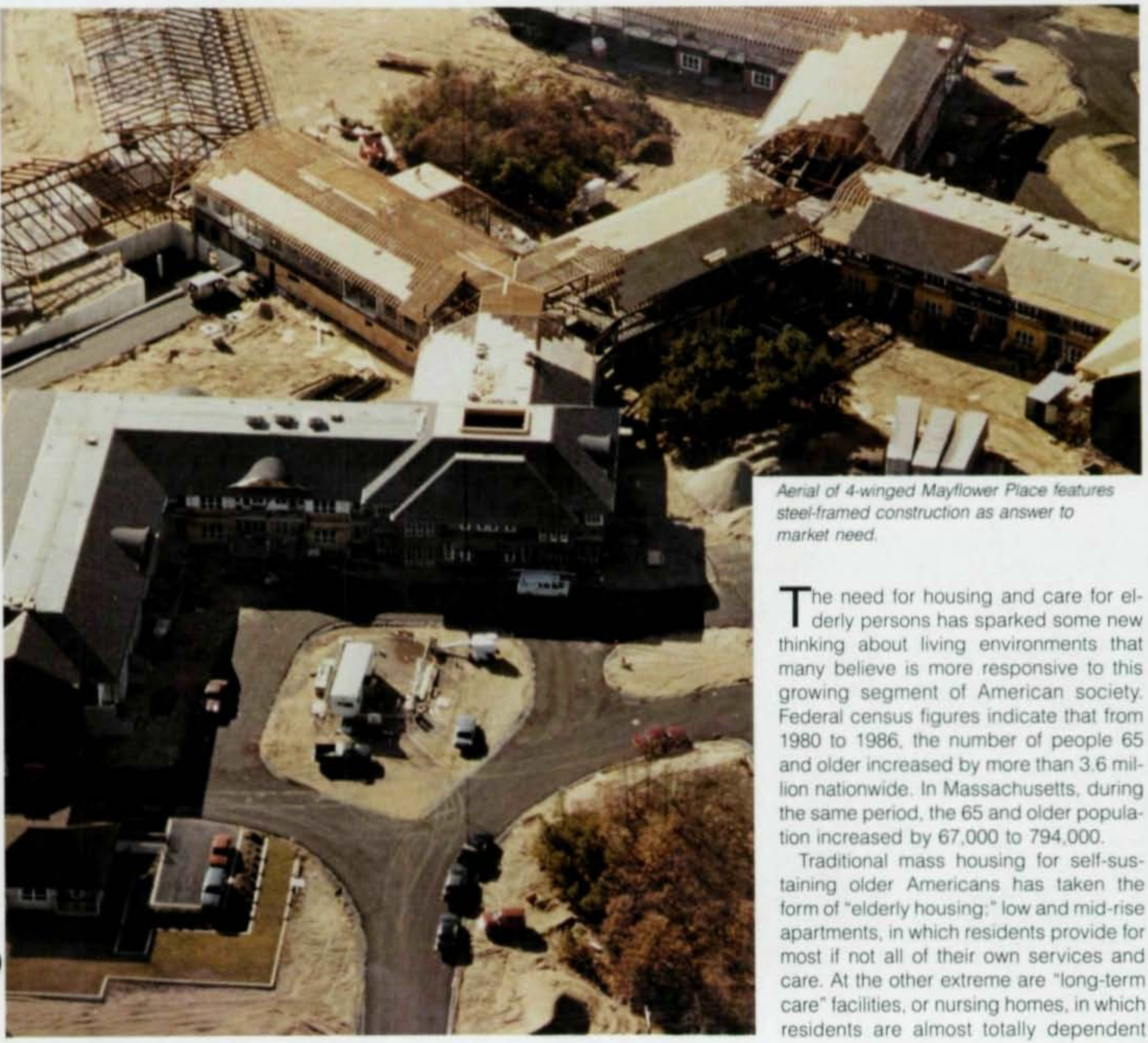
New Markets in Steel

MAYFLOWER PLACE
Steel's a Natural for Congregate Housing

by Stephen K. Crockett



Aerial of 4-winged Mayflower Place features steel-framed construction as answer to market need.

The need for housing and care for elderly persons has sparked some new thinking about living environments that many believe is more responsive to this growing segment of American society. Federal census figures indicate that from 1980 to 1986, the number of people 65 and older increased by more than 3.6 million nationwide. In Massachusetts, during the same period, the 65 and older population increased by 67,000 to 794,000.

Traditional mass housing for self-sustaining older Americans has taken the form of "elderly housing," low and mid-rise apartments, in which residents provide for most if not all of their own services and care. At the other extreme are "long-term care" facilities, or nursing homes, in which residents are almost totally dependent

Drive-in trellis at main entrance of retirement center (above). Residential courtyard (r.) features gazebo, greenhouse solarium.

upon on-site staff for day-to-day dining, health and social services.

A recent alternative living environment for senior citizens is called the "continuing care retirement community" or congregate housing. It is estimated that 700 such communities already exist nationwide, with a majority concentrated in Florida, California and Pennsylvania.

In planning Mayflower Place, a 60-bed Level II/III nursing home and 102-unit congregate housing project in Yarmouth, Cape Cod, Massachusetts, the architect set out to create a non-institutional environment to provide residents with privacy and substantial independence. At the same time, this "life-care" facility had to be a self-contained community, with an infrastructure offering a complete range of services so residents could develop a lifestyle tailored to their own particular capability and temperament.

Structural Steel Key to Framing

Typical of many congregate housing communities, Mayflower Place is low-rise, only two-stories, with one-story for the nursing home. But the building program is substantially more comprehensive and complex than any other form of elderly living environment. And that is the key to the suitability of structural steel for the framing of congregate housing communities.

This $20-million development, located

Residential courtyard looking toward dining room (above). Second floor and roof steel-framed for dining room and cathedral ceiling.

on a 40-acre site on Cape Cod, offers residents a private apartment. In addition, these services are available:

- Dining alternatives (in-room or at common facilities);
- Housekeeping and linen;
- Medical emergency response;
- 24-hour security;
- Maintenance; and
- A full range of social and recreational programs.

Consider the amenities offered at Mayflower Place for the active life style: fully equipped spa with whirlpool and indoor swimming pool; game rooms; lounges; beauty parlor/barber shop; library; chapel; meeting rooms; theater; gazebo courtyard; walking trails; central common area; bank; post office; cafe; and gardening areas. In thinking about how this kind of program can be accommodated within a two-story residential building that must be tailored for senior citizens, perhaps the reader can understand the complexity of the design required.

Structural Considerations

A total of five framing systems were evaluated during the preliminary design phase. The nursing home required by code in Massachusetts, a fireproof, non-combustible frame (fire-treated lumber is not acceptable). For the congregate housing, a structural fire rating was not required by code, thus conventional wood framing was a possible choice; wood is a traditional material for both structural and exterior cladding on the Cape. However, the owner, an experienced developer of congregate facilities, decided a non-combustible structure was essential for fire-safety and marketing purposes. The owner also provided complete sprinkler protection, which is not required by code. As it turned out, the complexity of the building program was such that wood framing would not have worked well anyway.

Since the soil condition is loose Cape Cod sand with an allowable safe bearing capacity of about one-ton per sq. ft, a light structure was desired. Reinforced concrete or masonry would have produced significant penalties in the foundation. And, the flexibility in locating gravity load components to accommodate the complex program would have been severely restricted.

The selection quickly focused on a steel frame with either cold-formed joists, composite beams or bar joists (composite or conventional) for the floors. After comparative economic studies by the construction manager, the final selection of a concrete slab on composite steel joists was made.

Mayflower Place contains three basic

Core intersection, with pipe collar to ease fabrication of ridge/valley connections.

apartment types, and is laid out as a series of two-story wings that frame into several central core areas. Due to site restrictions, i.e., property line setbacks and wetlands protections, the wings enter the core areas at various skews. The main core, comprised primarily of the Center and South Wings, contain most of the common spaces and amenities. The East, North and West Wings have dwelling units, except for the far end of the West Wing, which houses the indoor swimming pool and fitness center. The South Wing ties into the one-story nursing home.

Each wing at Mayflower Place is 55 ft wide. Longitudinal lines of TS4 × 4 columns run along both exterior walls and each side of the 6-ft wide corridor in each wing. Tubular columns minimized the width and fit entirely within the 4-in. corridor studs. The longitudinal spacing of the interior and exterior columns varies from about 12 ft to 23 ft. The transverse spacing between the exterior and corridor walls varies from 23 to 26 ft. The four lines of relatively close-spaced columns, supporting both the floor and roof framing, was necessary to adequately distribute gravity and lateral loads to the sandy soil through a conventional spread-footing arrangement. Fourteen-in. deep composite steel joists and wide-flange steel girders support a 3-in., 3,000-psi, concrete slab and span the 23- to 26-ft width from the corridor column lines to the exterior. Across the corridor's 6-ft width, shallow, composite sections are framed, providing sufficient ceiling space below to conceal the plumbing and mechanical equipment. The girders are typically W12 × 19's or W14 × 22's, all ASTM A36 steel. Comparative ASTM A572, Gr. 50 steel did not reduce costs, due mainly to the "lightness" of the A36 sections within the wings and deflection/vibration characteristics at the open core areas.

Because of the dampening losses on the second-floor open common spaces, the slab thickness was increased to 3½ in. as a result of studies conducted with the joist manufacturer to control transient vibrations to acceptable levels. Lateral load resistance is provided mostly by two-story tubular braced frames. The major exception to this framing system occurs in the swimming pool area. Here, W8 × 67 exterior columns support W18 girders clear-spanning the 55-ft width. W12 spandrel beams with field-welded flange moment connections to the W8 columns provide the lateral load resistance required.

Responsibility for Design

All connections of beams to tube columns are simple, with through-plates welded to each column face. The connections were initially designed by the steel fabricator and checked during the shop drawing submission by the structural engineer's office for conformance with the contract drawings (which specified the end reaction requirements) and the AISC specifications. For the most part, the connection types and details were left to the discretion of the steel fabricator, since connection particulars vary from shop to shop. This author, however, adheres to the philosophy that the responsibility for the adequacy of the connection design should fall upon the building's structural engineer. Statutes throughout this country impose this responsibility and exempt from certification, licensing and review, owners and employees of steel fabrication facilities. In the opinion of this author, registered engineers should not delegate connection design responsibility to laymen, since the decisions and calculations necessary for the connections are as much a part of the building structure as the members they are connecting.

Initially, blast cleaning and high-quality, lead-free shop painting of all structural steel was contemplated because of the location in a salt-air environment. However, upon further inspection and recommendations offered by the steel bidders, this requirement was deleted (except for the swimming pool structure and balcony support steel) and the steel remained unpainted, resulting in a savings of $50 to $60 per ton for the owner. Steel within the indoor pool area had an SSPC-SP6 commecial blast cleaning followed by a total of 10½ mils dry thickness of zinc-rich and high-solids epoxy paints, all shop-applied. The balcony support steel received an SSPC-SP3 power tool cleaning and a two-coat application of a polyurethane primer, 5 mils total dry thickness.

Skews Challenging

Perhaps the most challenging aspect of structural design for Mayflower Place was dealing with the skews at the multiple-wing intersections and the hipped roof framing. Wood trusses were selected for the primary roof framing in the wings of the retirement community. Since their support consisted of four parallel lines of steel girders (one at each exterior and corridor wall), with only minimal steel framing perpendicular to the supports, the frame proved difficult to plumb until the trusses were fastened and sheathed. In addition to skews, a two-story open cathedral space had to be framed at the main entrance lobby.

There is no question that structural steel assisted the architect in providing Mayflower Place with the kind of sophisticated program the owner wanted to offer. Increasingly, owners will be addressing the marketability of retirement communities and looking for such feaures as fire-safety, interior flexibility, multi-use and well-finished interiors. □

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Norwood, Massachusetts

Construction Manager
Quannapowitt Development Company, Inc.
Wakefield, Massachusetts

Owner
Yarmouth Mayflower Place, Inc.
Weston, Massachusetts

Stephen K. Crockett, P.E., is president of S.K. Crockett Associates, Norwood, Massachusetts.

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NORTHWEST PLAZA
A Look of the Nineties—in Steel

by Alan Elfanbaum

Completed North Feature Court with sculptured columns and exposed steel grillage above

In November, 1989, the third and last phase of the $60-million expansion of Northwest Plaza will open to the public. Already Missouri's largest retail shopping center, the addition of over 300,000 sq. ft of new mall space will make it one of the largest retail complexes of its kind in the country. Over 1,900 tons of structural steel and 400 tons of steel joists were used in the complex addition and enclosure.

Architectural Concept

The architect began working on this project over three years ago, having earned this commission as the result of a highly publicized design competition. The formidable challenge was to take what was once called the world's largest open-mall shopping center and not only to enclose the open garden courts but also to tie together nine prominent "free-standing" buildings into a unified theme. The European owners of the project were looking for a high-tech, space-age environment, emphasizing clean, strong lines and a crisp merchandising presentation for the nineties.

The structure itself was to play a crucial role in both the form and character of interior spaces and would be carried outside the building to form each of Northwest's six feature entrances. Sculptured metal-strip vaulted ceilings were selected as an innovative solution for joining the various elements together, converging at the Feature Courts, which would be accented with palm-like sculptural steel ornamentation and metal edge clear glass cube kiosks. Even the floor tile would take on the characteristics of a geometric optical illusion, which along with interior finishes, would reiterate the more subtle aspects of the exposed structural steel grillage above.

The finished project, as it unfolds, already gives promise as a unique and innovative addition to St. Louis' other recent premier retail complexes.

Elegance with Economy

In the almost one-half mile of its length, the main axis of the complex accommodates some seven separate sub-malls and three large Feature Courts distributed along its length. The court roofs rise some 40 ft above the main mall level and incorporate over 50,000 sq. ft of open space within their confines.

To create an intricate and interesting exposed roof structure, various schemes were considered, including standard space frames of various configurations, along with more conventional types of framing. The solution, finally selected, combined economy with grace, as elegantly sculptured columns with radial eyebrows rise to a two-way truss system, which spans up to 80 ft between supports.

Custom-made, long-span joists have modular panel points that match truss web member spacing. Special bottom chord, double-angle bridging matches joist chord member sizes to create an interesting three-dimensional effect. And perimeter skylights enclose and highlight the exposed structure along with special lighting and finishes to enhance the overall effect.

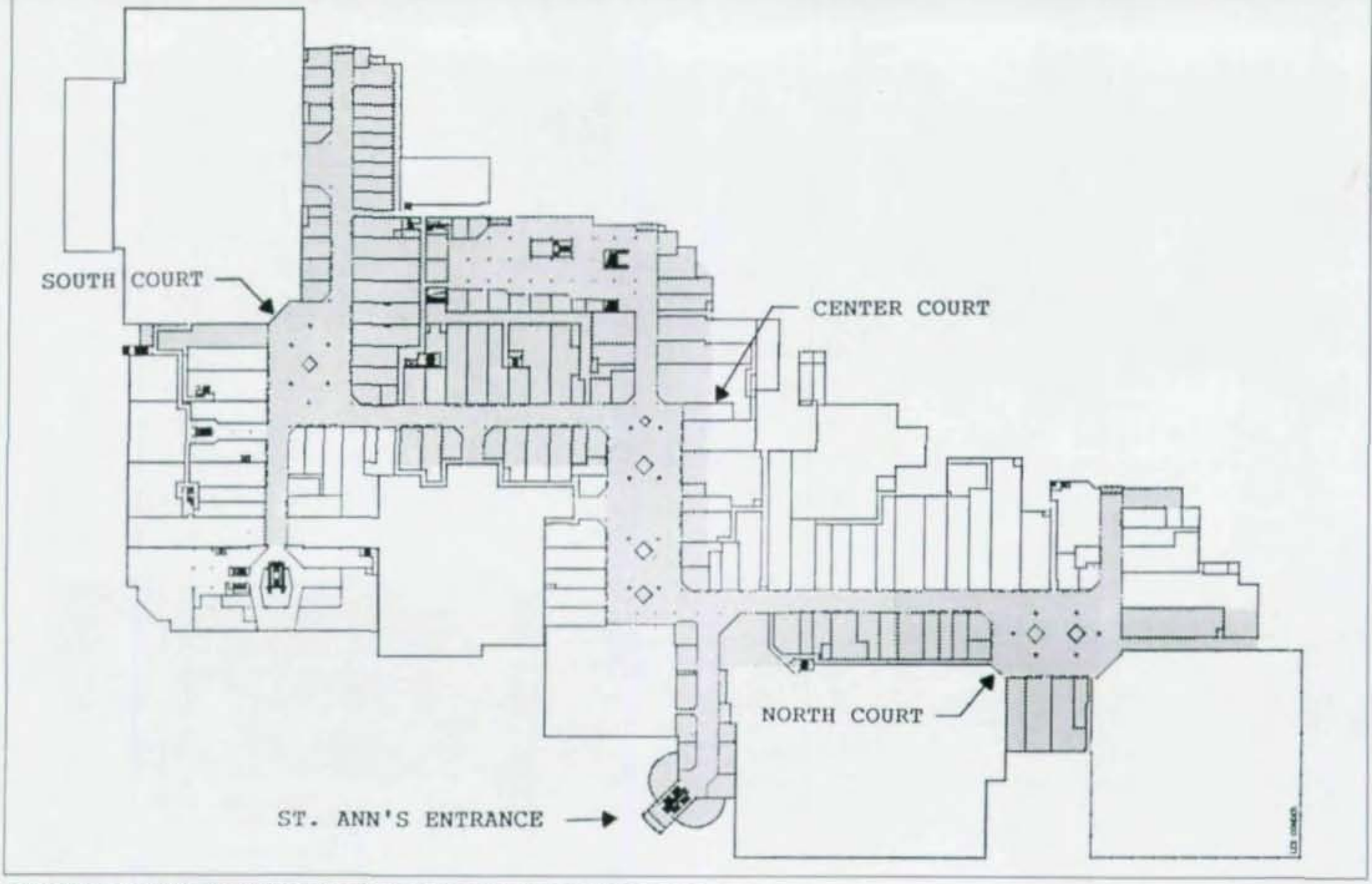
The primary steel columns and long-span trusses provide the required two-way rigid frame stiffness for lateral loads and foundation fixity is taken advantage of where possible. For economy, the balance of the mall construction utilizes cross bracing elements, where allowed, in demising partitions between tenant spaces.

St. Louis Arches

The arch motiff is carried out at each major entrance to the complex, with the highlight being the St. Ann's Entrance, which provides primary access to the new mall in-fill. The 50-ft high arched promenade (formed to a 16 ft-3 in. radius) is made up of five heavy 14-in. wide-flange shapes designed as rigid frames, fixed at the base.

The steel fabricator investigated several different methods to provide the close tolerance requirements of the finished profile and finally selected the relatively new method of induction heat bending. In this process, a steel section passes through an induction coil, which electrically heats short lengths of steel to forging temperatures. The heated section is bent to the required radius as it is cooled simultaneously in a controlled process.

A ¼-in. tolerance was maintained for the



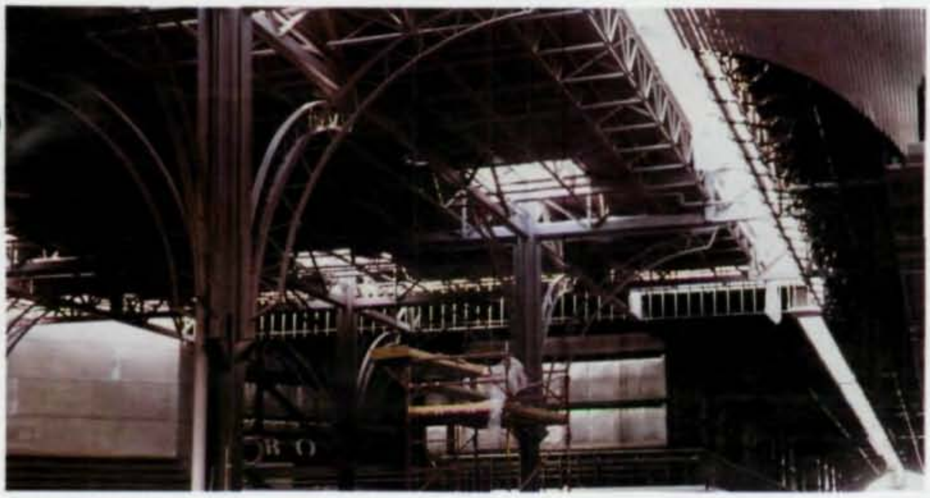
Shaded areas of Northwest Plaza Shopping Center represent fill-in sections.

St. Ann's Entrance, with arched steel canopy, under construction

arch frames with an acceptable level of flange distortion, which is minimal for the heavier sections. For shipping purposes, the arch frames were fabricated in two separate pieces and field-connected with full-penetrated butt welds at the ridge line.

Under-floor Grillage

The South Court in-fill had to be built over an existing garden plaza with truck dock facilities below. The existing plaza deck construction consisted of pan joist and concrete beams and the new roof above introduced column loads as high as 50



South Feature Court and sub-mall beyond under construction

tons in the open court areas. Existing underfloor utilities and a need to keep the loading dock area column free and in-service at all times, provided additional design challenges.

After several types of framing schemes were considered, structural steel was selected as the best solution for the complex requirements in this area. A steel beam grillage system was introduced below the existing concrete deck with the new steel columns above supported on concrete pedestals anchored to the top of the under-floor steel beams. Holes were punched through the existing deck at column locations and the concrete pedestals were kept free of the existing construction. Grillage beams were located so as to clear utilities, where possible, and where interference could not be avoided, beams were notched carefully and reinforced to provide the required clearances for both utilities and truck traffic below. Ends of grillage beams were primarily supported on new add-on concrete columns or were connected to existing concrete beams with expansion bolt connections where loads could be handled by the existing concrete construction.

The relatively light weight of the new grillage system and roof above allowed the use of existing columns and foundations without additional remedial work. Steel beam lateral bracing was accomplished by using steel straps and diagonal angle bracing to the concrete framing above.

Raising the Roof

One of the centerpieces of the new expansion will be a 100,000-sq. ft entertainment complex called Sensations. The three-level center will house a nine-screen cinema on the upper level, a 450-seat food court on the mid level and an entertainment/game complex on the lower level.

Since the structure was originally designed for department store use, major reworking of the existing structure was required, including raising the roof by 15 ft, elimination of alternate rows of columns and reinforcing the upper level to accommodate a raised theater floor and an extensive projection room mezzanine above. In addition, stairs and escalators were relocated, new elevators added and floor construction removed to provide two-level open spaces.

All of the above was accomplished using structural steel solutions. The existing roof and alternate rows of columns were removed. The remaining rows of wide-flange columns spaced at 56 ft o.c. were spliced and reinforced with flange plates to provide tubular sections capable of taking both gravity and wind loads. Cross bracing was added, where allowed, by architectural considerations and upper level floor beams were reinforced with plates, field-welded to top of bottom flanges, to upgrade their load-carrying capacity. Existing openings were infilled with steel beam and composite deck slabs and new openings framed in structural steel, as required.

One of the interesting features of the original building (built in 1965) was the incorporation of the first major installation of composite steel joists in the area. The high load-carrying capacity of these joists along with their added stiffness made them ideal for supporting the new sloping theater floor above.

Double Floor Capacity

Major remodeling of existing structures within the complex included the upgrading of over 10,000 sq. ft of concrete flat slab construction for an increase in live load capacity from 80 pfs to 160 psf, as required for a proposed heavy storage area.

Steel again was the ideal solution with new under-floor steel beams strengthening slab column strips for positive movement. Deep column caps furnished the required support for beam connections, which are expansion-bolted directly into the cap through 15-in. deep channels to more uniformly distribute load to the concrete. Grout pads and bolted shim plates at quarter points help transfer excess slab loads to the new steel beams below. □

Architect
D.I. Architectural—Baltimore, Maryland

Structural Engineer
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St. Louis, Missouri

General Contractor
Pepper/Tarlton (joint venture)
St. Louis, Missouri

Steel Fabricator
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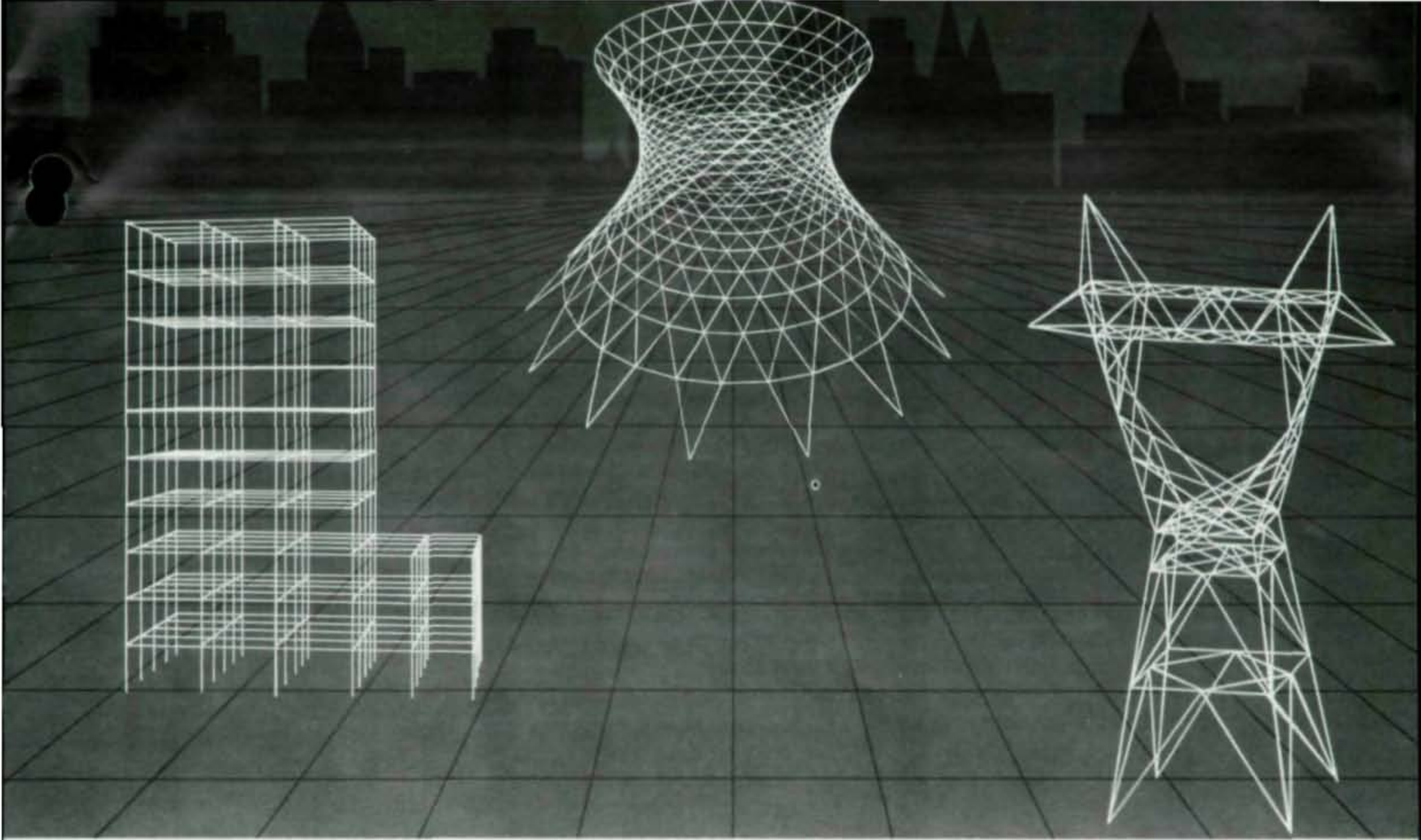
Owner
Paramount Group, Inc.
New York, New York

Alan Elfanbaum is the project principal for Siebold, Sydow & Elfanbaum, Structural Engineers, St. Louis, Missouri.



Kansas City Site for 1990 "All-steel" Show

The 1990 National Steel Construction Conference, the only "all-steel" conference and trade show produced in the U.S., will be held in Kansas City, Mo., March 14-17. Last year's record attendance in Nashville included more than 1,000 fabricators, erectors, consulting engineers, architects, educators and suppliers.

"Heartland of America"

Located in both the geographic and population center of the nation (more than one-third of the U.S. population resides within 600 miles, and more than 55 million people within a day's drive), Kansas City describes itself as the "Heartland of America." Electric and eclectic, casual yet energetic, the city's character features some of the best characteristics of east and west, north and south—a virtual microcosm of Americana. A sophisticated metropolis, it still retains a small-town friendliness.

The city, which spreads out over gently rolling hills and steep bluffs, is an exemplary model of urban planning. Nearly 140 miles of gracious, tree-lined and fountain-studded boulevards wind through neighborhoods and parks.

The arts thrive in Kansas City. Lyric Opera is in its 29th season, the Kansas City Symphony performs regularly from late fall to spring, and the city's jazz legacy is evident in the city's night life. Both the State Ballet of Missouri and the Westport Ballet delight audiences each season. Touring Broadway musicals and locally produced theatre, including children's and dinner theatre, offer another dimension to live entertainment.

Kansas City's museums house everything from the prehistoric to the future: an archeology museum dating back to 200 B.C.; memorabilia of early pioneer life, regional history and the Civil War; collections of miniatures, horse-drawn vehicles and vintage cars; artifacts of black and Hispanic culture. The Nelson-Atkins Museum of Fine Arts is one of the most comprehensive art museums in the country.

Two religious denominations are headquartered in Kansas City. Nearby, Independence is home to the Harry S Truman Library and Museum; Weston has over 100 pre-Civil War (and lived-in) homes listed on the National Register of Historic Places.

Conference Headquarters

The Kansas City Convention Center in downtown Kansas City, Mo. is headquarters for the 1990 Conference. The Center has the space, convenience and flexibility to rate it as one of the top convention sites in the country. Bartle Hall, which will be utilized for the 1990 National Steel Construction Conference exhibits, has 14 loading docks providing direct access to the unobstructed (column-free) exhibit floor. Utility boxes located on 30-ft centers include lines for electrical, water, gas, air and telephone. A floor load of 300 psf live load enables display of even the heaviest equipment. There is ample covered parking for exhibitors and conference attendees (1-day parking only $4). There is also underground access to the Allis Plaza Hotel (conference headquarters hotel), as well as to two of the supplemental hotels: Embassy on the Park and Radisson Suites. A fourth hotel, the Americana, is just one-half block away.

Kansas City International Airport, less than 15 miles northwest of downtown, is served by all major airlines.

Seminars and Technical Program

The 1990 National Steel Construction Conference combines, for the fourth consecutive year, the AISC National Engineering Conference and AISC Conference of Operating Personnel. Special sessions focus on the specific interests of structural steel fabricators, consulting engineers, architects, owners, public officials, erectors, detailers, researchers and educators.

The Conference continues to be the premier meeting place for engineering professionals, the best place to obtain the most information about buildings and bridges designed and built in steel.

Workshop sessions get down to basics, the nuts-and-bolts details of designing, fabricating and erecting structural steel. Every aspect of the construction process from concept to competition receives attention: computerized design, Load and Resistance Factor Design, Autostress Design, project management, shop and field inspection and safety, quality certification, productivity, welding, bolting, cleaning, painting.

The focus is on practical solutions to common problems, and it has also been the first forum for introducing the latest research on structural steel design, recent code changes and technological advances.

Exhibit Booth Space Available

The National Steel Construction Conference offers an ideal marketplace to those who provide products and services to the structural steel industry. In addition to display booths, exhibitors at the 1990 National Steel Construction Conference will also be given an opportunity to conduct a Product/Service Workshop. Introduced for the first time last year, these special sessions offer a forum where companies can share the latest technological advances in specialized fields, conduct demonstrations or question-and-answer dialogues, introduce new or updated equipment and programs. These workshops will be conducted during specific time periods, not in conflict with regular conference sessions, and the schedule will be included as part of the Official Conference Program. Information on exhibit space at the conference is now available from AISC headquarters (312-670-2400).

Pre-Conference Events

This year's Schedule of Events will include an Educator Meeting, concentrating on subjects of interest to those who teach structural steel design courses at colleges and universities; and a Professional Member Forum for structural engineers interested in current programs and publications available from AISC. Other organizations or associations who would like to schedule pre-conference activities to take advantage of this expected high concentration of industry representatives should contact Lona Babbington, Conference Coordinator, at 312-670-5432.

Spouses' Program/Optional Events

In addition to the technical program, the conference will also include a special program for spouses and guests of those registering to attend. A schedule of planned evening and post-conference activities will also be offered.

MSC to Publish Special Show Issue

Modern Steel Construction will publish its January/February issue as The 1990 National Steel Construction Conference Official Program issue. It will also expand circulation for the November/December issue to offer information (including Official Program and Registration Form) to the widest possible audience.

The Pattis Group-3M, Lincolnwood, Ill. is MSC's advertising representative. Eric Neiman (312/679-1100) will be happy to give you full details on advertising in this special issue. □

1990 National Steel Construction Conference
Schedule of Events—Preliminary

Monday and Tuesday, March 12, 13
Exhibitor Move-in
Pre-conference Events to be announced

Wednesday, March 14

8:00 - 5:00 p.m. - Educator Session
Noon - 5:00 p.m. - Professional Member Forum
8:00 - 5:00 p.m. - Committee meetings
9:30 - 12:00 a.m. - Optional Event: Tour of Kansas City
Noon - 1:00 p.m. - Partners in Education Luncheon
Noon - 1:00 p.m. - Speaker Luncheon
1:30 - 3:00 p.m. - General Session: "Construction Claims"
3:00 - 5:00 p.m. - Exhibits open
5:15 - 6:00 p.m. - Exhibitor workshops
6:30 - 7:30 p.m. - AISC Welcome Cocktail Party - Exhibit Hall

Thursday, March 15

7:00 - 8:00 a.m. - SASF Educator Breakfast
7:00 - 8:00 a.m. - VCSSF Educator Breakfast
7:00 - 8:00 a.m. - Speaker Breakfast
7:30 - 8:15 p.m. - Exhibitor Workshops
8:30 - 10:00 a.m. - General Session
10:00 - 3:00 p.m. - Exhibits open
10:00 - 10:45 a.m. - Coffee break (Exhibit Hall)
10:45 - 12:15 p.m. - Technical seminars
11:45 - 12:15 p.m. - Lunch service open
Noon - 1:30 p.m. - Spouses' Event (Lunch & Program)
12:15 - 2:30 p.m. - Lunch/Exhibit Session
3:00 Exhibits close
1:45 - 5:00 p.m. - Spouses' Event
2:30 - 4:00 p.m. - Technical seminars
4:10 - 5:25 p.m. - Technical seminars
5:30 - 6:15 p.m. - Exhibitor workshops (45 min.)
7:00 - 7:45 p.m. - Reception (cash bar) - Allis Plaza Mezzanine
7:45 - 9:30 p.m. - Optional Event: Conference Dinner and Entertainment - Allis Plaza Hotel - Count Basie Ballroom

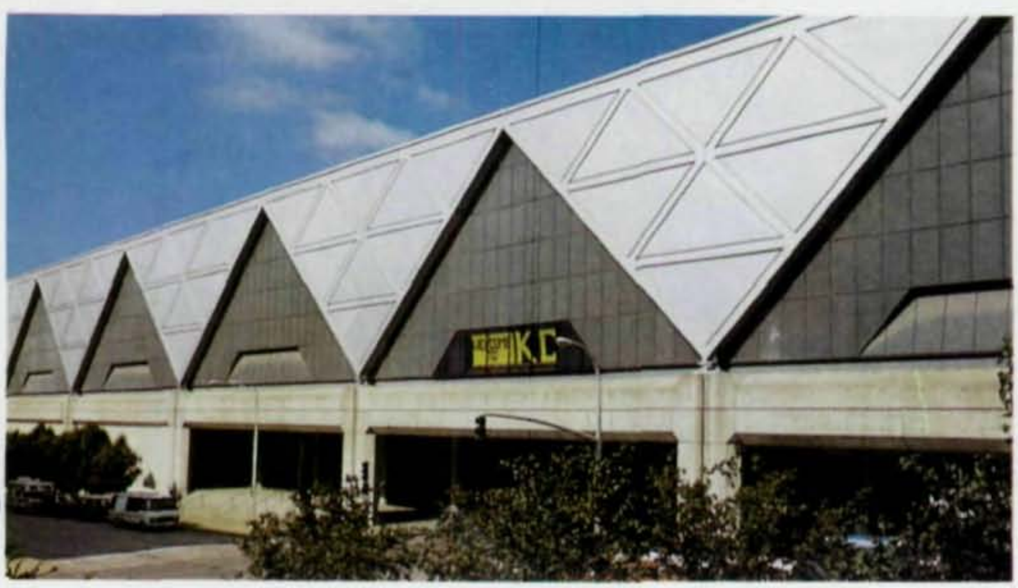
Friday, March 16

7:00 - 8:00 a.m. - Speaker Breakfast
7:30 - 8:15 a.m. - Exhibitor workshops
8:30 - 10:00 a.m. - Technical seminars
9:00 - 12:00 p.m. - Spouses' Event
10:00 - 10:45 a.m. - Coffee break
10:00 - 2:30 p.m. - Exhibits open
10:45 - 12:15 p.m. - Technical seminars
11:45 a.m. Lunch service begins
12:45 - 5:00 p.m. - Spouses' Event
12:15 - 3:00 p.m. - Lunch/exhibits open
3:15 Exhibits close, Exhibitor Moveout begins
3:00 - 3:45 p.m. - General Session: T. R. Higgins Lecture
4:00 - 5:30 p.m. - Technical seminars
6:30 - 6:45 p.m. - Optional Event: Dinner Theatre

Saturday

8:30 - 9:30 a.m. - General Session, "Block 111" (Kansas City 34-story steel-framed high-rise building)
9:30 - 12:00 Noon Choice of:
Hard-hat tour of Block 111
Tour of local fabricating plant
Hard-hat bridge tour
2:00 - 5:00 - Optional Event: Trip to Independence/ Truman Library

Note: The Conference Program, accompanied by Registration and Hotel Reservation forms, will be published in its entirety in the November/December issue of *Modern Steel Construction*. Copies will also be mailed in advance of that publication to more than 15,000 potential attendees who have requested information on, or regularly participate in, AISC's educational activities.



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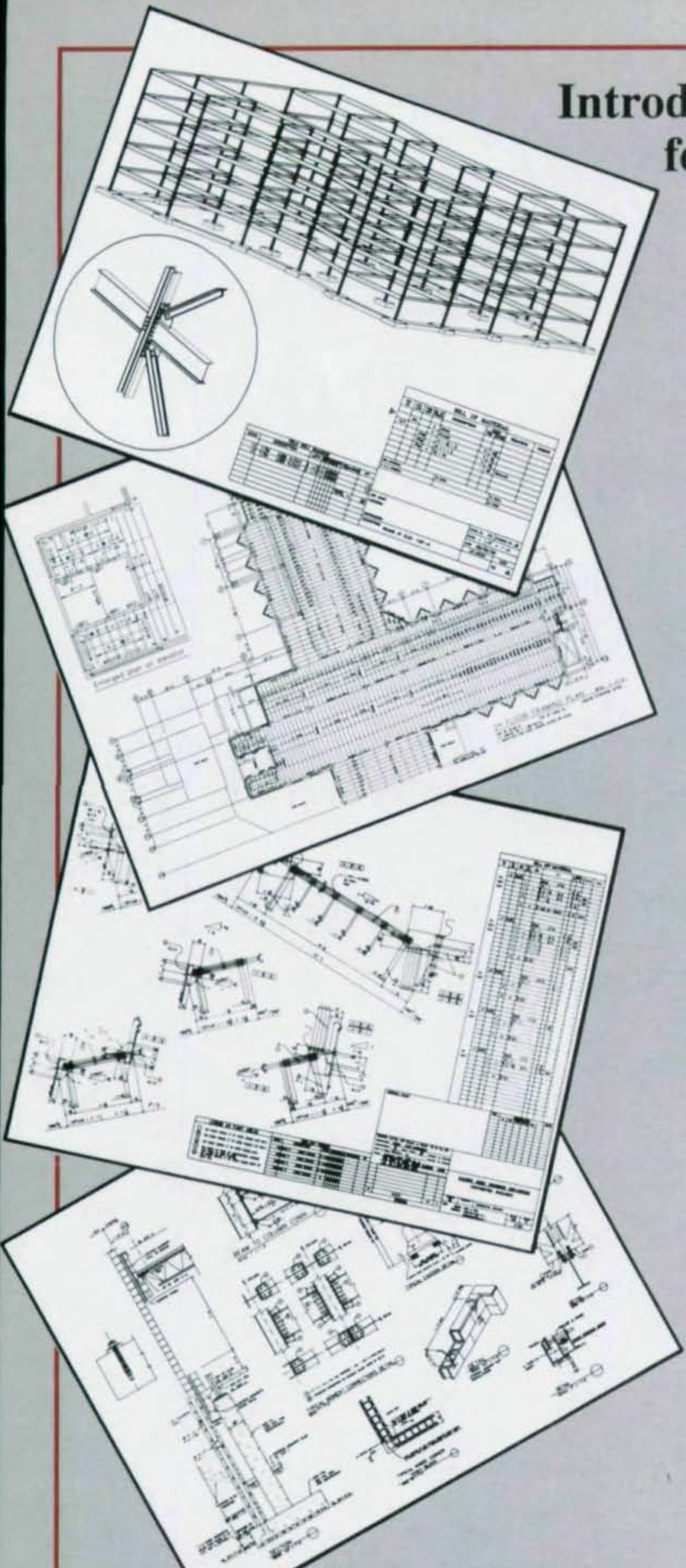
VULCRAFT

A Division of Nucor Corporation

Both Vulcraft super long span joists and steel deck were used to build this gigantic church in Memphis, Tennessee.



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AEGIS PRE-COMMISSIONING UNIT

Training for the Real Thing!

by David K. Pinkham

As part of their contract for the Aegis shipbuilding program, Bath Iron Works, Bath, Maine, is required to provide office space for "nucleus" U.S. Navy crews who are assigned to a new ship from the time shipbuilding gets underway. The recently completed Precommissioning Building was designed in response to this requirement. Each of its three decks houses offices, classrooms and support spaces which permit Navy personnel to train for and practice the administrative functions required when the crew actually goes to sea in their new vessel. In the new building, each 13,000 sq. ft "deck" is a dry-land "ship," which permits simulation of the activities, if not the environment, of the real thing.

An overall nautical tone is established at the front door, where a lighted showcase greets the visitor with a display of ship models. A flying staircase in the front entry rotunda connects three quarterdecks where visitors are "piped aboard." And each deck sports its own ship's store, barbershop, ship's supply and other functions.

The exterior treatment of the new facility is intended to respond subtly to the maritime influence of the area. Bath has a long and honored history as a shipbuilding city, reflected in many of its most prominent structures. As a result, all of the new building's neighbors are traditional in styling. Even recent additions to this part of the BIW complex are colonial adaptations, brick being the favored material for larger structures.

Exterior of new facility designed to fit maritime feel of area. LRFD design proved cost-effective.

These factors led the architect to opt for a continuation of the red-brick vocabulary of nearby structures and to design the building in a quietly post-modern style which echoes its neighbors. The use of oversized white columns, white precast concrete belt courses and multiple pane windows, plus bright red doors in traditionally styled entrances, lends visual sparkle to the building.

The structural engineer selected a structural steel/steel joist framing system since it is used commonly in the area and has proven to be cost-effective. Local contractors, erectors and fabricators are familiar with the system, and it is easily erected. Since the project is straightforward and is typical of steel systems used in this area, the structural engineer chose to use Load and Resistance Factor Design (LRFD) methods rather than the Allowable Stress Design (ASD). This presented an opportunity to use LRFD on an actual project and compare the results to ASD.

To accommodate the initial floor plan required by the Navy, column spacings range from 25 ft to 26 ft-8 in. in the north-south direction and 17 ft-2 in. to 22 ft in the east-west direction. Floors are 3 in. concrete slab on metal form deck supported by steel joists spanning in the north-south direction. The roof is 1½-in. deep wide-rib steel deck on steel joists spanning north-south. The structural system is braced in both directions using K-braces to permit door location in interior walls.

An 80-psf floor live load was used to allow unrestricted corridor locations in the future. Live-load reductions allowed by the 1987 BOCA Code were used for beams and columns. Floor dead load was 46 psf, which includes a 5-psf allowance for mechanical and electrical systems. The live-to-dead-load ratio for floors was about 1.75 before live-load reductions were taken. To simplify design, live-load reductions were based on the smallest tributary area for floor beams which allowed a 24% reduction in live load. After reduction, live-to-dead-load ratio was 1.3.

The roof system was designed for a 42-psf snow load and a 30-psf dead load, which included a 5 psf allowance for mechanical and electrical systems. Live-to-dead-load ratio was 1.4.

As expected, some savings in steel weight were realized by using LRFD. The greatest savings in weight over ASD members were in the interior floor beams. Typical spans were 17 ft-2 in., 20 ft and 22 ft. The total designed weight for these beams was 30,200 lbs. For the 20- and 22-ft spans, beam sizes were about 4 to 6 lbs. per foot lighter than ASD sizes. Using the smallest sections allowed by LRFD, total weight savings over ASD was about 3,100 pounds, or approximately 10%. No savings were realized for spandrel floor beams, roof beams and columns. The column spacings required by the floor plan were smaller than spacings preferred for economy. Had some bay spacings been slightly greater, LRFD would have resulted in the next lower size for some of these beams and for columns.

A 10% savings in steel weight when using LRFD vs. ASD seems a reasonable expectation, at least for more heavily loaded interior members. Note that the savings in this case were realized in a braced-frame structure with non-composite beams subject to common design loads. Other structure types such as industrial facilities with large design live loads will demonstrate more benefit from LRFD.

No significant difficulties were encountered using LRFD rather than ASD for design. The expected "learning curve" was encountered, but was not severe, though calculation bookkeeping was slightly more involved. Loads must be tracked in their various forms, such as unfactored loads (deflections and foundation sizing), LRFD factored loads (steel design) and ACI factored loads (foundation design). For straightforward member loading, composite load factors and ratios can simplify this task. *(continued)*

A flying staircase to each "deck", which simulates division of administration shipboard, permits naval personnel to train for new duties in familiar environment.

The structural engineer has used LRFD on several projects subsequent to the B.I.W. building, including a school, industrial facilities and other commercial projects. The most obvious advantage in using LRFD vs. ASD is the weight savings which can be realized. A less obvious benefit is the reduction in member depth that often accompanies the reduction in weight. This has been a real benefit on projects where beam depths are restricted. LRFD permits a smaller beam size and greater design flexibility for the architect—with no weight penalty. □

Architect
William J. Bisson Architect
Falmouth, Maine

Structural Engineer
Pinkham and Greer Consulting Engineers, Inc.
Falmouth, Maine

General Contractor
Allied Construction
Portland, Maine

Owner
Hamblet Development Corp.
Portland, Maine

David K. Pinkham, P.E., is a principal in the consulting engineering firm of Pinkham and Greer, Falmouth, Maine.

Steel Notes

HONORING BOGARDUS

Building professionals familiar with the relation of cast-iron architecture to the tectonics of modern steel structures, will be pleased to learn that James Bogardus (1800-1874), "the inventor in iron" who correctly claimed credit for being designer and builder of "the first complete cast-iron edifice in America, or in the world . . ." at long last was honored by the City of New York. On April 14, 1989, Mayor Edward Koch affixed a plaque with his name on a small parcel of city property (with six trees!) located in the lower Manhattan area called TriBeCa.

At age 14, Bogardus began his working career as watchmaker and eventually as a civil engineer adept at inventiveness related to a multitude of cast-iron fabrication and construction methods, as well as to precision instruments. Patents awarded to him included inventions for "Construction of the Frame, Roof and Floor of Iron Buildings," and for engraving and die-cutting machines, a pyrometer, a deep-sea sounding device, a chronometer and a glass pressing machine. Along with his contributions to cast-iron construction, he anticipated skyscrapers by designing and building about four iron-frame, fire-watch towers and shot towers ranging in height from 175 to 200 ft; they have been described as "the first true skeleton structures in the modern world."

At this point, we must confess that no building professional had initiated this belated gesture of respect; the promoter of the idea was the well-known Margot Gayle, respected and beloved by the many supporters of our culture, including a great number of architects. Mrs. Gayle is a writer of four books, many articles and a newspaper column, a lecturer and civic activist. As a "tireless advocate of historic preservation and urban amenities," she has been involved closely with a large group of civic-interest organizations, including the *Victorian Society of America* of which she was a founder and the *Friends of Cast-Iron Architecture*, of which she is both founder and President.

ARCHITECTS/ENGINEERS BEWARE: A CHANGE MAY BE COMING

The present law in most states, holds that architects or engineers may be legally responsible for faulty designs or services only if they are negligent. Negligence in this sense is the failure of the architect or engineer to exercise that degree of care or skill customarily exercised by prudent architects/engineers under the same or similar circumstances.

Thus, in a case where an architect is

accused of negligence, the typical instruction given to the jury, or the law which would be followed by a judge in a non-jury trial, would be:

> It is the duty of an architect in his work to employ that degree of knowledge, skill and judgment ordinarily possessed by members of that profession, and to perform faithfully and diligently any service undertaken as an architect in the manner a reasonably careful architect would do under the same or similar circumstances.
>
> The failure to perform such duty constitutes negligence. *Colorado Jury Instructions* (Civil) 2d 15:18 (1980)

It is apparent from the quoted instruction that perfect results are not required of the architect/engineer under the negligence rule. Instead, he must only conform to the standard of care exercised by his peers under the same or similar circumstances.

Signs of Change Loom

However, signs of change loom on the horizon. In a recent Kansas case, the supreme court of that state ruled that the law of warranty would apply to an architect. The court held the architect impliedly warrants his services will achieve the result

(continued)

Steel Notes *(continued)*

called for under his contract with his client. In its discussion, the court expressed the opinion that architecture and engineering are sciences, capable of precision—unlike the practice of law or medicine which involve inexact sciences.

In defense of the Kansas court, it is noted the complaint against the architect involved his alleged failure to properly inspect and check grading and drainage problems resulting from excessive dirt removal. Surely, the grades were scientifically determinable.

However, it may be argued that architecture and engineering are not always exact sciences. New materials, different applications, even changing atmospheric conditions appear to render architecture and engineering practices inexact in many aspects. If architects and engineers are forced to limit themselves to established methods, materials, etc., there will be little or no advancement into new and untried areas of design. One must wonder whether Buckminster Fuller would have conceived the geodesic domed structure if he would have been required legally to guarantee its performance.

Whether other states will follow the lead of the Kansas court in the case considered, *Tamarac Development Co., Inc., v. Delawater Freund & Associates, P.A.*, 234 Kan. 618, 675 P.2d 361 (1984), remains to be seen.

What is certain is that more and more owners will insist their courts adopt the warranty theories and that an equal number of architects or engineers will argue otherwise.

This *Brief's* practical suggestions are:

1. Architects and engineers be aware of the possible changes in the law,
2. The professions consider whether to state in their contracts that they make no warranties, express or implied, with respect to the quality or character of their work, and
3. Architects/engineers determine whether their professional liability insurance covers liability for breach of implied warranties. □

The author, Al Wolf, is a lawyer with over 20 years of experience in the many facets of construction law. He has lectured many years using his knowledge and experience to explain the litigation process, showing how the law and the reader may work together to obtain positive results.

If you would like a collection of Construction Law Briefs *previously published in a fully indexed, convenient to use loose-leaf volume, contact Jacqueline Enterprises Publications, 1873 S. Bellaire, #800, Denver, Co. 80222, 303/779-8278.*

1989 AISC Prize Bridge Awards

The 1989 Prize Bridge and Merit Award winners have been announced by the American Institue of Steel Construction. This year, 10 Prize Bridge winners and 11 Awards of Merit were announced, chosen as the most handsome and functional bridges opened to traffic between July 1, 1986 and June 30, 1989. Prize Bridges were selected in each of the 10 judging categories.

The Prize Bridge awards will be presented to the designers of the winning bridges at a dinner Thursday evening, Oct. 19, at The Shoreham Hotel, Washington, D.C., during the 1989 National Bridge Symposium on Steel Bridge Construction. Plaques adapted from the Joe Kinkel-designed sculpture, "The Long Reach," will be presented to winners. Designers of bridges chosen to receive Awards of Merit will be honored at local ceremonies later this year.

The Prize Bridge Competition, conducted since 1928, has inspired much greater attention to the aesthetics of bridge design as well as to the advancement of steel as a structural material.

And the winners are . . .

The Awards Jury
(left to right)

DIRK LOHAN
President & CEO
Lohan Associates
Chicago, Illinois

JOHN SMITH, JR.
State bridge design engineer
North Carolina DOT
Raleigh, North Carolina

DR. ARTHUR W. HEDGREN, JR.
Vice president
HDR-Richardson Gordon
Pittsburgh, Pennsylvania

ALBERT A. GRANT
Past president
ASCE
Potomac, Maryland

AWARD CATEGORIES

Movable Span
Bridges with a movable span

Long Span
Bridges with one or more spans over 400 ft

Reconstructed
Bridges with major rebuilding/reconstruction to upgrade to current needs

Grade Separation
Bridges whose basic purpose is grade separation

Short Span
Bridges with no single span 125 ft long, or more

Special Purpose
Includes pedestrian, pipeline, airplane and others not otherwise identified

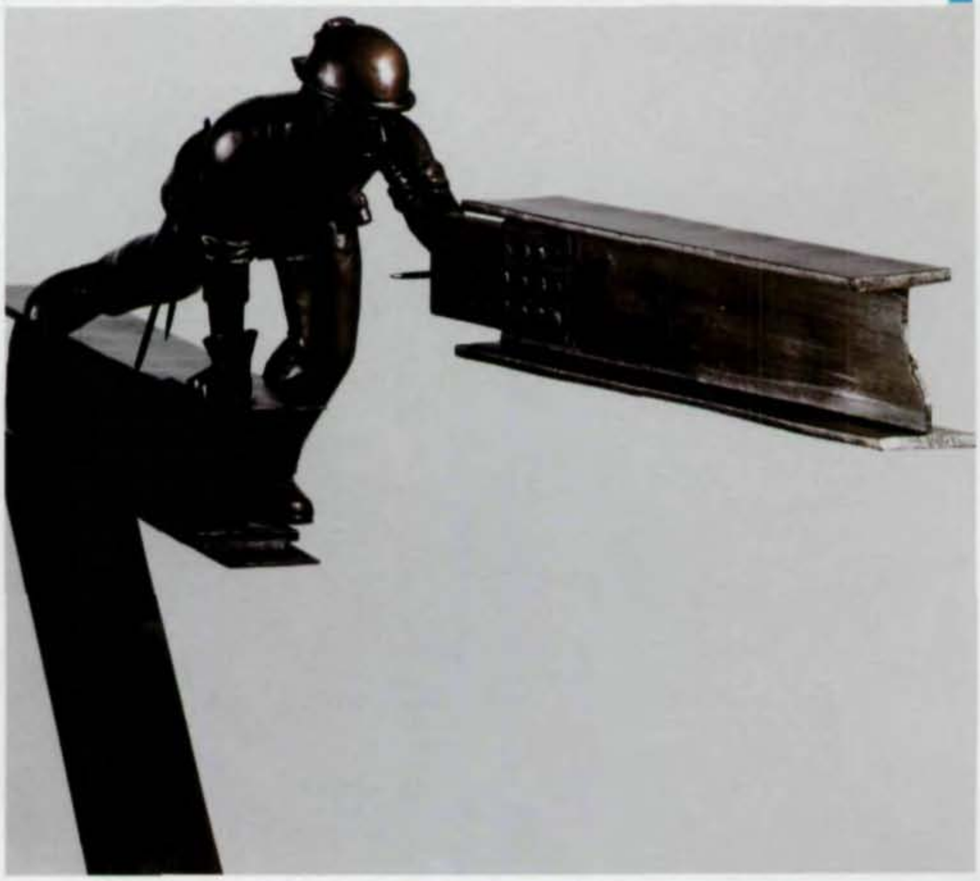
Railroad
Bridges (non-movable), primarily to carry a railroad, but may also be a combination railroad-highway bridge

Medium Span, Low Clearance
Bridges with vertical clearances of less than 35 ft, with longest span no more than 400 ft nor less than 125 ft

Medium Span, High Clearance
Bridges with vertical clearances of 35 ft or more, with longest span no more than 400 ft nor less than 125 ft long

Elevated Highways/Viaducts
Bridges with more than five spans which cross one or more established traffic lanes, and may afford access for pedestrians or parking

A Joe Kinkel sculpture on permanent display at AISC headquarters, "The Long Reach," is the motif for AAE and Prize Bridge awards presented by AISC. Winners receive bas relief plaques adapted from the sculpture.



1989 Prize Bridge

LONG SPAN

QUINCY BAYVIEW BRIDGE

Quincy, Illinois

The component steel girder and concrete slab configuration of this 4,500-ft cable-stayed bridge is believed to be the first such application in the U.S. Other firsts: use of parallel, seven-wire strands for stay cables and use of epoxy strands (believed to be the first use in stay cables in the world). Framing includes longitudinal welded girders, transverse rolled-section floor beams and longitudinal roadway stringers. A computer, built into the bridge design, will monitor effects of wind, rain, traffic and motion of the river. Total cost was $29 million, reportedly $4 million less than a conventional truss-style bridge.

Structural Designer
Booker Associates, Inc.
St. Louis, Missouri

Consulting Firm
Modjeski and Masters
Mechanicsburg, Pennsylvania

General Contractor/Steel Erector
McCarthy
St. Louis, Missouri

Steel Fabricator
Stupp Bros. Bridge & Iron Co.
St. Louis, Missouri

Owner
Illinois Department of Transportation
Springfield, Illinois

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Valmont	29
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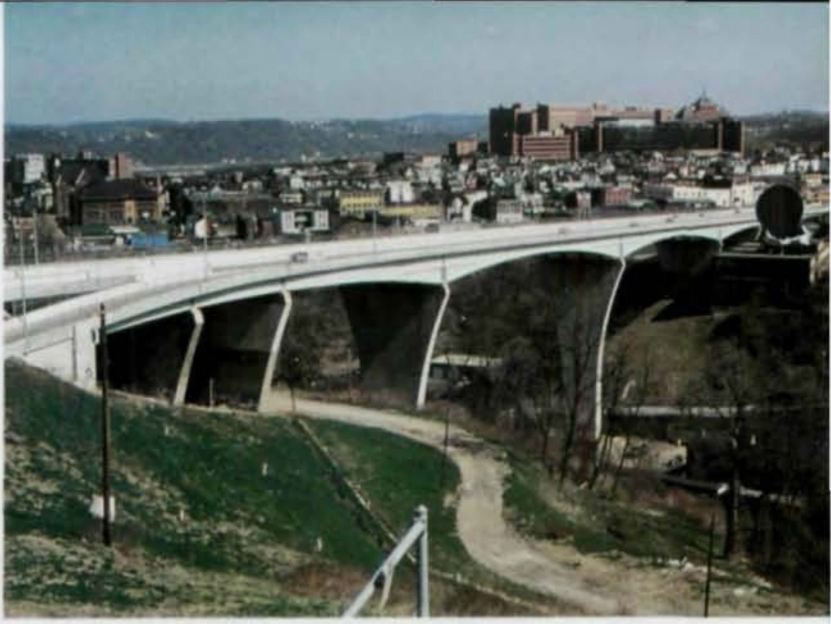
1989 Prize Bridge

MEDIUM SPAN, HIGH CLEARANCE

BLOOMFIELD BRIDGE

Pittsburgh (Allegheny County), Pennsylvania



Linking two hillside communities by traversing a steep-sided valley, the design of this 9-span, 1,535-ft long bridge was the result of a conscious and continuing effort to adapt the high-level structure to the urban environment. Bridge design features include unusual tulip-shaped pier configuration, main girder spans comprising a four-span continuous, composite haunched girder system longitudinally fixed on the three main bridge piers via pot bearings, and main girder spans comprising five girders with sub-floor stringer framing system. An inspection walkway is provided between each girder line.

Structural Designer
Gannett Fleming Transportation Engineers, Inc.
Pittsburgh, Pennsylvania

General Contractor
Thomas A. Mekis & Sons, Inc.
Fenelton, Pennsylvania, and

Middle States Steel Construction Co.
Eighty-Four, Pennsylvania, and

Anjo Construction Company
Plum Boro, Pennsylvania

Steel Fabricator
Williamsport Fabricators, Inc.
Williamsport, Pennsylvania

Steel Erector
Middle States Steel Construction Co.
Eighty-Four, Pennsylvania

Owner
City of Pittsburgh
Department of Engineering & Construction
Pittsburgh, Pennsylvania

1989 Prize Bridge

SPECIAL PURPOSE

TRINITY CHURCH PEDESTRIAN BRIDGE

New York, New York

The Trinity Church Pedestrian Bridge connects the Gothic portico at the rear of the church with the second floor of a 25-story building across the street which houses parish offices and church and parish meeting rooms. The bridge design could not compromise the historical integrity of the landmark church, nor could construction be permitted to interrupt heavy vehicular and pedestrian street traffic. An architectural design came first: a lacey, graceful, flat-arched open metal structure patterned after the Loew Bridge at Saint Paul's Chapel built in 1866 and since dismantled. The structural design, a pair of Vierendeel-trussed deck arches, was shop-welded and fabricated in one piece and erected—in 90 minutes—as a unit. The final result appears so appropriate that "many regular passersby are not quite sure it hasn't always been there."

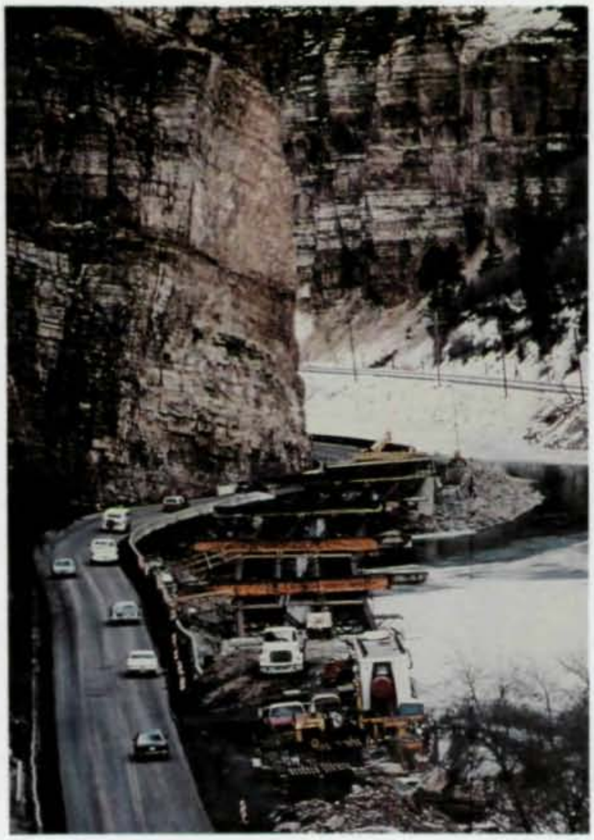
Structural Designer
Ammann & Whitney
New York, New York

Architectural Designer
Lee Harris Pomeroy Associates, Architects
New York, New York

General Contractor/Steel Erector
Nab Construction Corporation
College Point, New York

Steel Fabricator
Reynolds Manufacturing Company
Avonmore, Pennsylvania

Owner
Parish of Trinity Church
New York, New York



1989 Prize Bridge

MEDIUM SPAN, LOW CLEARANCE

STRUCTURE 18E (REVERSE CURVE)

I-70 in Glenwood Canyon (Garfield County), Colorado

Difficult foundation conditions, constructability constraints requiring lightweight members and a very short construction season made steel the most economical answer for this scenic canyon structure. Four steel plate girders spanning 136 ft clear made erection easy and required less foundation, were easy to curve in following the alignment. Box steel pier caps, cantilevering over a very narrow shaft, were framed with the plate girders—rendering them invisible.

Structural Designer
Meheen Engineering Corporation
Denver, Colorado

General Contractor
Flatiron Structures Company
Longmont, Colorado

Steel Fabricator
Grand Junction Steel
Grand Junction, Colorado

Steel Erector
Grett Steel & Iron Company
Denver, Colorado

Owner
Colorado Department of Highways
Denver, Colorado

1989 Prize Bridge

RAILROAD

CSX RAILROAD OVER RELOCATED US 25E

Bell County, Kentucky

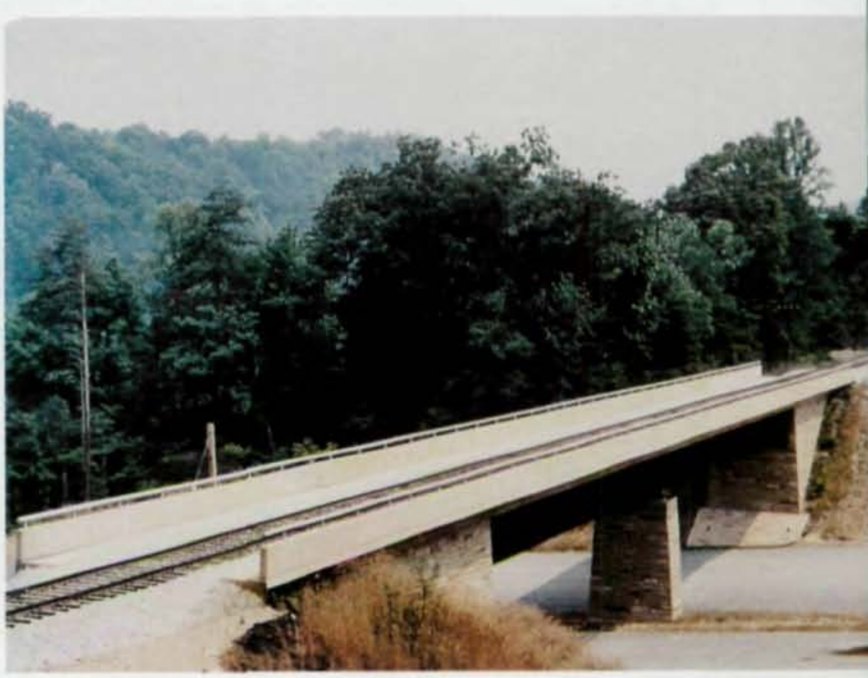
Located in the Cumberland Gap National Historical Park (Bell County, Ky. and Clairborne County, Tenn.), this single railroad track bridge had to blend with the natural environment. Aesthetic considerations ultimately resulted in a design of two 100-ft simple spans with a ballasted track on a concrete deck supported by a single composite steel box girder. ASTM A588 weathering steel and stone masonry facades for substructure abutments and piers also assisted in accomplishing those objectives.

Structural Designer
Howard Needles Tammen & Bergendoff
Alexandria, Virginia

General Contractor/Steel Erector
London Bridge Company, Inc.
London, Kentucky

Steel Fabricator
Carolina Steel Corporation
Greensboro, North Carolina

Owner
National Park Service
Middlesboro, Kentucky



1989 Prize Bridge

SHORT SPAN

Bridge No. 3013—MD Route 7 over Gunpowder River

Baltimore County, Maryland

Although a painted steel arch was probably more expensive than a conventional steel girder structure, aesthetics governed in this bridge design, selected to replace a deteriorating 120-ft reinforced concrete arch. However, the bridge was built and opened within the eight-month time frame dictated by contract. Speed of fabrication and erection more than offset higher costs because of site and traffic constraints.

Structural Designer/Owner
Maryland State Highway Administration
Office of Bridge Development
Baltimore, Maryland

Consulting Firm
Envirodyne Engineers
Chicago, Illinois

General Contractor
Central Atlantic Contractors, Inc.
Aberdeen, Maryland

Steel Fabricator/Erector
High Steel Structures, Inc.
Lancaster, Pennsylvania

1989 Prize Bridge

GRADE SEPARATION

HENDERSONVILLE BY-PASS/STATE ROUTE 6

Sumner County, Tennessee

The need to eliminate a median pier support as well as to provide a 30-ft horizontal clear recovery zone from the edge of the traveled way to any fixed obstacle was successfully achieved by relying on the long-span capabilities of structural steel. The three-span, continuous welded plate girder bridge with composite concrete deck was constructed with no roadway expansion devices, thus making the structure virtually maintenance-free.

Structural Designer/Owner
Tennessee Department of Transportation
Division of Structures
Nashville, Tennessee

General Contractor
Vaughn Contractors, Inc.
Waverly, Tennessee

Steel Fabricator
Carolina Steel Corporation
Greensboro, North Carolina

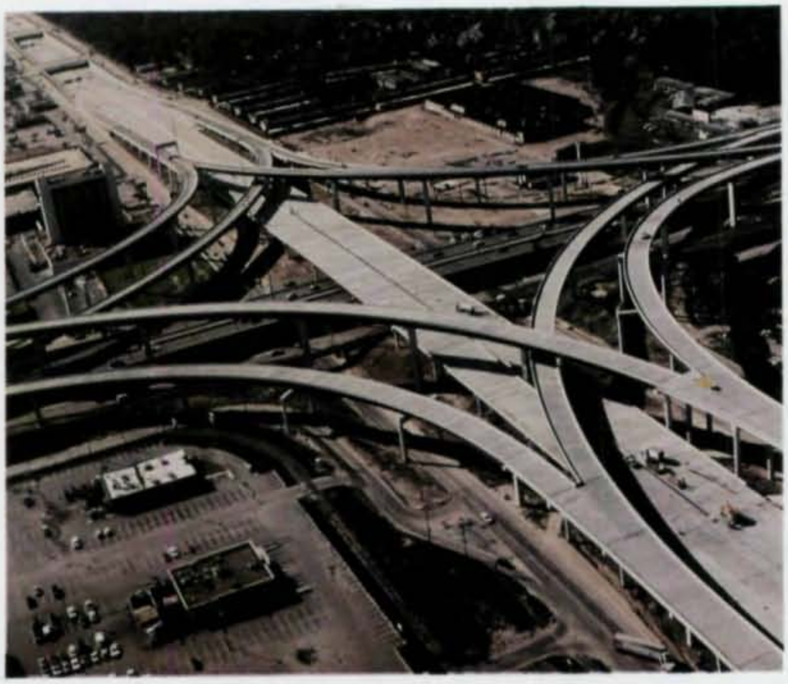
Steel Erector
Sentry Steel Service Company, Inc.
Madison, Tennessee

1989 Prize Bridge

ELEVATED HIGHWAY

SAM HOUSTON/I-10 INTERCHANGE

Houston (Harris County), Texas



This multi-level interchange includes eight connector bridges (4½ miles of bridge structures) and a new mainline bridge carrying the tollway over IH-10. All were designed using A588 structural steel, selected because of vertical clearance requirements, restricted site conditions and economic considerations. Spans up to 245 ft were required, with horizontal curves ranging up to nine degrees, requiring unusual design and construction techniques. Continuous units (78 to 90 in. in depth with flange thickness up to 3 in.) required the handling and placing of steel member segments up to 180 ft long and weighing nearly 100 tons. Because of the existence of an active fault line with continuous and substantial movement, the bridge design permits the bridge to be jacked up to offset differential movement caused by the fault.

Structural Designer
Brown & Root U.S.A., Inc.
Houston, Texas

General Contractor/Steel Erector
Traylor Brothers, Inc.
Houston, Texas

Steel Fabricator
McDermott Marine Construction
Morgan City, Louisiana

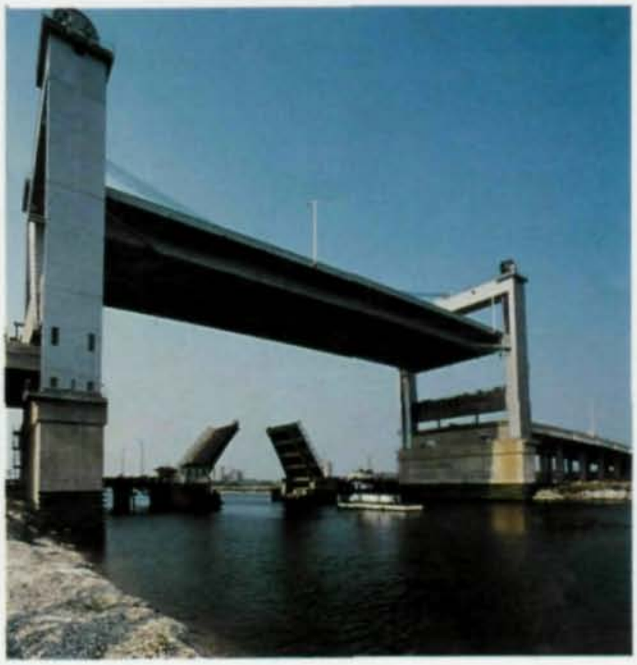
Owner
Harris County Toll Road Authority
Houston, Texas

1989 Prize Bridge

MOVABLE SPAN

DANZIGER BRIDGE

New Orleans, Louisiana



Because of the unusual size of the bridge (a main span length of 320 ft clearing the entire width of the Industrial Canal), the owner selected a design seldom used due to fabrication complexity and comparatively high costs: a system of longitudinal steel boxes with an orthotropic deck. However, the system was lighter and smaller, and comparable in price to a two-truss system with greater lift system requirements. The design produced a cleaner, more aesthetic structure and provided the bridge operator a clear view of both navigation and vehicular traffic.

Structural Designer
Sverdrup Corporation
St. Louis, Missouri

General Contractor/Steel Erector
Williams Brothers Construction Co., and
Cianbro Corporation (Joint Venture)
Houston, Texas

Steel Fabricator
USS Fabrication
Orange, Texas

Owner
Louisiana Department of Transportation & Development
Baton Rouge, Louisiana

1989 Prize Bridge

RECONSTRUCTED

CAPITOL BOULEVARD UNDERCROSSING

Olympia (Thurston County), Washington

One of the bridges scheduled as part of a 10-year project to widen seven miles of Interstate 5 through Olympia, this reconstructed undercrossing required four additional lanes of traffic and a new support system permitting existing piers to be removed while maintaining above- and below-bridge traffic at all times. A steel arch was the chosen design because it required minimal falsework, minimal traffic interruption—and the curved lines were considered more pleasing than the straight lines of a concrete sloped-leg frame (which had been proposed). Shop welding of thin, stiffened steel plates produced a strong, lightweight structure which was easy to ship, handle and erect.

Structural Designer/Owner
Washington State Department of Transportation
Olympia, Washington

General Contractor/Steel Erector
David A. Mowat Company
Bellevue, Washington

Steel Fabricator
Universal Structural, Inc.
Vancouver, Washington

1989 Award of Merit

LONG SPAN

GLADE CREEK BRIDGE

Raleigh County, West Virginia

Structural Designer
Greiner, Inc.
Timonium, Maryland

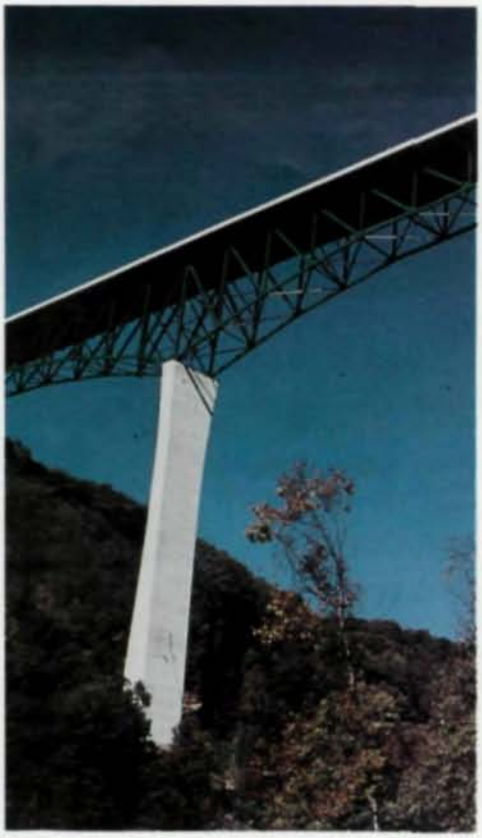
Consulting Firm
Sheladia Associates, Inc.
Rockville, Maryland

General Contractor
PCL Civil Constructors, Inc.
Plantation, Florida

Steel Fabricator
Harris Structural Steel Company, Inc.
South Plainfield, New Jersey

Steel Erector
American Bridge Company
Pittsburgh, Pennsylvania

Owner
West Virginia Department of Transportation
Division of Highways
Charleston, West Virginia



1989 Award of Merit

MEDIUM SPAN, HIGH CLEARANCE

PINEY CREEK BRIDGE

Beckley (Raleigh County), West Virginia

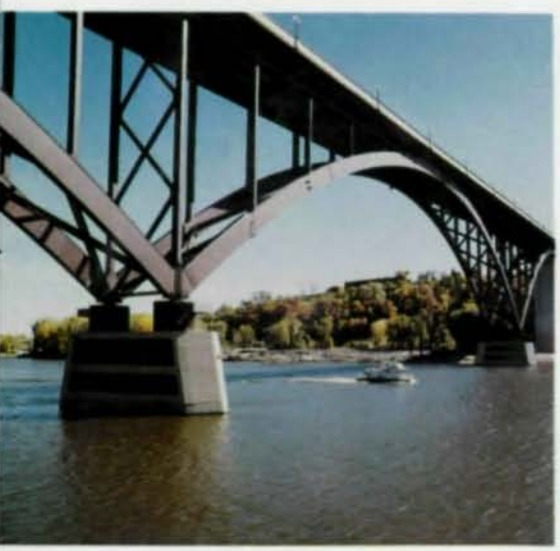
Structural Designer
Pavlo Engineering Co., P.C.
New York, New York

General Contractor
National Engineering & Contracting Co.
Strongsville, Ohio

Steel Fabricator
Bristol Steel & Iron Works, Inc.
Bristol, Virginia

Steel Erector
Broad, Vogt & Conant, Inc.
River Rouge, Michigan

Owner
West Virginia Department of Transportation
Division of Highways
Charleston, West Virginia



1989 Award of Merit

LONG SPAN

SMITH AVENUE HIGH BRIDGE

St. Paul (Ramsey County), Minnesota

Structural Designer
Strgar—Roscoe—Fausch, Inc.
Minneapolis, Minnesota

Consulting Firm
T. Y. Lin International
San Francisco, California

General Contractor
Edward Kramer and Sons, Inc.
Plain, Wisconsin

General Contractor/Steel Erector
Lunda Construction Company
Black River Falls, Wisconsin

Steel Fabricators
Phoenix Steel Inc.
Eau Claire, Wisconsin, and
Vincennes Steel Corporation
Vincennes, Indiana

Owner
Minnesota Department of Transportation
St. Paul, Minnesota

1989 Award of Merit

MEDIUM SPAN, LOW CLEARANCE

BROADWAY BRIDGE OVER CHERRY CREEK

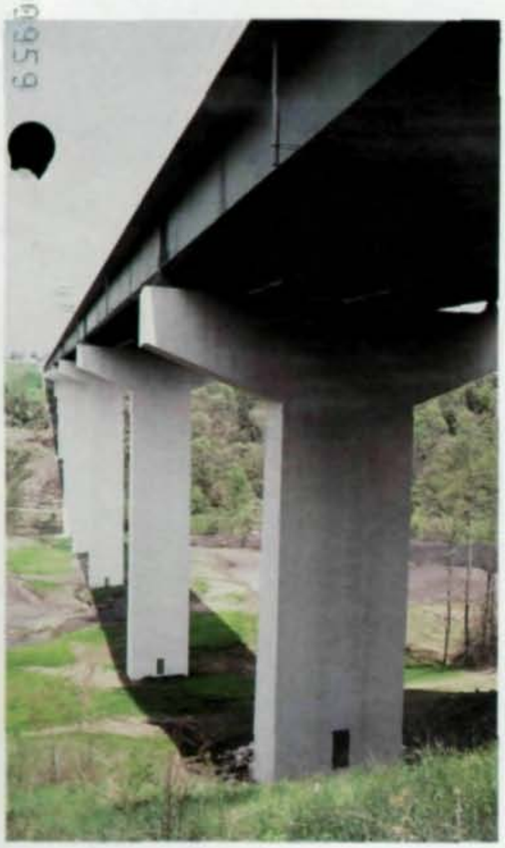
Denver, Colorado

Structural Designer
Howard Needles Tammen & Bergendoff
Denver, Colorado

General Contractor/Steel Erector
Centric-Jones Constructors
Lakewood, Colorado

Steel Fabricator
Avondale Industries
Avondale, Louisiana

Owner
City and County of Denver
Denver, Colorado



1989 Award of Merit

MOVABLE SPAN

LIBERTY BRIDGE

Bay City, Michigan

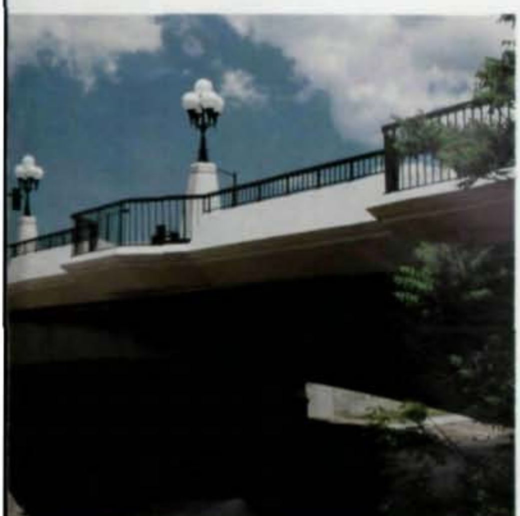
Structural Designer
Howard Needles Tammen & Bergendoff
Kansas City, Missouri

General Contractor
Midwest Bridge
Williamston, Michigan

Steel Fabricator
Phoenix Steel, Inc.
Eau Claire, Wisconsin

Steel Erector
Alliance Steel
Superior, Wisconsin

Owner
City of Bay City, Michigan



1989 Award of Merit

SHORT SPAN

LECHMERE CANAL BRIDGE

Cambridge, Massachusetts

Structural Designer
Howard Needles Tammen & Bergendoff
Boston, Massachusetts

General Contractor
John Mahoney Construction Co., Inc.
Milton, Massachusetts

Steel Fabricator
Bancroft & Martin, Inc.
South Portland, Maine

Steel Erector
Rusco Steel Co.
Warwick, Rhode Island

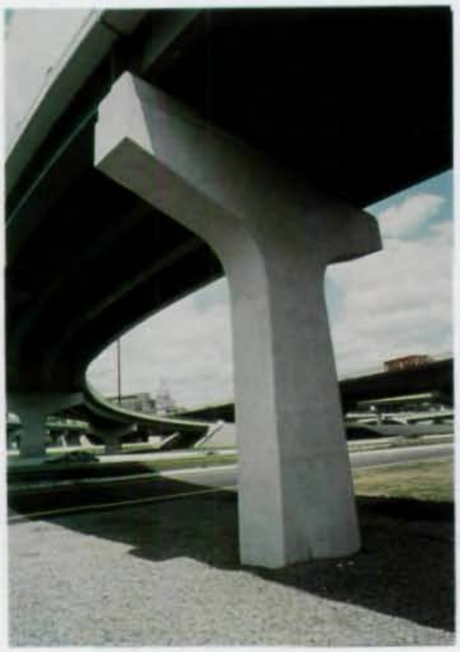
Owner
Commonwealth of Massachusetts,
Department of Public Works
Boston, Massachusetts

1989 Award of Merit

ELEVATED HIGHWAY OR VIADUCT

CIVIC CENTER INTERCHANGE

Providence, Rhode Island



Structural Designer
Maguire Group Inc.
Providence, Rhode Island

General Contractor
Aetna Bridge Company
Pawtucket, Rhode Island

Steel Fabricator
High Steel Structures, Inc.
Lancaster, Pennsylvania, and
Carolina Steel Corporation
Greensboro, North Carolina

Steel Erectors
Aetna Bridge Company
Pawtucket, Rhode Island, and
Northeast Steel Corporation
Wickford, Rhode Island

Owner
Rhode Island Department of Transportation
Providence, Rhode Island

1989 Award of Merit

SPECIAL PURPOSE

WADDELL "A" TRUSS BRIDGE

Parkville (Platte County), Missouri

Structural Designer
Howard Needles Tammen & Bergendoff
Kansas City, Missouri

Steel Erector
Bratton Corporation
Kansas City, Missouri

Owner
City of Parkville, Missouri

1989 Award of Merit

RAILROAD

PATTERSON AVENUE/CSX GRADE SEPARATION

Grand Rapids (Kent County), Michigan

Structural Designer
Williams & Works, Inc.
Grand Rapids, Michigan

General Contractor/Erector
Argersinger-Morse Construction Co.
Ann Arbor, Michigan

Steel Fabricator
Phoenix Steel, Inc.
Eau Claire, Wisconsin

Owner
Kent County Road Commission
Grand Rapids, Michigan

1989 Award of Merit

RECONSTRUCTED

MERRIAM STREET BRIDGE OVER MISSISSIPPI

Minneapolis (Hennepin), Minnesota

Structural Designer/Owner
Hennepin County Bureau of Public Service
Minneapolis, Minnesota

Consulting Firm
Van Doren-Hazard-Stallings, Inc.
Minneapolis, Minnesota

General Contractor
Lunda Construction Company
Black River Falls, Wisconsin

Steel Fabricator
Phoenix Steel, Inc.
Eau Claire, Wisconsin

Steel Erector
Alliance Steel Construction, Inc.
Superior, Wisconsin

1989 Award of Merit

RECONSTRUCTED

ROEBLING DELAWARE AQUEDUCT BRIDGE

Lackawaxen (Pike County), Pennsylvania and Minisink Ford (Sullivan County), New York

Structural Designer
Ammann & Whitney
New York, New York

Architectural Designer
Beyer Blinder Belle
New York, New York

General Contractor/Fabricator/Erector
Chesterfield Associates, Inc.
Westhampton Beach, New York

Owner
National Park Service
Narrowsburg, New York

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