VOLUME VI / NUMBER 4 / FOURTH QUARTER 1966

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MODERN STEEL CONSTRUCTION

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VOLUME VI / NUMBER 4 / FOURTH QUARTER 1966

CONTENTS

NATIONAL ENGINEERING CONFERENCE IN SAN FRANCISCO

The 19th annual AISC National Engineering Conference will be held on April 20 and 21, 1967 at the Palace Hotel in San Francisco, California. Leading authorities in steel design, research, and construction will meet to exchange ideas and information about the latest developments in these fields. This conference is a "must" for anyone who designs structures.

New developments in the design of both bridges and buildings will be extensively treated in the program. The seismic design of buildings in the San Francisco area will be one of the conference features. A highlight of the conference will be a field trip to the site of the San Mateo-Hayward orthotropic bridge.

For additional information about registration contact AISC, 101 Park Avenue, New York, N. Y. 10017.

NEW DETAILING TEXTBOOK

The new AISC textbook Structural Steel Detailing is now available. Cross-referenced to the Manual of Steel Construction, 6th Edition, this new 468 page book is a necessary tool for structural draftsmen as well as a valuable reference for anyone who needs up-to-date information about current practices in structural steel detailing and fabrication.

The basic subjects covered in the textbook are:

- *Detailing and Fabricating Structural Steel*
- *Drafting Equipment and Drafting Procedures*
- *Reactions and Stresses*
- *Connections – Bolted or Riveted*
- *Connections – Welded*
- *Framed and Seated Beam Connections – Bolted or Riveted*
- *Framed and Seated Beam Connections – Welded*
- *Skewed, Sloped and Canted Beam Connections*
- *Column Details*
- *Framing for Industrial Buildings*

The price of the new textbook is $10.00 per copy. Orders should be directed to AISC, 101 Park Avenue, New York, N. Y. 10017.

SOME THOUGHTS ON THE CREATIVE PROCESS

While elements of modern high-rise construction have become more simplified – even mechanized – others have grown enormously complex. So much so that the thought of one man shouldering the responsibility for the total design is now inconceivable. In fact, as each year passes, it becomes more and more apparent that a successful alliance between architects and engineers weighs heavily in determining the success of the finished structure.

Human nature being what it is, these alliances don't always come off smoothly. But when they do, there is a deep sense of satisfaction – even excitement – among the members of the design team. Almost without qualification, this **esprit** or spark or verve among the construction professionals translates into satisfaction for the client and community pride.

The Fresno County Court House, Fresno, California, seen here, is a first-rate result of teamwork that clicked. Principals on the project were Paul Harris, AIA, and William M. Brooks, PE, both members of Walter Wagner & Partners in Fresno. In addition to mechanical and electrical engineers, this alliance included Digital Analysis Consultants of La Jolla, California. More about that in a moment. Here's what their combined efforts achieved.

• A 200,000 sq ft building to house the superior courts, municipal courts and related county departments.

• A structure that is diginified, monumental, and strong enough to become a focal point in the area.

• A successful blend of diverse needs for space among the various governmental bodies. And space that is flexible.

• An environment that is comfortable all year in a demanding climate.

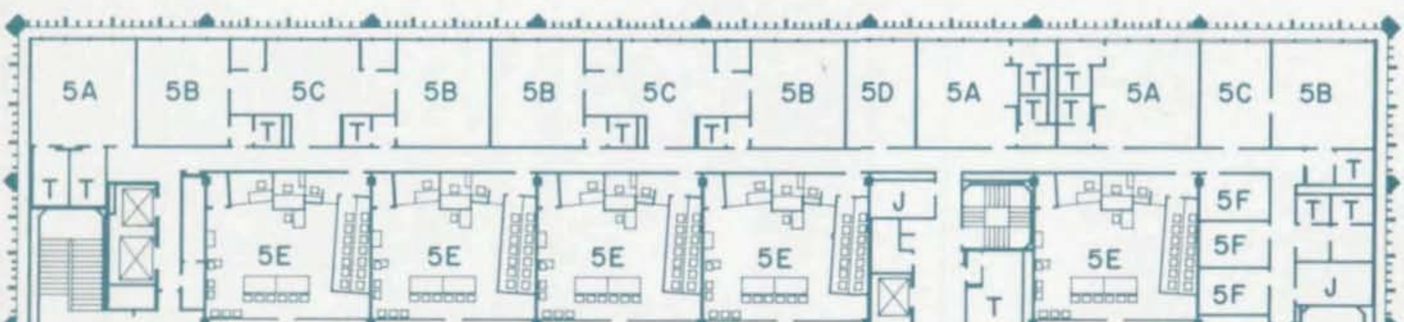
• A building that was designed and constructed on time. Fresno officials had obtained a federal assistance grant for the structure. But along with the grant came stringent time limits set down by the U. S. Government. If the architect or contractor had failed to meet these limits, the grant would have evaporated. This is one reason, incidentally, that steel was chosen for the structural framing. Speed of erection was imperative, and steel qualified easily.

Also, because 90 percent of the field connections were welded, the steel went up quietly. Existing court and county buildings on the site continued to hold session throughout the construction. The judges and county executives made it clear they didn't wish to hear disturbing noises during working hours.

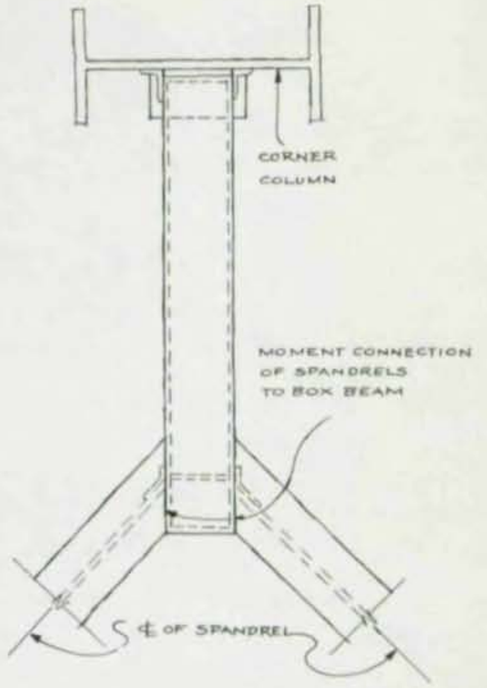
Moreover, because of the nature of government, building interiors were subject to periodic change, calling for modification of partitions, floors and ceilings. Steel framing and a cellular steel deck with lightweight concrete fill at each floor met this requirement. These materials also helped reduce the building mass, and consequently, the earthquake design forces.

An interesting sidelight: an electronic computer was employed in the structual design work. Says engineer William Brooks, "We gave the consultants (the La Jolla firm, mentioned above) our initial steel frame sizes and the loadings. These figures were programmed for the computer to gain shear and bending moments at all joints vertically and horizontally. In addition, the machine told us how the maximum combined stress on a member in place compared with the allowable stress.

"Working with the computer firm, we soon nailed down the distribution of lateral forces. We determined from the information to use frames in the longi-



TYPICAL FLOOR



SPANDREL—
COLUMN CONNECTION
@ CORNER

tudinal direction and the stiffness of the elevator shafts in the transverse direction to resist these lateral forces.

"The machine saved us many hours of laborious hand computations. It was well worth the expense."

The exterior, pre-stressed concrete screen plays an important role in the design, and is also quite functional. Principally it creates a uniform exterior scale to the structure by concealing the variations in floor-to-floor heights and irregular fenestration patterns. It also reduces glare and solar heat gain, and was responsible for reducing the refrigeration portion of the air conditioning equipment by about 200 tons.

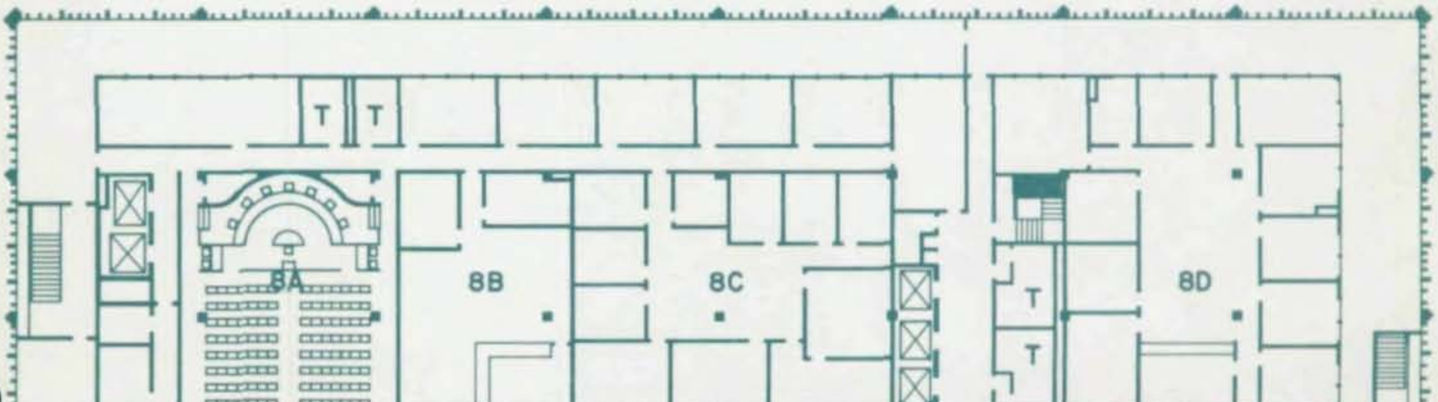
There were several structural hurdles encountered along the way, and overcome handily. For example, there was a lack of continuity between columns and beams at the exterior walls. This not only nullified any frame action at these locations, but also left a remote column

TYPICAL FLOOR

A. Jury Room
B. Judge's Chambers
C. Clerk & Bailiff
D. Secretary Pool
E. Superior Court
F. Witness Room
G. Attorney Conference
J. Janitor

EIGHTH FLOOR

A. Board of Supervisors
B. Clerk of the Board
C. County Administrator
D. County Counsel



EIGHTH FLOOR

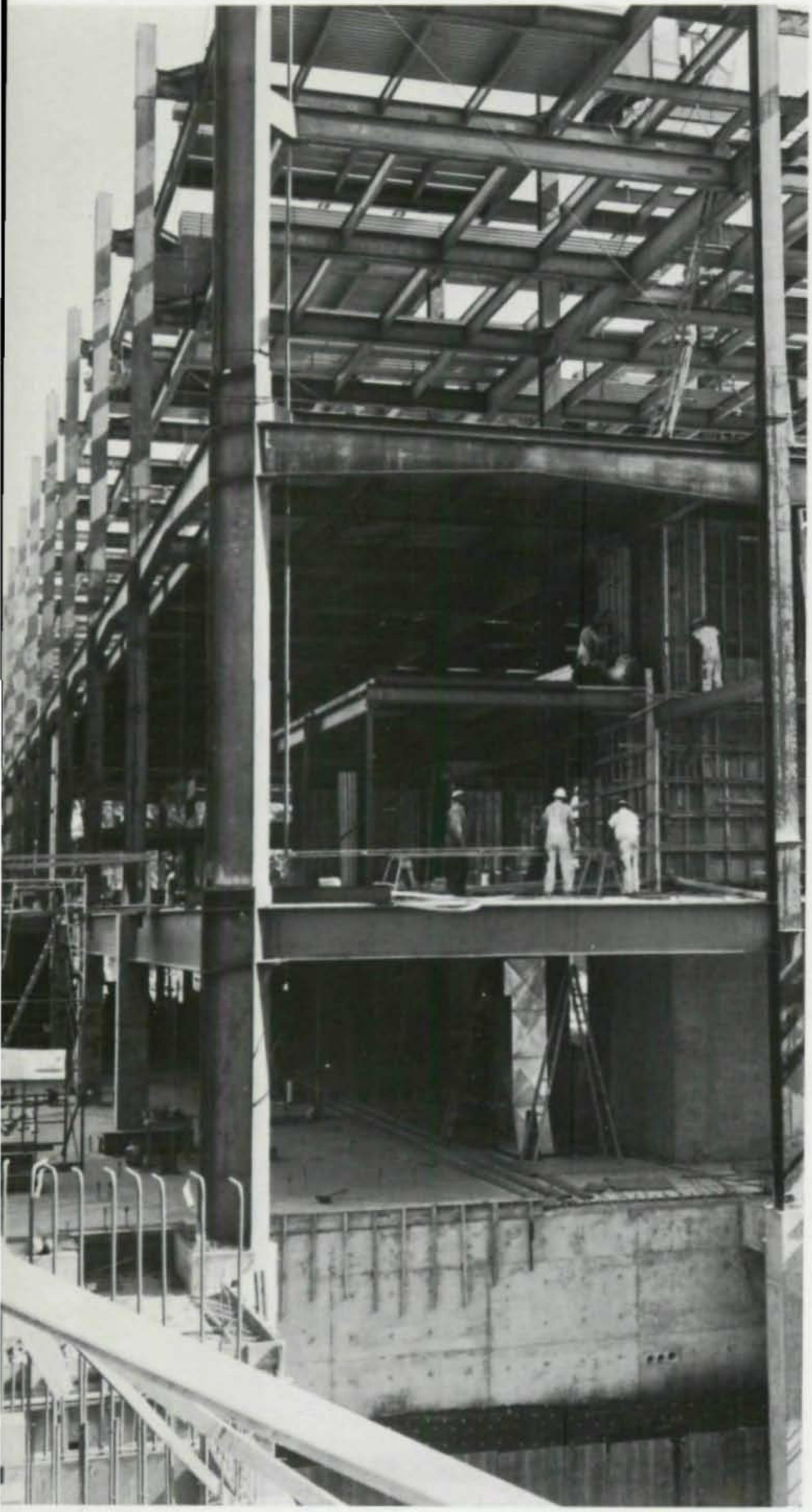
at each corner of the building, resulting from the offset in each direction. A wishbone-shaped spandrel frame was devised to provide support and transfer vertical load at these points. At each floor level, between spandrel and screen wall, a catwalk circumvents the building to facilitate window washing and maintenance.

Another difficulty was encountered at the normal beam-column connections. Should they be welded directly, or with splice plates? In the end, a compromise of sorts was made by using splice plates at alternate column stations and welding directly at the intermediates. Brooks says the results were quite satisfactory from the standpoints of erection, structural rigidity and plumb.

Nine steel trusses support the penthouse, which contains elevator, mechanical and radio equipment. Being rather bulky, the trusses were craned to the roof in parts, then bolted together and lifted into place by a mobile crane on the building.

The court house is the major structure and the third of five buildings to be erected in a 14-acre, center-city park. Consisting of a total of eight floors, a penthouse, and two below grade floors, the court house went up for a bid cost of $5,271,000, including landscaping and site work. The entire county complex, when completed, will relate to long-range development plans for the Fresno downtown areas.

General contractor was Huber, Hunt & Nichols, Inc., Sunnyvale, California, and the steel fabricator was R. C. Mahon Co., Detroit, Michigan.



Welded steel frame and cellular steel deck of the Fresno County Court House provided a logical and economical solution to the owner's basic requirements — fast, quiet construction and flexibility for future building modifications.

COLLEGE DORMITORY AND DINING HALL UP IN RECORD TIME

If ever you had doubts that steel framing can significantly speed up a job, consider that:

In cold and mercurial February weather, steel erection for a 9-story, 125-study-bedroom men's dormitory began at Ashland College, Ashland, Ohio.

Six weeks later, the steel work was completed. Concurrently, the prestressed, hollow-core, concrete slab floors were placed.

Fourteen weeks later, the built-in furniture was going in.

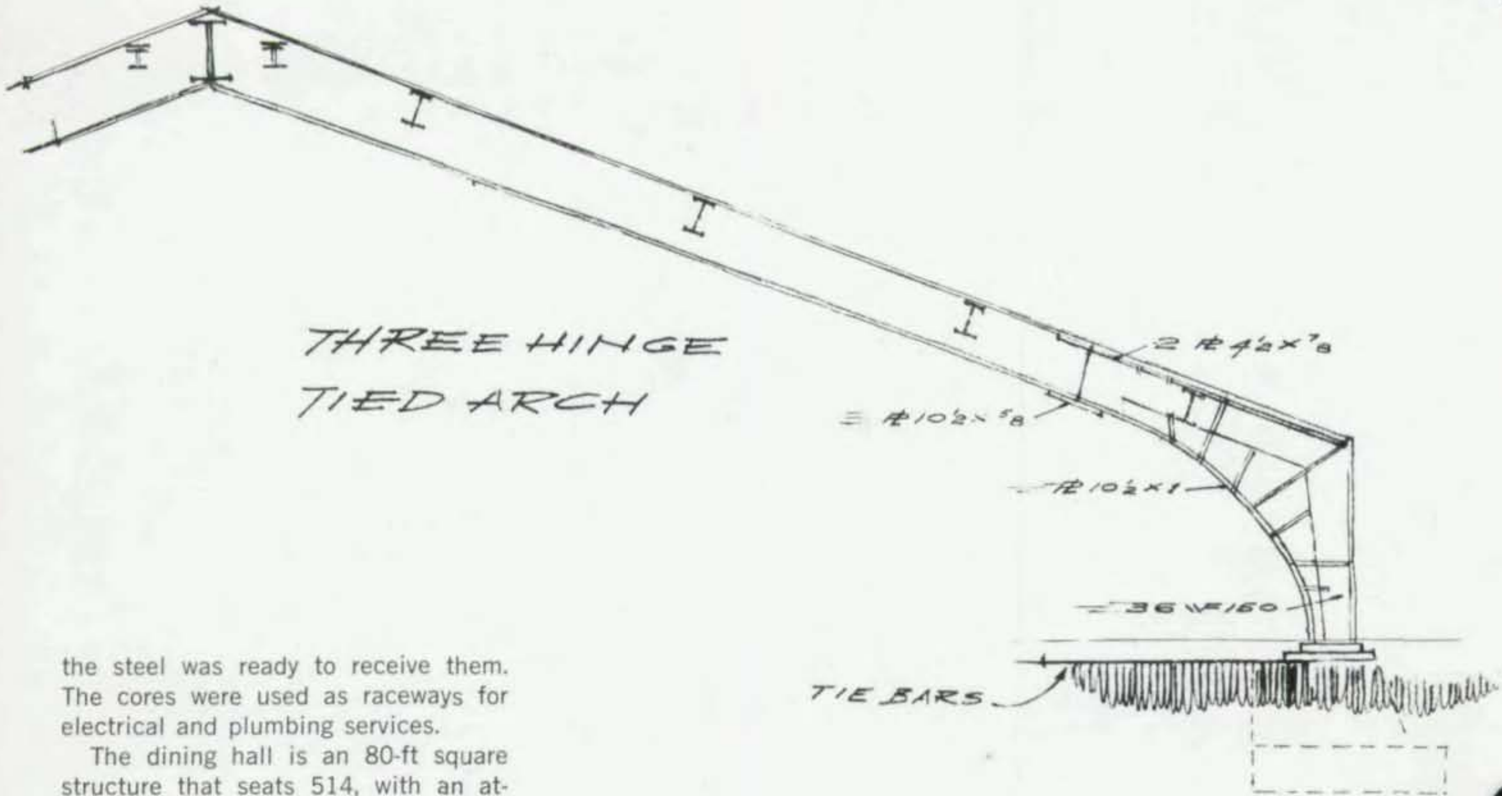
And four weeks after that, the building was finished and furnished. In September, the first students moved in.

On June 1 of the same year, steelwork began on the Redwood Dining Hall, adjacent to the dorm. This 6,400 sq ft dining hall and separate kitchen were squared away, furnished and organized to serve meals by the end of August.

The entire job – dormitory and dining hall complex – took six months, a time span which the project architect, Charles Robert Johnson of Youngstown, Ohio, believes may be a record, at least for the area. Could the pace have been kept without steel framing? "No," says Johnson, flatly. Adds structural engineer, V. E. Shogren, also of Youngstown, "At one point, we were considering wood as a material to frame the dining hall roof. But it was eliminated in favor of steel on the basis of savings in construction time and cost."

Johnson said that the total cost for the furnished dorm and dining hall, including the architect's fee, came to $1,555,000. He estimates that this figure is approximately $300,000 to $400,000 less than comparable structures, in sections of Ohio where prices are essentially the same as in Ashland.

The high strength steel framed dormitory contains rooms on a 10 ft x 15 ft module. The 7-in. thick hollow-core concrete slabs went into place as soon as

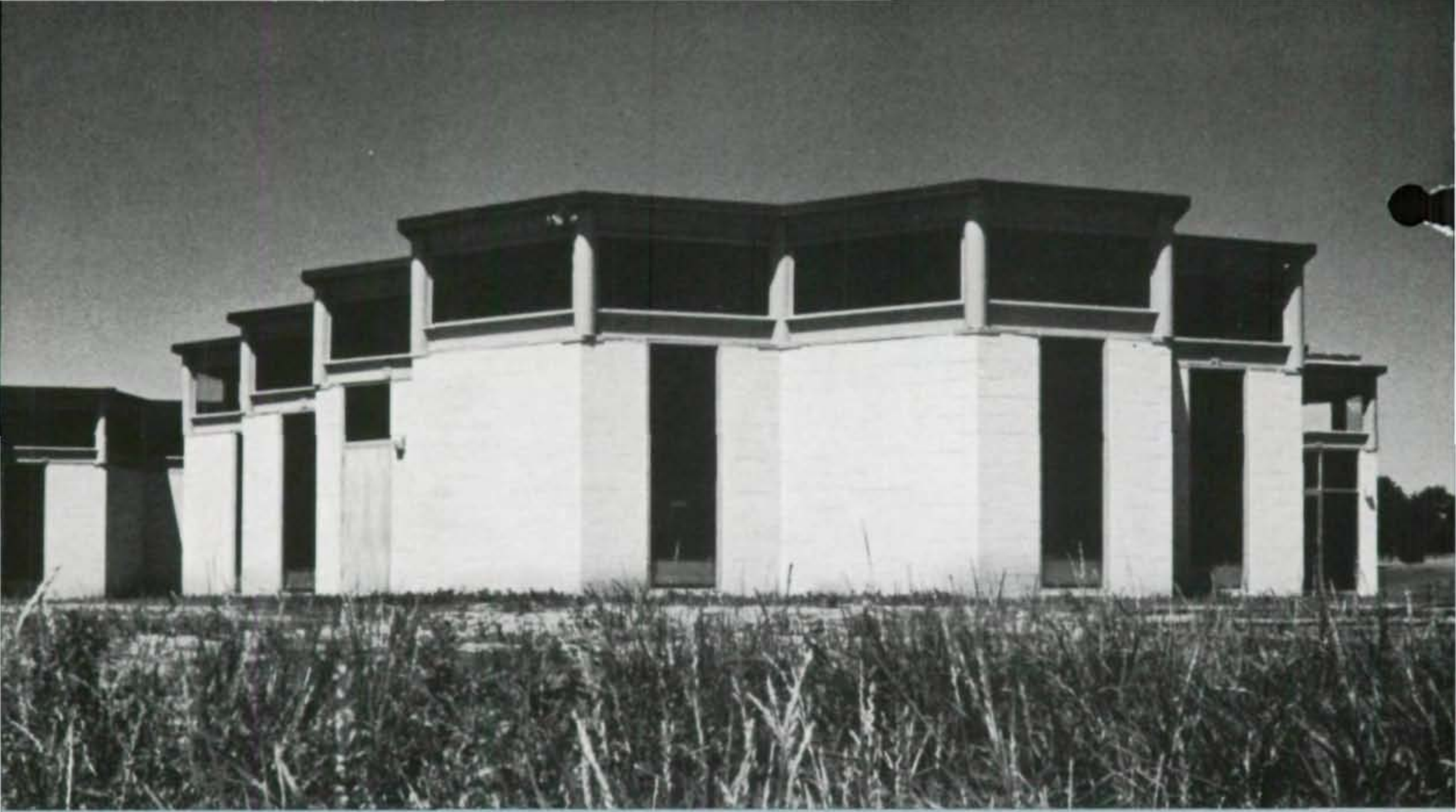


the steel was ready to receive them. The cores were used as raceways for electrical and plumbing services.

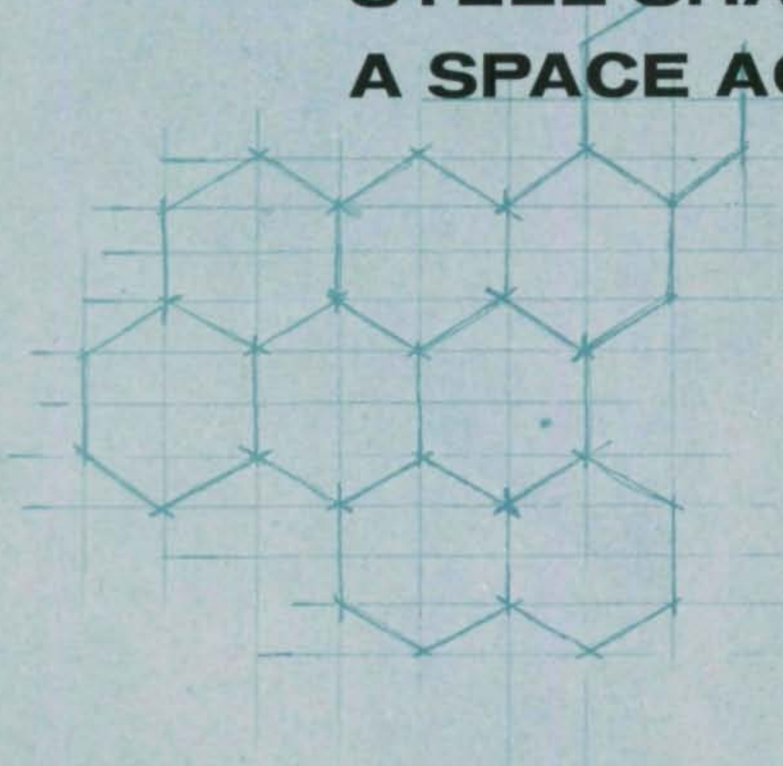
The dining hall is an 80-ft square structure that seats 514, with an attached kitchen engineered to feed 1,200. Since the main supporting arches rest on piers outside the wall line, all of the interior space is functional and columnless. The long spans in the two intersecting three-hinged arches which make up the base support for the roof are 30WF132 beams. The curved portions at the bases are built up of heavier steel. Intermediate rigid frames vaulting the four quadrants between the arches range from 12B19 at the point nearest the peak to 18WF50 at the gables. These frames support a 3-in. thick timber deck of redwood.

A steel strut at the ridge and steel braces at the peak of the roof complete the framing. From corner to corner, below grade, nine #10 steel bars tie together the opposing bases of the rigid-framed arches. The rods were encased in concrete and covered with a floor of terrazzo. Redwood was used to face all the glass walls and interior panels.

Credits
Architect: Charles Robert Johnson, Youngstown, Ohio
Structural Engineer: V. E. Shogren, Youngstown, Ohio
General Contractor: Baltimore Contractors, Inc., Baltimore, Md.



STEEL SHAPES A SPACE AGE PLANT

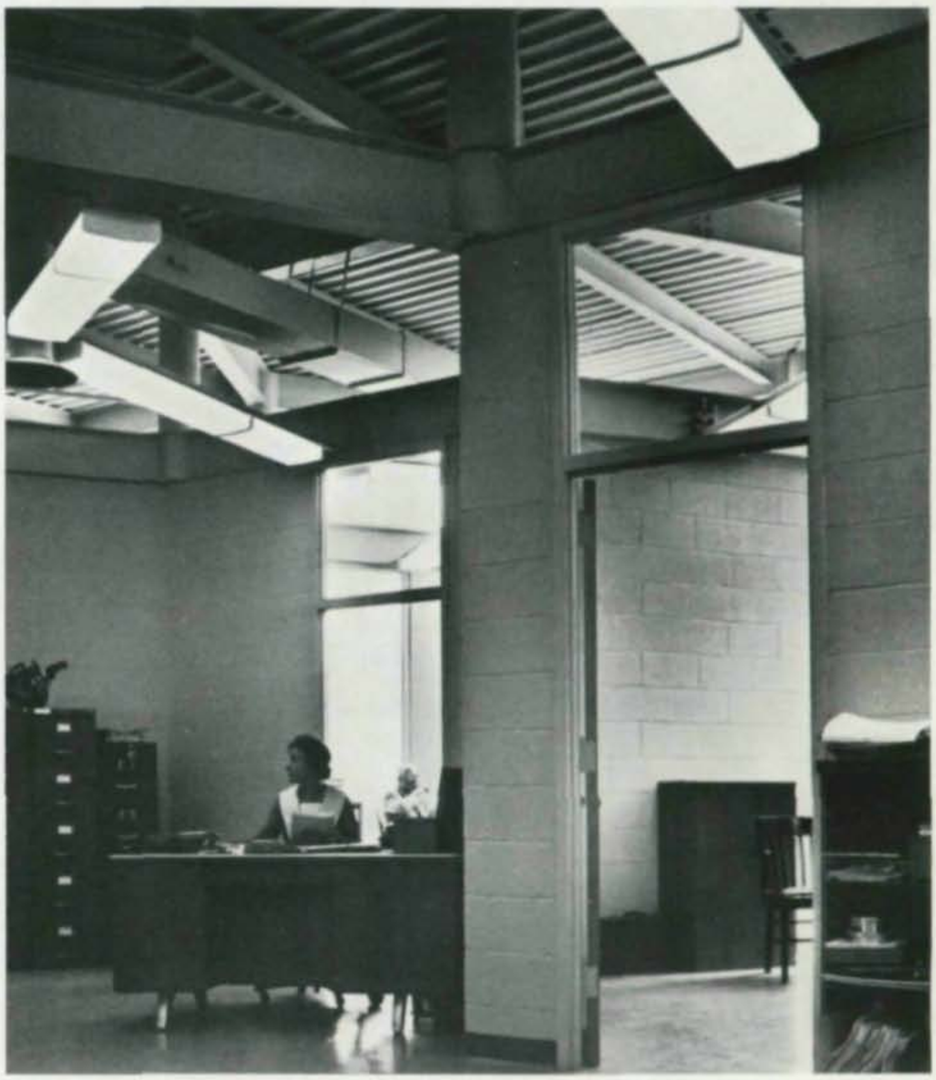


By Arthur M. Tofani, Jr., AIA
Partner, Tofani & Fox,
Architects and Planners, Phila., Pa.

Uniform Tubes, Inc. of Trappe, Pennsylvania, is almost a pure phenomenon of our space age. Its specialty is precision-engineered seamless metal tubing. Before World War II, only a handful of electric meter and measuring-device makers were interested in such esoteric material. However, the need for this tubing in spacecraft and space age equipment is enormous. This explains why Uniform—an organization of eight people in 1933 – now is a corporation of more than 250 employees – and still growing.

Its swiftest growth has occurred during the past decade. This factor was one of the reasons we were called in several years ago to design a new plant at Trappe. I suppose the obvious question is this: "What made us settle on a seemingly free-form, honeycomb design using

Honeycomb pattern of exposed steel space frame provides interest and lightness to interiors of both production and administrative areas.



a steel Vierendeel truss?" There are several reasons, but fundamentally, I believe it no longer makes sense to apply Model-T reasoning to the design of a factory that turns out tubing for missile propulsion systems. Today's manufacturing plants must match today's manufacturing systems.

To understand what was needed at Uniform, we did considerably more than interview the client. We immersed ourselves in the entire operation. We learned everything we could about their then-current problems, plans for the future, hopes for expansion, the range of materials used, the demands in the manufacturing process, and the optimum conditions under which the products could be turned out. By the time we had completed our study, we were on a first-name basis with nearly all the top plant men. These friendships proved to be very helpful. The men gave us information vital to the design of the factory – information they might have unconsciously withheld if they hadn't been "rooting" for us.

We discovered, very soon, that **flexibility** was a key requirement. For example, the plant had to be expandable in some way. Everyone anticipated an increase in business. (This has already happened. At this writing, we are in the process of designing and supervising construction of an additional 18,000 sq ft, spreading **out** in three areas and **up** in a fourth.)

There was a demand for flexibility inside, too. Government contracts could call for an unusual quantity of, say, .013 OD tubing. Six months later, demand might shift to another size, in tubing made of an entirely different alloy. The manufacturing facilities must be ready to adapt quickly. In addition, a part of the firm's expansion plans includes development in other areas. For example, it recently inaugurated the MicroDelay Division, which produces microwave time-delay systems and coaxial cable.

This flexibility, however, had to be arranged so that the traffic flow on the

Flexibility was the key to the design of the Uniform Tubes plant. Result was an amoeba-like pattern based on a 192 sq ft hexagonal module.

plant floor and the management functions in the administrative areas would remain essentially intact during additions to (or even subtractions from) the plant.

Finally, it was everyone's opinion that constant pressure for precision in the manufacturing process called for a comfortable environment year round. So, the offices **and** the manufacturing areas were air conditioned – an enlightened step for a plant in a middle-Atlantic state.

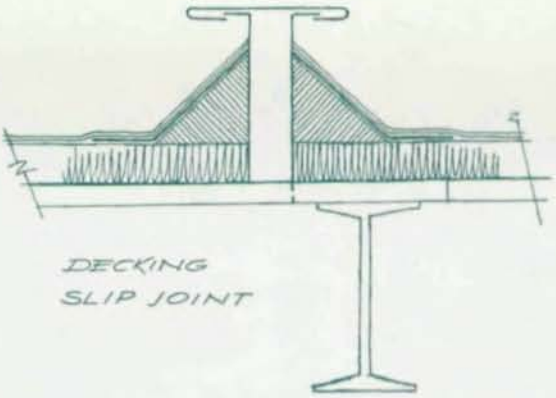
Synthesizing these requirements, we came up with an amoeba-like pattern, based on a hexagonal module containing 192 sq ft. Using this module, we gave Uniform space that precisely fit its needs. There is virtually no waste space; and the plant is laid out to match the manufacturing process, with work flow extending along a straight line, 500 ft long, beginning at receiving and ending at shipping. Perhaps, however, the hexagonal-shaped module is more important for its remarkable adaptability to expansion. The concrete-block curtain walls between the steel framing can be knocked out inexpensively, and the steel, as is, is ready to be tied to a new hexagonal frame. Moreover, the additions can be made one at a time, if needed, and at precisely the point where the addition is required. The cost to add one module or ten modules would be roughly the same–about $10 a sq ft. In the case of a conventionally-built plant, management would find it difficult, if not impossible, to add space in such small increments.

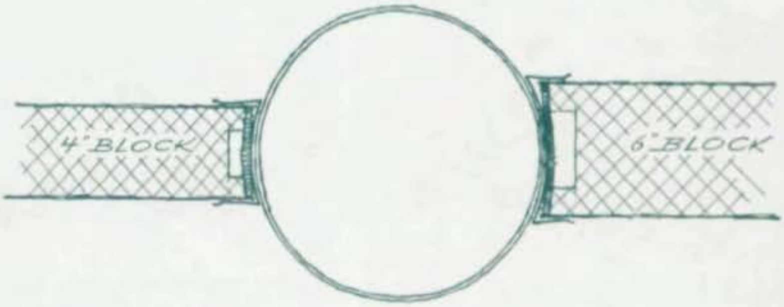
Once the shape of the module was set, we made up two complete designs for the roof framing – one in concrete and one in steel. It was soon apparent that steel was the logical choice, on the basis of adaptability, speed of erection and economy.

We selected the Vierendeel truss to open up columnless areas in the plant, assist in forming a rigid frame and simplify distribution of heating and air conditioning ducts. The truss is interlocking, 5 ft deep overall, and typically spans a distance of 45 ft from column to column. Top and bottom chords are 12WF beams, and in the vicinity of the columns, 12WF31. A36 steel was specified for all truss chords. Vertical truss members are made up of 10-in. diameter, standard weight pipe. All columns are 12-in. diameter, extra strong steel pipe, concrete-filled, making them rigid enough to resist the skewed loading at the edges of the building.

Five basic shapes, repeated over and over again, resulted in an unusually low cost structure, considering its space advantages. General construction cost (not including mechanical) was $302,000. With 54,000 sq ft of usable space inside, this figure works out to about $5.60 a sq ft. A total of 490 tons of steel went into the building, 400 tons of which were employed in the main frame.

And one more advantage of the module: it can be omitted within the structure without altering any other portion of the frame. We did just that next to the plant cafeteria. The equivalent of four modules was eliminated and a garden was planted in the open space. It's visible from the cafeteria, offices **and**





the factory floor.

Altogether, this has been (and continues to be) a very satisfying experience for me, and I feel sure it is for the other members of the planning and construction team, as well as for Uniform management. Uniform was particularly pleased, for example, over the fact that the machinery and personnel had been moved into the new plant so efficiently that the company was up to full production at Trappe within two days. The firm's Vice-president and Secretary, Gordon B. Hattersley, tells me that the average plant, similarly sized, would consider itself lucky to get back to top operating efficiency in a month after a move. The feat was due primarily to remarkably good cooperation among all parties involved.

Arthur M. Tofani, Jr. Associates, Philadelphia, Pennsylvania, was architect for the project. Alan Newman and Charles Ang of Philadelphia were structural engineers. General contractor was the Leonard Pevar Co., Unionville, Pennsylvania.

STRUCTURAL STEEL FOR A ONE-OF-A KIND RESTAURANT

By Paul Rogers, P.E.*

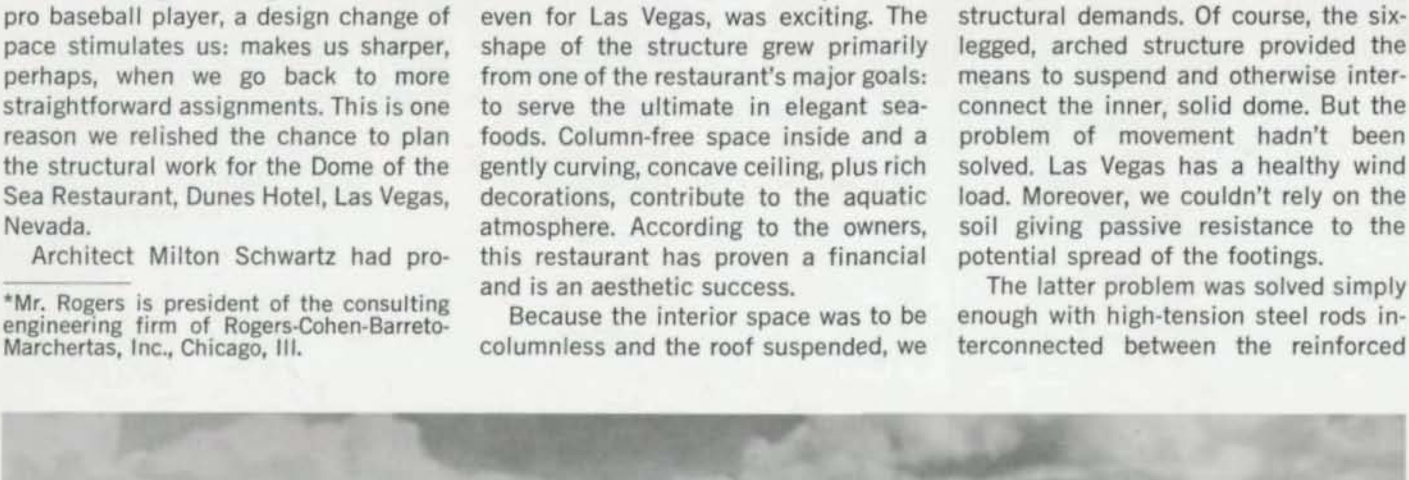
Just as a game of golf refreshes a pro baseball player, a design change of pace stimulates us: makes us sharper, perhaps, when we go back to more straightforward assignments. This is one reason we relished the chance to plan the structural work for the Dome of the Sea Restaurant, Dunes Hotel, Las Vegas, Nevada.

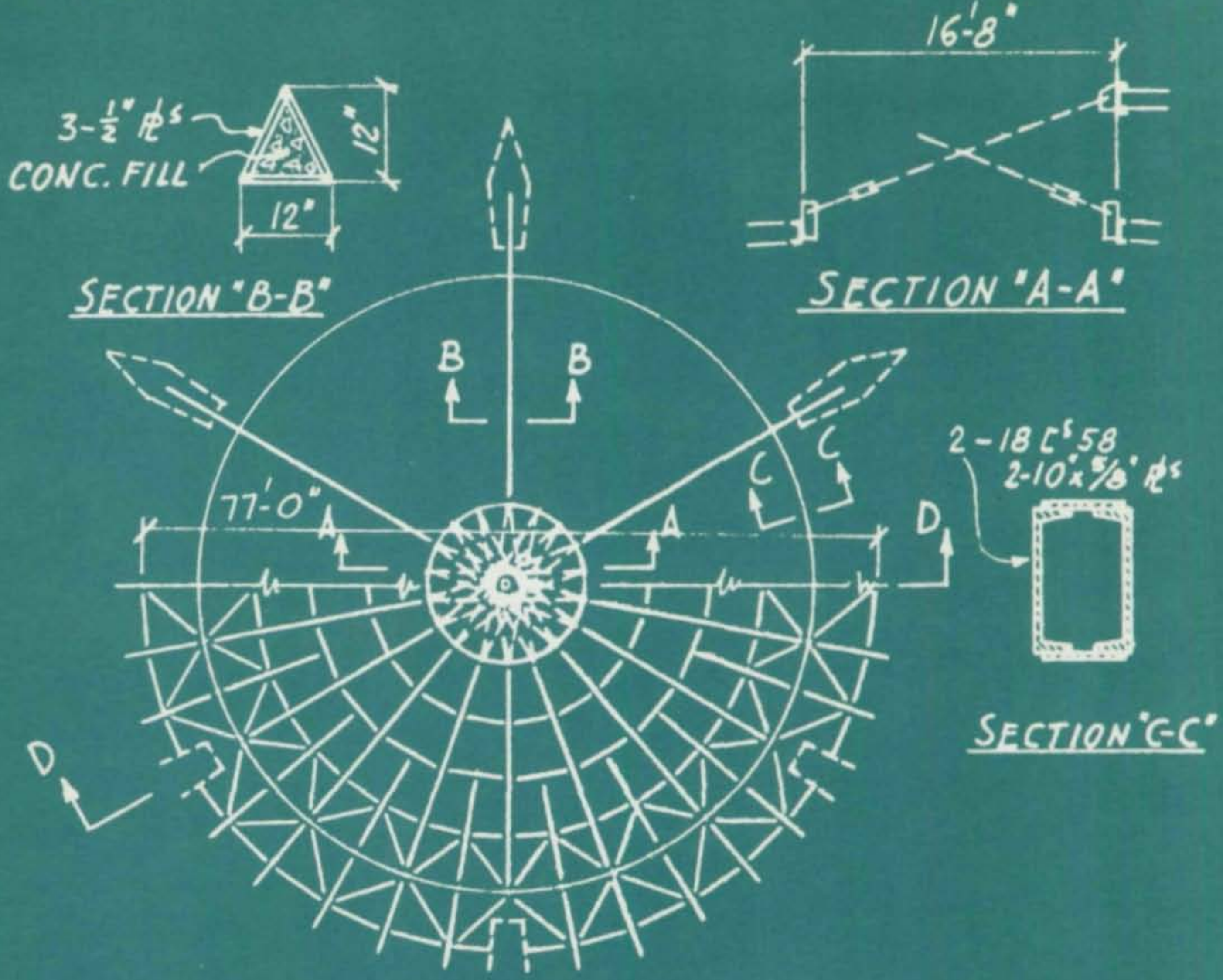
Architect Milton Schwartz had produced an architectural concept which, even for Las Vegas, was exciting. The shape of the structure grew primarily from one of the restaurant's major goals: to serve the ultimate in elegant seafoods. Column-free space inside and a gently curving, concave ceiling, plus rich decorations, contribute to the aquatic atmosphere. According to the owners, this restaurant has proven a financial and is an aesthetic success.

Because the interior space was to be columnless and the roof suspended, we were presented with some interesting structural demands. Of course, the six-legged, arched structure provided the means to suspend and otherwise interconnect the inner, solid dome. But the problem of movement hadn't been solved. Las Vegas has a healthy wind load. Moreover, we couldn't rely on the soil giving passive resistance to the potential spread of the footings.

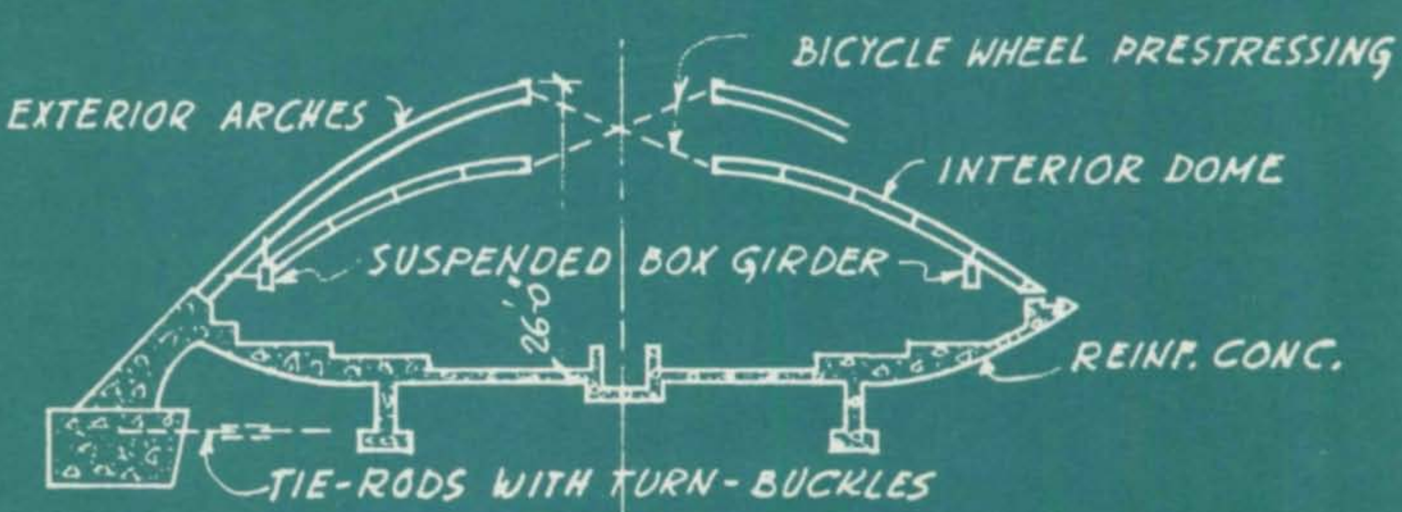
The latter problem was solved simply enough with high-tension steel rods interconnected between the reinforced

*Mr. Rogers is president of the consulting engineering firm of Rogers-Cohen-Barreto-Marchertas, Inc., Chicago, Ill.





HALF PLANS OF EXT. ARCHES & INT. DOME



HALF-SECTIONS "D-D"

concrete piers, on which the outer arches rest. These rods are equipped with turnbuckles, which facilitated equalization of the tensions.

Movement was stabilized in several ways. Structural steel for the outer arches is triangular in cross-section; formed of A36 steel plates, shop welded. In order to avoid the possibility of flutter, due to aerodynamic vortices, the arches were filled with concrete. As a result, the natural frequency of vibration in the system was favorably altered.

These outer arches rest below on a 1¼-in. steel base plate and ¼-in. setting plate. Both plates are attached to the reinforced concrete pier with three 1-in. diameter anchor bolts, giving the arches some measure of restraint. At the top, the arches frame into a compression ring 16 ft-8 in. in diameter, formed with a 15-in. deep steel channel weighing 40 lbs per ft.

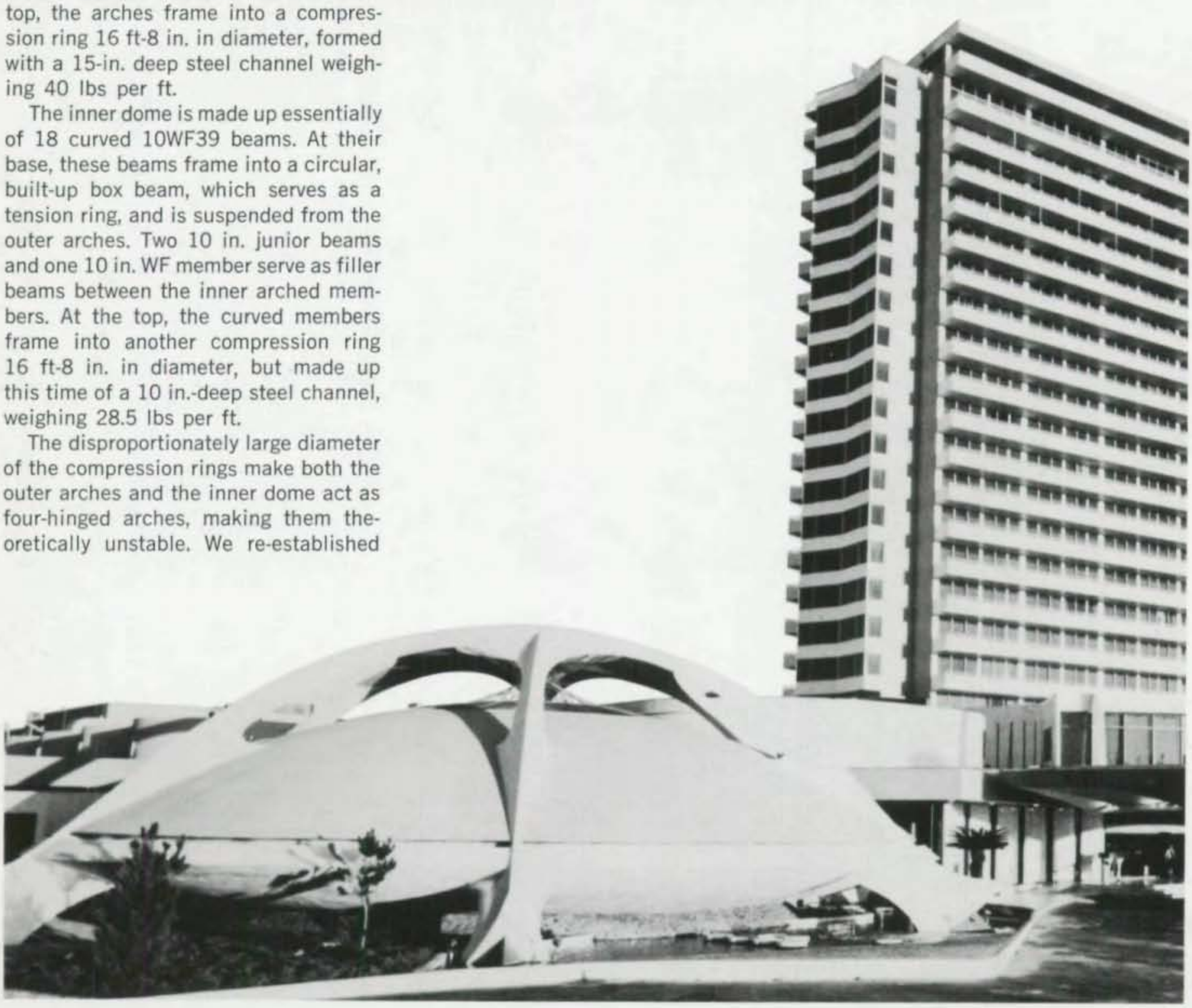
The inner dome is made up essentially of 18 curved 10WF39 beams. At their base, these beams frame into a circular, built-up box beam, which serves as a tension ring, and is suspended from the outer arches. Two 10 in. junior beams and one 10 in. WF member serve as filler beams between the inner arched members. At the top, the curved members frame into another compression ring 16 ft-8 in. in diameter, but made up this time of a 10 in.-deep steel channel, weighing 28.5 lbs per ft.

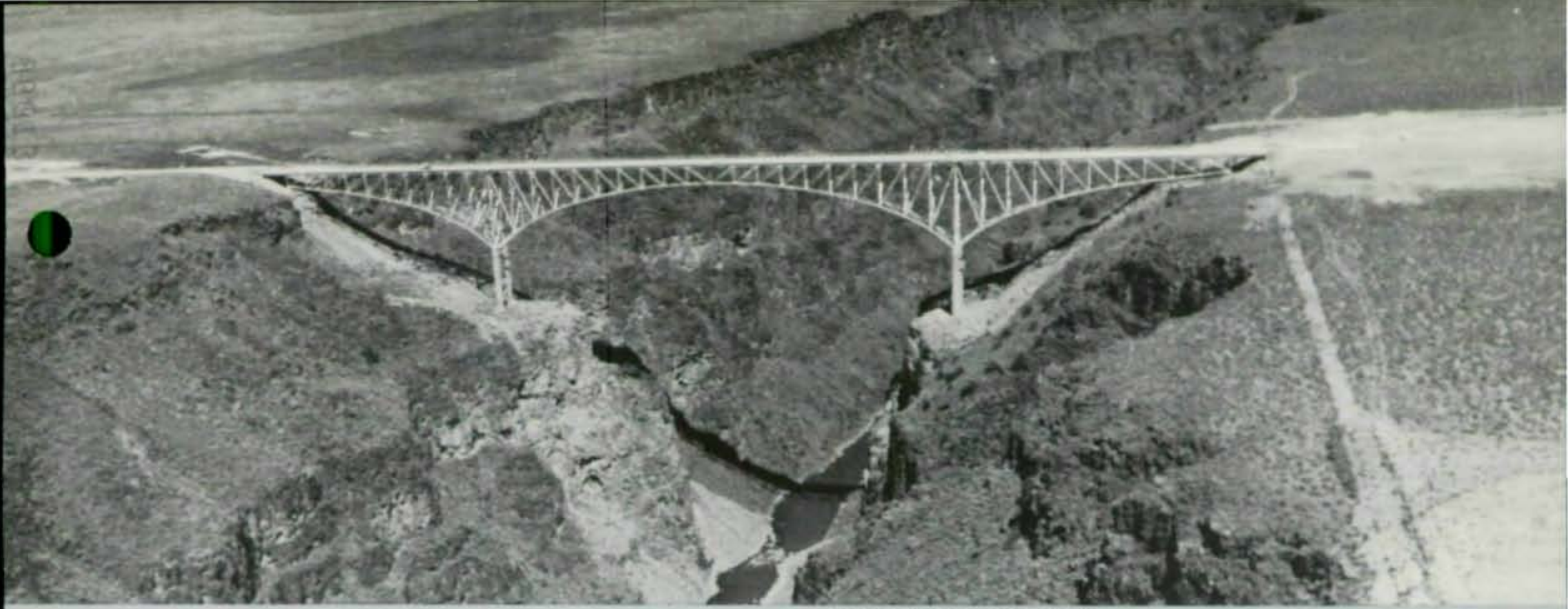
The disproportionately large diameter of the compression rings make both the outer arches and the inner dome act as four-hinged arches, making them theoretically unstable. We re-established stability by tying together the two compression rings with steel hanging rods arranged around the rings in much the same way as the spokes of a bicycle wheel. These rods also have turnbuckles and provide the necessary torsional and flexural rigidity.

Between the domed roof and the lower portion of the restaurant is a rim of ¼-in. thick obscure glass. In progression, the dome is covered with 1-in. form-board, 2 in. of poured gypsum and a hypalon coating. The outer arches are surrounded with metal lath, 1 in. of cement plaster and a hypalon coating. The piers are faced with terrazzo, and the structure rests on a base of concrete block faced with "canyon" stone.

Inside, the ceiling is coated with a ¾-in. layer of acoustical plaster over metal furring. And suspended from the ceiling is a large, decorative acrylic screen. Above the screen is the skylight, filled with ⅜-in. tempered solar glass. Floors are white terrazzo with aluminum feature stays, and many portions are covered with carpet.

Architect was Milton M. Schwartz & Associates, Chicago, Illinois. We were structural engineers under the name of Paul Rogers & Associates, now Rogers-Cohen-Barreto-Marchertas, Inc., Chicago, Illinois. General contractor was Bakker Construction of Las Vegas, Nevada, and the steel fabricator was Western Steel Co., Salt Lake City, Utah.





PRIZE BRIDGES 1966

PRIZE BRIDGE – LONG SPAN

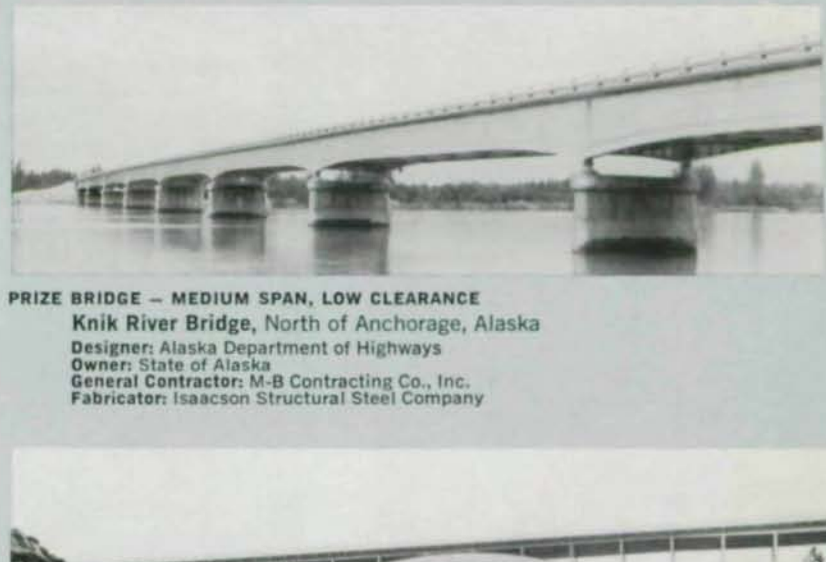
Rio Grande Gorge Bridge, Taos County, New Mexico
Designer: New Mexico State Highway Commission
Owner: State of New Mexico
General Contractor: J. H. Ryan & Son, Inc.
Fabricator: American Bridge Division – United States Steel Corp.

Each year since 1928, the American Institute of Steel Construction has sponsored an annual Prize Bridge Competition to honor the architectural excellence of American bridge design and to promote a more widespread appreciation of the beauty of steel bridges. Selections are made by a distinguished Jury of Awards, composed of leading architects, engineers and art directors.

This year the Jury of Awards selected seven "Prize Bridges" and eleven "Awards of Merit" from 129 entries received in the competition.

The Jurors were:

□ **Earle T. Andrews,** president American Society of Civil Engineers and president of Pennsylvania Glass Sand Corporation, Hancock, West Virginia □ **Admiral E. J. Peltier,** Sverdrup & Parcel & Associates, Inc., St. Louis, Missouri □ **Lloyd J. Lovegren,** Partner, Lloyd J. Lovegren and Associates, Architects, Seattle, Washington □ **Norman C. Raab,** Tudor Engineer-



PRIZE BRIDGE – MEDIUM SPAN, LOW CLEARANCE

Knik River Bridge, North of Anchorage, Alaska
Designer: Alaska Department of Highways
Owner: State of Alaska
General Contractor: M-B Contracting Co., Inc.
Fabricator: Isaacson Structural Steel Company

PRIZE BRIDGE – MEDIUM SPAN, HIGH CLEARANCE

Eagle Canyon Arch, I-70, Emery County, Utah
Designer: Utah State Department of Highways
Owner: State Road Commission of Utah
General Contractor: Strong and Company
Fabricator: Western Steel Company

PRIZE BRIDGE – SHORT SPAN

White Canyon Bridge, U-95, San Juan County, Utah
Designer: Utah State Department of Highways
Owner: State Road Commission of Utah
General Contractor: S. S. Mullen, Inc.
Fabricator: Titan Steel Corporation

PRIZE BRIDGE – HIGHWAY GRADE SEPARATION
Interstate Route 70 Over Pennsylvania Railroad, Cambridge Bypass, Guernsey County, Ohio
Designer: Alden E. Stilson & Associates, Ltd.
Owner: State of Ohio, Department of Highways
General Contractor: V. N. Holderman and Sons Company
Fabricator: The C. E. Morris Company

PRIZE BRIDGE – MOVABLE SPAN
Pennsylvania Railroad Lift Bridge Over Chesapeake & Delaware Canal, Kirkwood – Mount Pleasant, Delaware
Designer: Howard, Needles, Tammen & Bergendoff
Consulting Architect: A. Gordon Lorimer
Owner: Pennsylvania Railroad
General Contractor: Superstructure: The Ingalls Iron Works Company
Substructure: Nello L. Teer Co. and Construction Aggregates Corp.
Fabricator: The Ingalls Iron Works Company

ing Company, Consulting Engineers, San Francisco, California □ **Patric Shannon,** Director, Oklahoma Art Center, Oklahoma City, Oklahoma.

In commenting on this year's competition, the Jurors noted that younger engineers who were not brought up during the austerity of the depression are showing more imagination and less concern for the absolute minimum dollar involved. This, they feel, is more desirable in creating maximum aesthetics in a structure. They noted, too, that many schools of engineering are encouraging their students to take design courses with emphasis on art, rather than just on structure.

The Jurors complimented the Ameri-

PRIZE BRIDGE – SPECIAL TYPE
Westinghouse Transit Expressway, Pittsburgh, Pennsylvania
Designer: Richardson, Gordon and Associates
Owner: Port Authority of Allegheny County
General Contractor: Westinghouse Electric Corporation
Fabricator: Bethlehem Steel Corporation

AWARD OF MERIT – MEDIUM SPAN, LOW CLEARANCE
Eudora Bridge Over Kansas River, Near Eudora, Kansas
Designer: Finney & Turnipseed
Owner: Douglas County and Leavenworth County, Kansas
General Contractor: Superstructure: E. W. Blair
Substructure: J. A. Tobin Construction Co.
Fabricator: George C. Christopher & Son, Inc.

can Institute of Steel Construction for conducting the competition. They said that it has helped focus the attention of bridge designers on aesthetics and the creation of more pleasing designs. They pointed to the clean and simple lines of this year's entries to emphasize that designers are paying more attention to the integrity of the material. "This is good design", they acknowledged.

The seven Prize Bridges will have stainless steel plaques affixed to them as a permanent tribute to their designers for combining aesthetics and utility. The designers, owners, fabricators and general contractors of all eighteen winning bridges will receive Award Certificates.

AWARD OF MERIT — MEDIUM SPAN, HIGH CLEARANCE

Mifflinville Bridge Over The Susquehanna River, I.80, Columbia County, Mifflinville, Pennsylvania

Designer: Brookhart & Tyo, Consulting Engineers
Owner: Pennsylvania Department of Highways
General Contractor: *Woelfel Engineering Corporation*
Fabricator: Harris Structural Steel Company

AWARD OF MERIT — MEDIUM SPAN, HIGH CLEARANCE

Roanoke River Bridge, Blue Ridge Parkway, Roanoke County, Virginia

Designer: U. S. Bureau of Public Roads
Owner: National Park Service, U. S. Department of Interior
General Contractor: McDowall and Wood, Inc.
Fabricator: American Bridge Division — United States Steel Corp.

AWARD OF MERIT — MEDIUM SPAN, HIGH CLEARANCE

Bluegrass Parkway Bridge Over Kentucky River, Lawrenceburg, Kentucky

Designer: Carl P. Kroboth Consulting Engineers for Smith-Pollitte & Associates
Owner: Kentucky State Highway Department
General Contractor: John F. Beasley Construction Co.
Fabricator: Nashville Bridge Company

AWARD OF MERIT — SHORT SPAN

Cle Elum River Bridge, Kittitas County, Washington

Designer: Arvid Grant & Associates, Engineers
Owner: Kittitas County, Washington
General Contractor: Anderson Bridge Company
Fabricator: Union Iron Works Division—Coeur d'Alenes Company

AWARD OF MERIT — SHORT SPAN

Willow Creek Bridge, Willow Creek, California

Designer: State of California
Owner: State of California
General Contractor: Thomas Construction Company
Fabricator: San Jose Steel Company

AWARD OF MERIT — HIGHWAY GRADE SEPARATION

South Crest Road Bridge, Chattanooga, Tennessee

Designer: Aake F. Hedman & Associates
Owner: State of Tennessee, Department of Highways
General Contractor: Michael Construction Company
Fabricator: Allied Structural Steel Company
Tucker Steel Corporation

AWARD OF MERIT — HIGHWAY GRADE SEPARATION

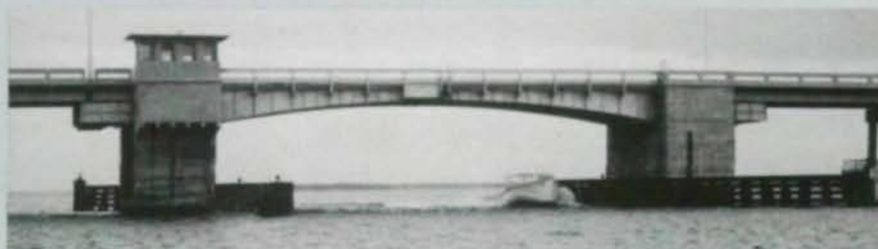
Route 680/580 Separation, West of San Joaquin County Line, California

Designer: State of California
Owner: State of California
General Contractor: Green Construction Co. & Winston Bros. Company
Fabricator: American Bridge Division — United States Steel Corp.

AWARD OF MERIT — HIGHWAY GRADE SEPARATION

Pletcher Road Bridge, Lewiston, New York

Designer: Clark & Rapuano under supervision of Office of Deputy Chief Engineer (Design), State of New York
Owner: State of New York, Department of Public Works
General Contractor: S. J. Groves & Sons Company
Fabricator: City Iron Works



AWARD OF MERIT — MOVABLE SPAN

Jensen Beach Bascule, Jensen Beach, Florida

Designer: Rader & Associates in cooperation with the Florida State Road Department
Owner: Florida State Road Department
General Contractor: Scott Construction Company Inc.
Fabricator: Nashville Bridge Company

AWARD OF MERIT — SPECIAL TYPE

Pedestrian Bridge Over George Street
New Brunswick, New Jersey

Designer: New Jersey State Highway Department
Owner: New Jersey State Highway Department
General Contractor: John W. Thompson
Fabricator: Keystone Structural Steel Company