VOLUME VII / NUMBER 3 / THIRD QUARTER 1967

A9. 7-3

MODERN STEEL CONSTRUCTION

MODERN STEEL CONSTRUCTION

Published by

American Institute of Steel Construction

101 Park Avenue, New York, N. Y. 10017

VOLUME VII / NUMBER 3 / THIRD QUARTER 1967

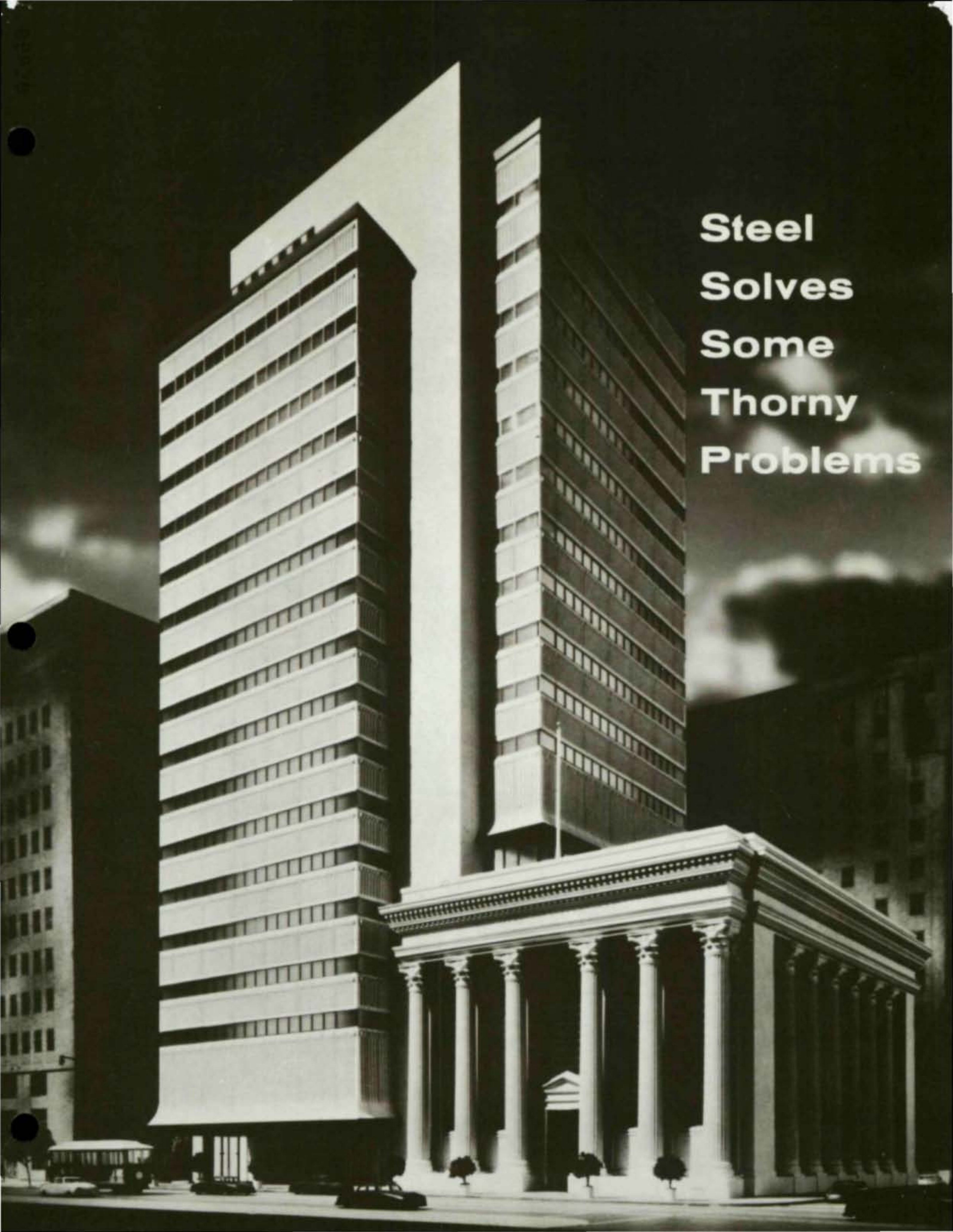
CONTENTS

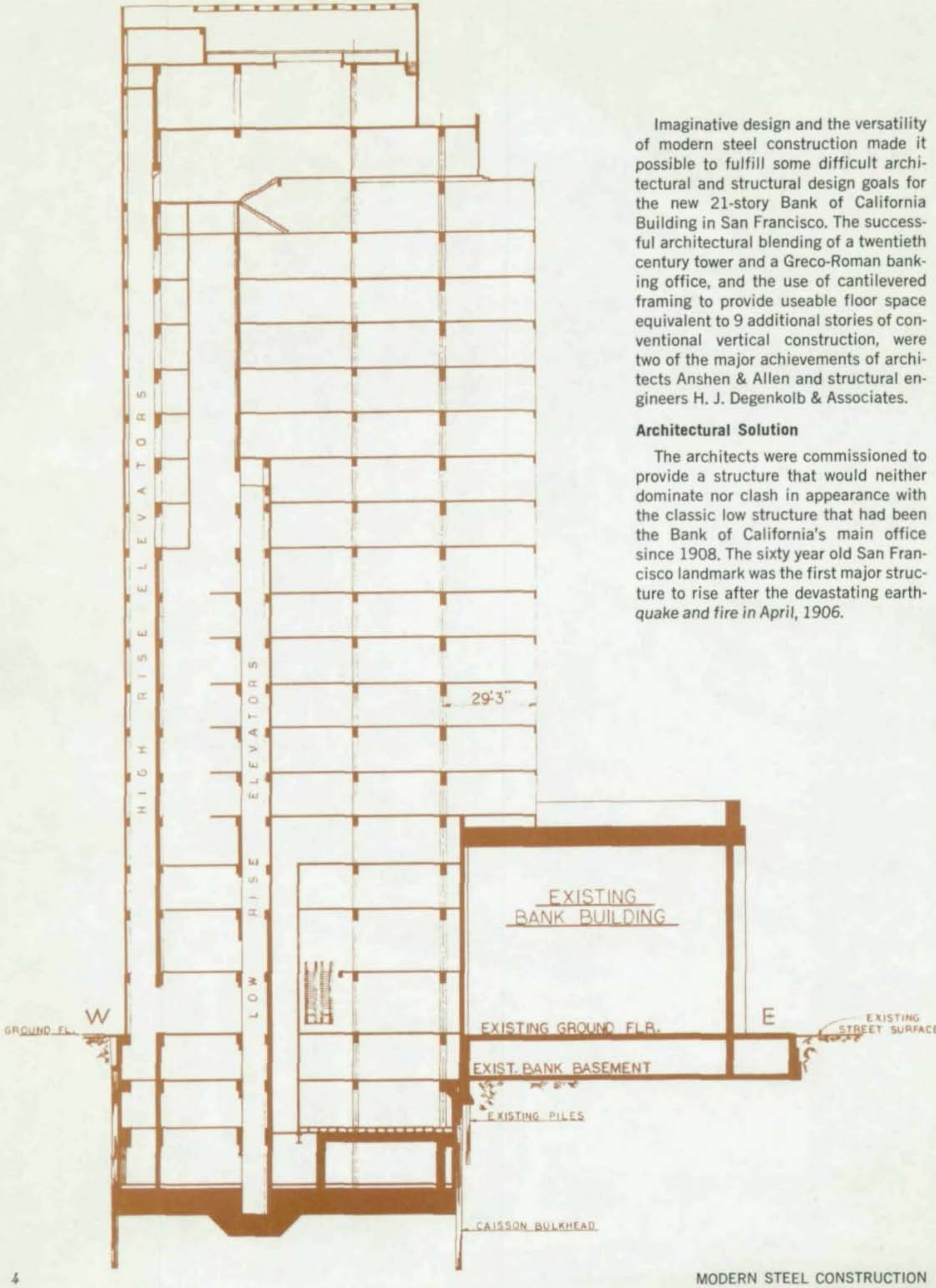
YOUR LOCAL AISC REGIONAL ENGINEER

On the outside back cover of this issue you will find the names and addresses of the AISC Regional Engineering staff. These 32 professional structural engineers, operating out of 26 regional offices, are ready to assist architects and engineers with any structural steel design problem. The techniques of steel design are changing rapidly and it is difficult for designers to keep informed about all the new developments and their advantages. Because the AISC Regional Engineer is a specialist in steel construction and is aware of new methods before they are widely publicized, he is in a unique position to assist the design professions.

We suggest that you contact your local Regional Engineer early in the preliminary stages of design — to get his suggestions for the most economical steel framing for your project. He may be able to suggest new ideas and new economies that didn't exist a short while ago. And once a design is under way, if you have a difficult detail or a problem connection or need a new way to solve an old problem, call on your local AISC Regional Engineer — he wants to help.

Steel Solves Some Thorny Problems





Imaginative design and the versatility of modern steel construction made it possible to fulfill some difficult architectural and structural design goals for the new 21-story Bank of California Building in San Francisco. The successful architectural blending of a twentieth century tower and a Greco-Roman banking office, and the use of cantilevered framing to provide useable floor space equivalent to 9 additional stories of conventional vertical construction, were two of the major achievements of architects Anshen & Allen and structural engineers H. J. Degenkolb & Associates.

Architectural Solution

The architects were commissioned to provide a structure that would neither dominate nor clash in appearance with the classic low structure that had been the Bank of California's main office since 1908. The sixty year old San Francisco landmark was the first major structure to rise after the devastating earthquake and fire in April, 1906.

It might have been difficult to achieve these aims with a new structure essentially the same size as the 1908 building. But the bank's need for more office space and the limitations of the site demanded a high-rise structure – an even more challenging proposition.

The thinking that led to the final design is explained below by Derek Parker, AIA, partner in charge of the project:

"The principal facade of the existing bank is a powerful symmetrical design. Equally strong symmetry in the new structure would have drawn attention away from the older building; made them seem separate entities. That's why we chose an unsymmetrical design. In this way, the two buildings have the best chance of being linked visually as one institution.

"We also subordinated the horizontal dimensions of any one face on the new building to the 87-ft width of the bank facade. In some measure, this keeps the taller building in harmonious scale with the bank and neighboring structures. We broke up the mass easily enough with elevator shafts and stair towers.

"Studies of comparative heights convinced us that the high-rise addition, if more than four times the height of the bank, would prove overbearing. The existing bank is approximately 5½ stories high. The new tower has 21 stories.

"The 10-ft setback of the new tower gives greater prominence to the historic building than it originally enjoyed. And the small plaza the setback creates should prove an agreeable civic addition for the area.

"We felt very strongly that a vertical entrance to the new building would compete with the pronounced vertical lines in the older bank. Thus we've designed the new entrance on the horizontal, broad and low.

Architect: Anshen & Allen, San Francisco, Calif.
Structural Engineers: H. J. Degenkolb & Associates, San Francisco, Calif.
General Contractor: Cahill Construction Co., San Francisco, Calif.
Steel Fabricator: Murphy-Pacific Corp., San Francisco, Calif.

New framing cantilevers 29 feet into air space over the landmark 1908 building. Cantilevers on three sides provide floor space equivalent to 9 additional stories.

"Finally, the pale gray of the precast concrete panels encasing the tower will be matched to the granite of the 1908 building. A portion of the old stone was steam cleaned to assure a perfect match, and the building project includes a steam bath for the landmark building after the official opening."

Steel Framing

The building, consisting of three basements, 19 office floors and two mechanical penthouse levels, is built with a moment-resisting structural steel frame. Thus, both vertical and lateral (wind and seismic) forces are held in check. On the east side of the building, the 6th to 19th floors are cantilevered out 29 ft into the air space over the older banking offices. This cantilever increased the square footage by 1,840 sq ft per floor. Shorter cantilevers from the 2nd to the 19th floors on the north and south sides provide an additional 1,260 sq ft at each of those floors. The cantilevered girders were fabricated from steel plate, and on the east side were 42 in. deep. The unusualy long cantilevers on the east side required the erection of the building out-of-plumb to compensate for the resulting sidesway.

The new heavy series of rolled steel columns, with weights up to 734 lbs per ft, were used in this building for the first time west of Chicago. All columns are ASTM A441 steel, and all other framing members are A36 steel. All connections were field bolted with ASTM A325 and A490 high strength bolts. Cellular steel decking and lightweight concrete were used for the floors.

Gross area for the new annex is approximately 300,000 sq ft, with a net area of 243,000 sq ft. Estimated cost for the entire project is $12.5 million.

Unusual Foundations

Once construction was under way, steel began solving other problems. For example, bank management wanted a three-basement building. This required a foundation 55 ft deep. However, the new building is located on filled land, roughly 6 ft above sea level, and with a water table 14 ft below street level.

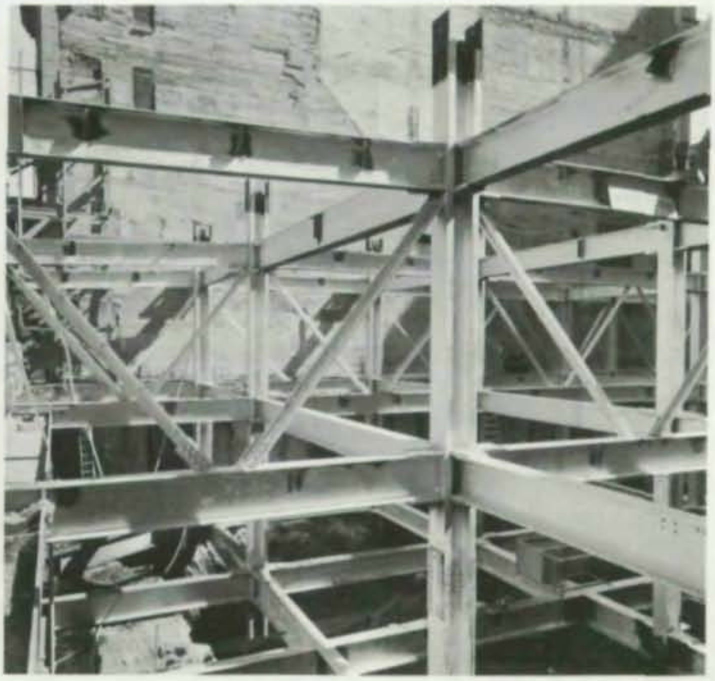
To overcome the barriers to normal foundation construction, the basements were built from the top down. First step in this unusual, though not unique, method was to drill 20-in. diameter holes 80 ft deep on 4-ft centers along the foundation lines. 24WF soldier beams were inserted in the holes, and trenches scooped out between the beams to the 80-ft depth. The trenches were filled with concrete, making a solid, 2-ft wide beam-reinforced bulkhead. Then excavation began for the first basement.

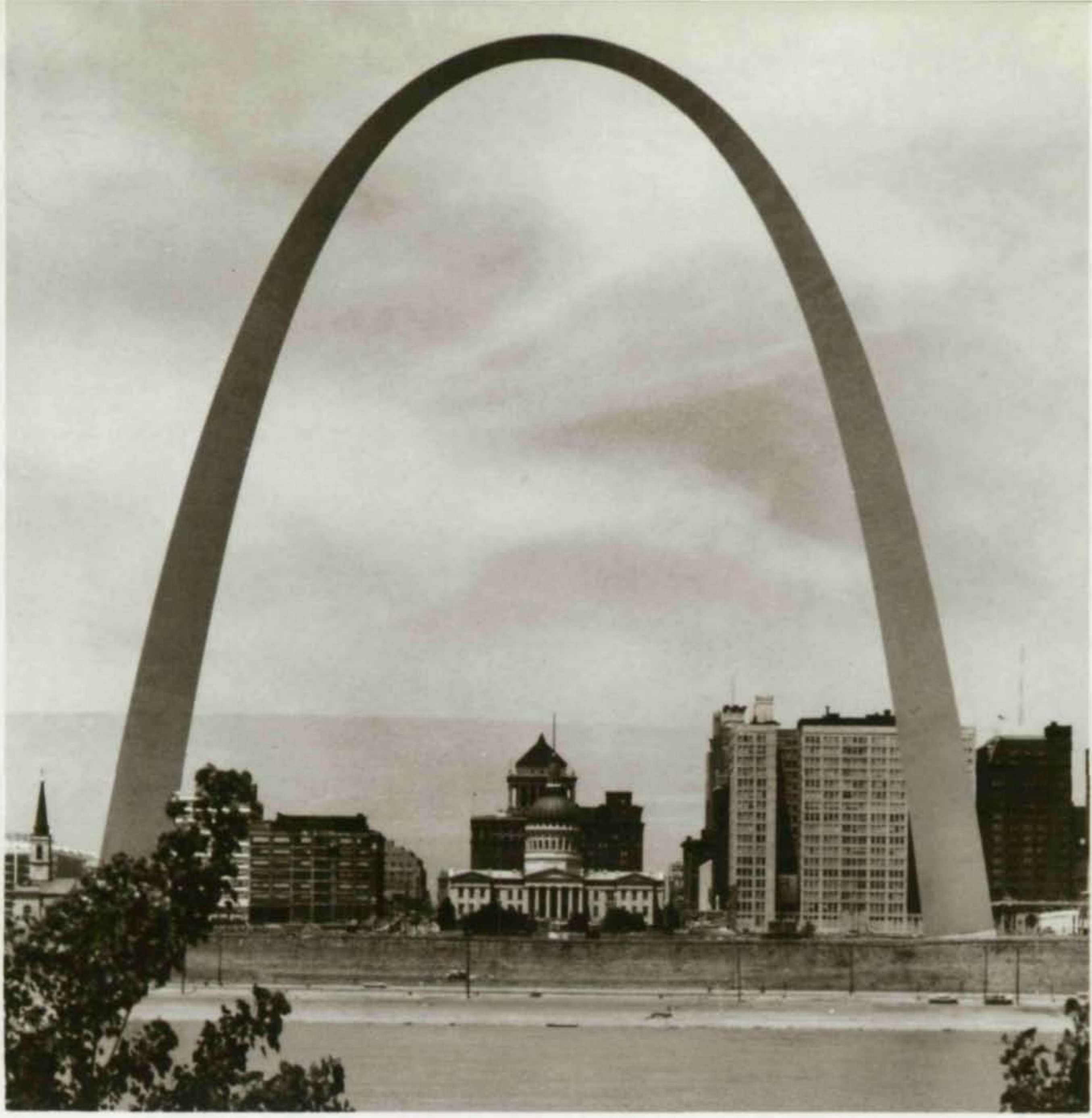
When the hole was 12 ft deep, steel was placed for the ground floor and first basement. Temporary diagonal bracing was bolted to the upper and lower beams along the 143-ft length of the excavation to form trusses which not only shored up the excavation walls but served as "hooks" from which the subterranean steelwork was hung as the excavation proceeded. Filler beams across the 108-ft width provided lateral bracing for the trusses. An 8-ft-thick, steel-reinforced foundation mat "bottomed-out" the foundation.

The weight of the dirt excavation from the site approximated the weight of the new building. As a result, the building "floats" on the alluvial deposits without any significant settling.

Cantilevered girders are 42-in. deep. Ductwork passes through stiffened web cutouts.

Basement framing steel was hung from trusses formed by beams and temporary diagonal braces.





The Gateway Arch, Jefferson National Expansion Memorial, St. Louis, Missouri

SPECIAL AWARD FOR EXCELLENCE

A special award of recognition has been made by AISC to The Gateway Arch as "an outstanding achievement in technology and aesthetics". In honoring the boldness of the design of this memorial to the American pioneers, the AISC Board of Directors paid tribute to the men whose imagination, courage and technical skill created a unique and monumental landmark.

Architect:
Eero Saarinen and Associates

Structural Engineer
Severud-Perrone-Sturm-Conlin-Bandel, Consulting Engineers

General Contractor:
MacDonald Construction Company

Steel Fabricator & Erector:
Pittsburgh-Des Moines Steel Company

Owner:
National Park Service, Dept. of the Interior

PD MOVES INTO NEW HIGH-RISE APARTMENT

Architect: Sheridan, Behm and Associates, Arlington, Va.
Structural Engineer: Horatio Allison Associates, Rockville, Md.
General Contractor: Leegate Corporation, Falls Church, Va.
Steel Fabricator: Ingalls Iron Works Co., Birmingham, Ala.

Nearly completed in Bladensburg, Md., is the first plastically designed high-rise building in the United States – The Stevenson Apartments. This pioneer structure is the first of a new breed of multi-story steel framed apartment, office, dormitory and hospital buildings that will be lighter, more economical and more efficient than ever before.

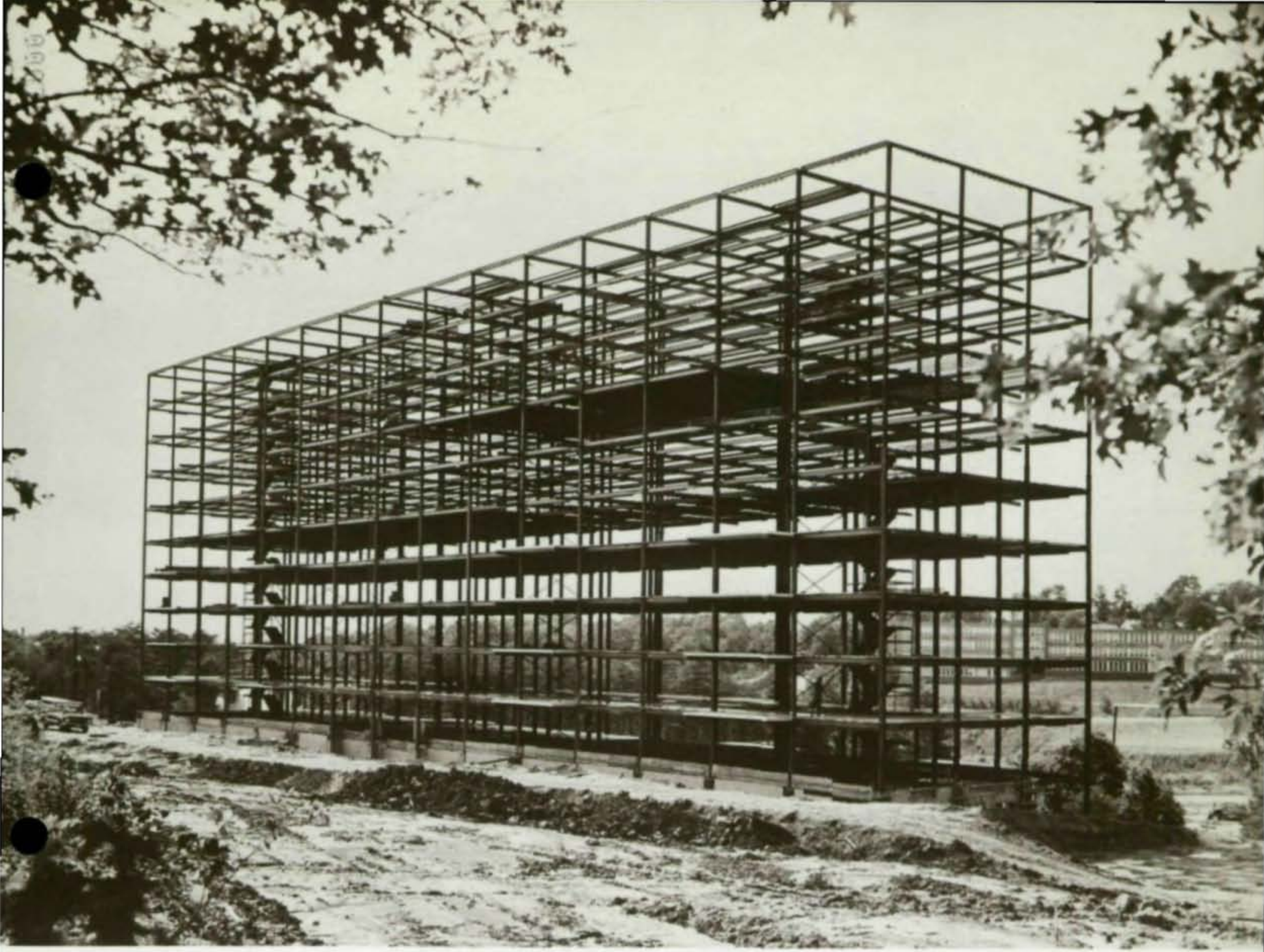
During early planning stages of the project, structural engineers Horatio Allison Associates of Rockville, Md., investigated the use of the new multi-story plastic design criteria resulting from a 10-year research project at Lehigh University. They determined that through the use of plastic design, not only could a significant amount of weight be pared from the structure, with corresponding reduction in framing and foundation costs, but more efficient utilization of the site could be also achieved.

The building was originally conceived as an 8-story structure. However, by raising the height of the building to 11 stories, and reducing the number of square feet per floor, the designers maintained the amount of rentable space available and obtained considerable added surface parking space. Plastic design utilizing high-strength steels saved nearly 10 percent of the cost of conventional framing, enough to offset a premium in cost per floor due to adding the extra floors.

Plastic vs. Elastic

Plastic design of one- and two-story steel framing has proven its efficiency and economy in many structures built during the last decade. However, until completion of the Lehigh study, no definitive criteria had been established for application of the method to multi-story buildings. With elastic design (the conventional method for steel construction) the load-carrying capabilities of steel members are based on their strength in the elastic range, in which the steel is not stressed beyond the yield point. This means that beams deflect under load, but return to their original position if the load is removed. However, the maximum strength of steel beams is not actually reached until after the yield point has been exceeded. Plastic design safely utilizes this reserve strength in calculating the load-carrying ability of steel members, and results in more efficient use of the inherent strength of structural steel framing.

The behavior of buildings utilizing plastic design under service loads is essentially the same as for those designed within the elastic limit, since structural members are not actually stressed to the yield point. Even experienced sidewalk



superintendents could not see anything different in the framework of The Stevenson Apartments; it looked just the same as any other multi-story structure.

Structural Features

The building is 271 ft long and 53 ft wide. Lateral loading is resisted across the building's width by four cross-braced bays carried in partitions at each level. No bracing is required along the length of the building. The architects and engineers carefully coordinated the floor plan to fit the framework and to permit regular column spacing with no costly short or offset spans. With this arrangement, the cost of design, fabrication and detailing was held to a minimum.

The steel frame is all-welded. Beams are lighter and columns smaller than in similar elastically designed apartment structures. The typical 10WF15 floor beams would have been 10WF21 in a conventional building (a difference of 40 percent in weight). Column sizes vary from 8WF67 in the basement to 8WF24 in the roof. Columns are A36 (36,000 psi yield) and A572 (50,000 psi yield). Horizontal framing is all A36.

Cost

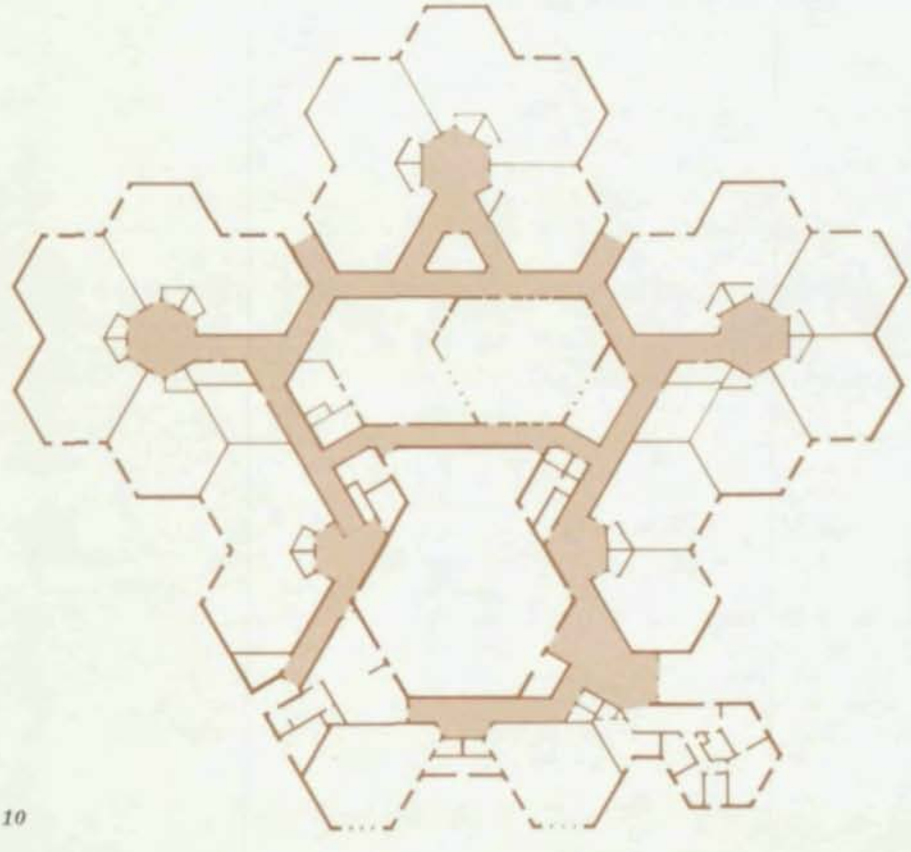
Total cost of the erected steel framework, including steel joists for the floor system, amounted to $1.17 per sq ft for the 160,000 sq ft building. The cost for the steel frame, deck, lightweight concrete topping, and a plasterboard ceiling amounted to $1.91 per sq ft, a saving of 10 percent from the $2.10 per sq ft estimated for conventional flat plate concrete construction.

The building department of Prince Georges County, Md., gave special permission to use plastic design in this structure, assured that analysis and computations were reviewed by qualified authorities. Representatives from the County Department of Inspection and Permits met with a team composed of the structural engineers and Dr. George Driscoll of Fritz Engineering Laboratory at Lehigh University, plus representatives from Bethlehem Steel Corporation and two local structural engineering firms.

The building will contain 150 one- and two-bedroom units. A basement level will contain a large recreation room, laundry and storage, plus a limited number of parking spaces. A sun deck will be located on the roof. Many apartments will have balconies. Six of the first floor apartments on the uphill side of the sloping lot will have private patios. Exterior finish will be brick, featuring light-colored recessed brick panels.

Steel Easily Frames Roof For Hexagonal School

Robert P. Lathrop, P.E. and Ciprian A. Pauroso, P.E.



The versatility of steel framing was certainly demonstrated in the unusual design of the High Hill Elementary School in Madison, Connecticut. Set high on a beautiful rolling 52 acre site, the building takes form from hexagonal classrooms arranged principally around a hexagonal multi-purpose room. Not only did the design capture the imagination of all who were involved with it, but it proved to be an ideal architectural solution for the needs of the community.

Stecker & Colavecchio, Architects, in developing the planning of the school, succeeded in designing a building that is economical, yet more aesthetically pleasing than the usual "glass and brick box". The design also permitted classrooms to be clustered according to the

Mr. Lathrop is Partner in the consulting engineering firm of Onderdonk, Lathrop, Coel of Glastonbury, Connecticut. Mr. Pauroso is AISC Regional Engineer in Hartford, Connecticut.

various pupil age levels, thus preventing the young children from being overwhelmed by the surrounding building.

Although the unusual shape of the building indicated that the structural design might well become complicated and indeterminate, once steel was selected as the structural medium the development of the framing became relatively simple. The roof extends to provide a canopy completely around each unit, broad enough to warrant omission of a gutter drainage system. Where each pair of classroom units abuts, the roof is oriented to provide maximum overhang, the roof girders cantilevering 21 ft. This arrangement results in a covered out-of-doors play area.

Exposed wood was first considered for the roof structural system, but was discarded when required sizes for the large cantilevers became impractical. Steel easily and economically handled the cantilevers with minimum beam depths. Originally an exposed steel system with precast insulating plank was considered, but cost studies indicated it was just as economical and more attractive to use metal deck and hung ceilings.

The weight of framing steel averages less than 8 lbs/sq ft of roof area, despite the pyramidal forms and long spans involved. At each hip, girders were designed to cantilever over the exterior columns, supporting the extensive canopy areas over the outside sheltered play areas, and tapered to give a lighter and more airy feeling for these spaces. Additional sub-girders were used where necessary to ensure that the purlins were no deeper than 10 in. (an architectural consideration.) All purlins were circumferential in layout and hence horizontal.

Fabrication of the steel was rapid, with a minimum of shop problems. The tapered girders were formed from 16WF58 rolled sections. By cutting the webs diagonally, reversing the top and bottom halves and rewelding the webs, the desired taper was achieved. All secondary framing connections were standard, in most cases one-sided. Skewed connections were made with bent plates.

Butt-end plate moment connections were used wherever continuity of beams was required through girders. This type of connection was particularly efficient and attractive at the exposed roof overhang around the multi-purpose room.

Considering the shape of the building, construction was accomplished with remarkable ease. Careful detailing by the architects and engineers, good advance planning by the General Contractor, and erection by the steel fabricator certainly were responsible for this. Only 10 months elapsed from ground-breaking to occupancy of the school. Complete steel erection required two weeks.

The 19 classrooms, two kindergartens, offices, library and multi-purpose room add up to an area of 38,522 sq ft with a pupil capacity of 670. The square foot cost of $16.91 compares favorably with other elementary schools, but more important, the $930 pupil cost was 13 percent less than the state average of $1,069 for elementary schools built in the period. The hexagonal shape contributed to the efficient use of space and structural steel was able to frame the roof economically.

Architects: Stecker & Colavecchio, Hartford, Connecticut.
Structural Engineers: Onderdonk, Lathrop, Coel, Glastonbury, Connecticut.
General Contractor: Pieretti Construction Company, Essex, Connecticut
Steel Fabricator: Connecticut Steel Co., New Haven, Connecticut.

INSTEAD OF A BILLBOARD

Architects and engineers have long recognized the inherent design flexibility of structural steel, and the freedom of design it makes possible. Despite this, designers often channel steel construction into narrow concepts of beam and column framing, then hasten to hide the steel behind a variety of screens and facades.

Increasingly, however, imaginative designers are turning to exposed structural steel for unusual and aesthetic effects, not only in buildings, but also in special constructions. Pictured here is one recent example of imaginative, creative design in steel.

• • •

Symbol of a 500 acre industrial park in South San Francisco, California, is a 92-ft high steel sculpture that has become a new landmark on the western shore of San Francisco Bay, and has drawn national and local praise for the developer, Cabot, Cabot and Forbes.

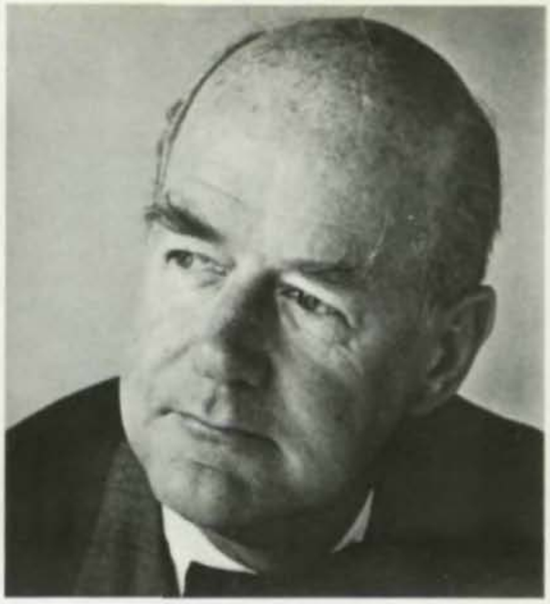
At night, 8 million foot-candles of floodlighting illuminate the monumental, 67-ton sculpture, producing a startlingly delicate effect despite the massiveness of the structural steel elements.

The abstract sculpture, created by Aristedes Demetrios of San Francisco, was commissioned by the developer in conjunction with Bethlehem Steel Corp.

Pietro Belluschi, Dean Emeritus of the School of Architecture and Planning at Massachusetts Institute of Technology, who served on an advisory panel working with the artist, praised the sponsoring developers: "Instead of consigning their prime hilltop space to a huge billboard, they chose to commission a major work of art and made it their statement and their identification."

Sculptor Demetrios describes the shape as "a strong link to one of the bay area's most common cultural experiences – the bridge."

ARCHITECTURE AND REGIMENTATION



by David N. Yerkes, FAIA

Mr. Yerkes is a partner in the firm of Deigert and Yerkes and Associates, Architects, Washington, D.C. and is Director, Middle Atlantic Region, AIA.

Several months ago I was a member of a Jury that met in New York to select the winners of the AISC Architectural Awards of Excellence for 1967. Looking again at the photographs of the winners several months later, I am impressed by the fact that they are a very workmanlike and competent group of buildings. I use those adjectives without implying either praise or criticism, because they describe a quality which most of these buildings share. These are not the intensely personal and dramatic efforts of strong individualists; nor are they routine products, mechanically turned out by architects who were uninterested in design. They are the work of skillful and conscientious designers, using the vocabulary that is commonly accepted at this point in architectural history, attempting to solve practical problems, seriously concerned about the aesthetic quality of their buildings.

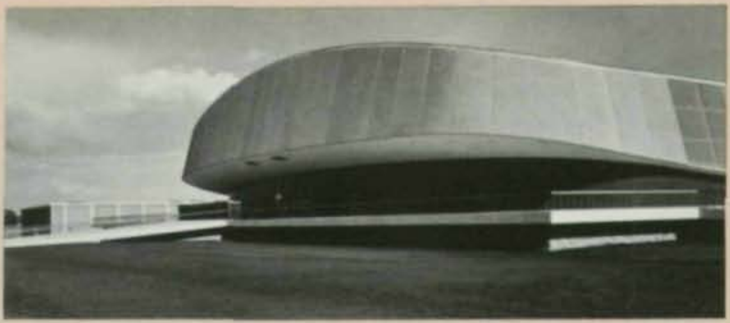
We hear scathing comments about architects designing buildings as "monuments to themselves". What is usually referred to is a building which is, or attempts to be, strongly individualistic, conspicuously outside the main stream of contemporary architecture. Some of these "monuments" are blatant efforts to attract attention. They are advertising, with no claim to serous consideration as architecture. But others are the work of thoughtful and gifted designers who are genuinely creative. Creativity is almost synonymous with originality, and the buildings of the truly creative architect are likely to be different, unusual, arresting.

I hope the conditions of an increasingly mechanized and regimented society will not mean that the door is closed to this sort of creative individualism. I think there is a real risk that this will happen. Powerful forces are constantly pushing us in the direction of increased standardization. But if we permit this process to destroy the uniqueness of the individual, we are accepting the fact that the machine has mastered us, instead of the reverse. Whether life will be worth living in the sort of society which is the logical conclusion of this process is certainly a matter for doubt.

I hold no brief for the exhibitionists and opportunists in the architectural profession who are out to catch the public eye at any price. But I uphold the value of genuine creativity as one of the most precious qualities any individual, or any society, can have. To encourage it involves some risks and requires courage. I hope that our society will continue to produce individuals — both architects and clients — who are sufficiently daring and perceptive to recognize real creative power and cherish it.

Since this creative power, at least at full strength, is such a rare quality, it is not surprising that the buildings submitted for AISC Architectural Awards of Excellence showed it only in diluted form — at least in my judgment. On the other hand, the fact that many of the submissions represent such a high degree of competence, ingenuity, and sound aesthetic judgment, is a matter for real satisfaction.

1967 ARCHITECTURAL AWARDS OF EXCELLENCE

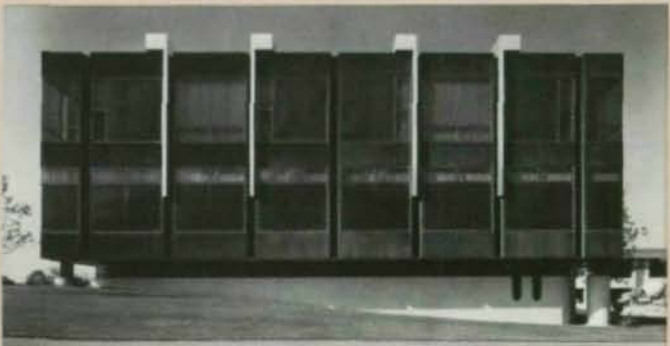


AUDITORIUM-GYMNASIUM, Colorado State University, Fort Collins, Colorado
Architect: Bunts and Kelsey – Architects

WASHINGTON & LEE HIGH SCHOOL GYMNASIUM, Montross, Virginia
Architect: Stevenson Flemer, Eason Cross, Harry Adreon, Associated Architects

FOREST HOME BRANCH LIBRARY, Milwaukee, Wisconsin
Architect: von Grossmann, Burroughs and Van Lanen, Architects, Inc.

WHITESBORO SENIOR HIGH SCHOOL, Whitesboro, New York
Architect: The Perkins & Will Partnership and Frank C. Delle Cese



LOUTIT HALL OF SCIENCE, Grand Valley State College, Allendale, Michigan
Architect: Meathe, Kessler and Associates, Inc.

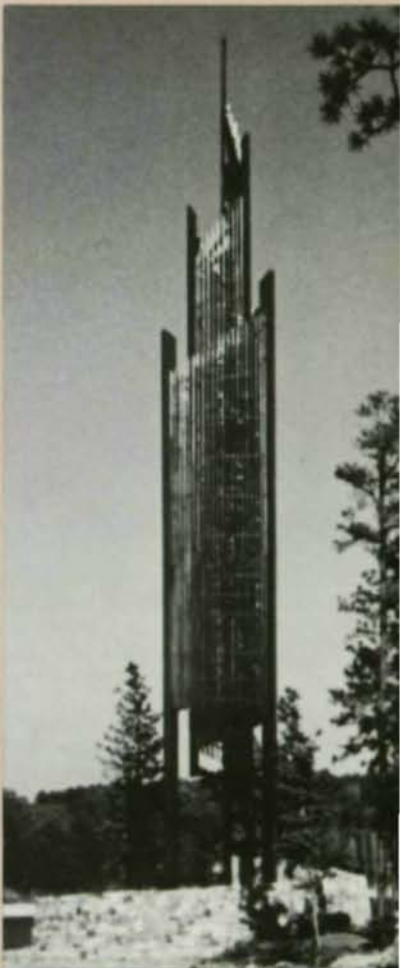
WESTCHESTER TUBERCULOSIS AND PUBLIC HEALTH ASSOCIATION OFFICE BUILDING, White Plains, New York
Architect: Joseph A. Roth, AIA

HEALTH SCIENCES INSTRUCTION AND RESEARCH BUILDING, San Francisco, California
Architect: Reid, Rockwell, Banwell and Tarics, Architects and Engineers

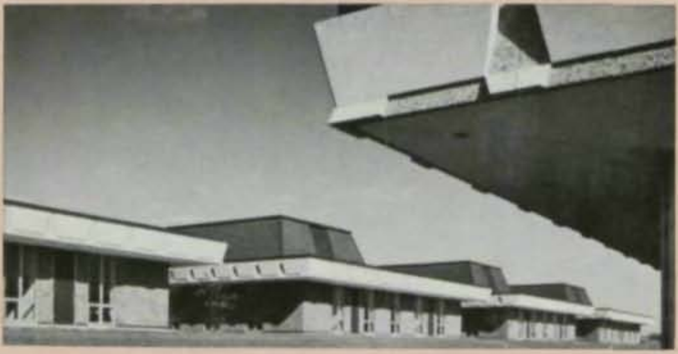
FORD MOTOR CREDIT COMPANY BUILDING, Dearborn, Michigan
Architect: Skidmore, Owings & Merrill

PARTS DEPOT, FORD MOTOR COMPANY, Richmond, California
Architect: Volkmann & Stockwell

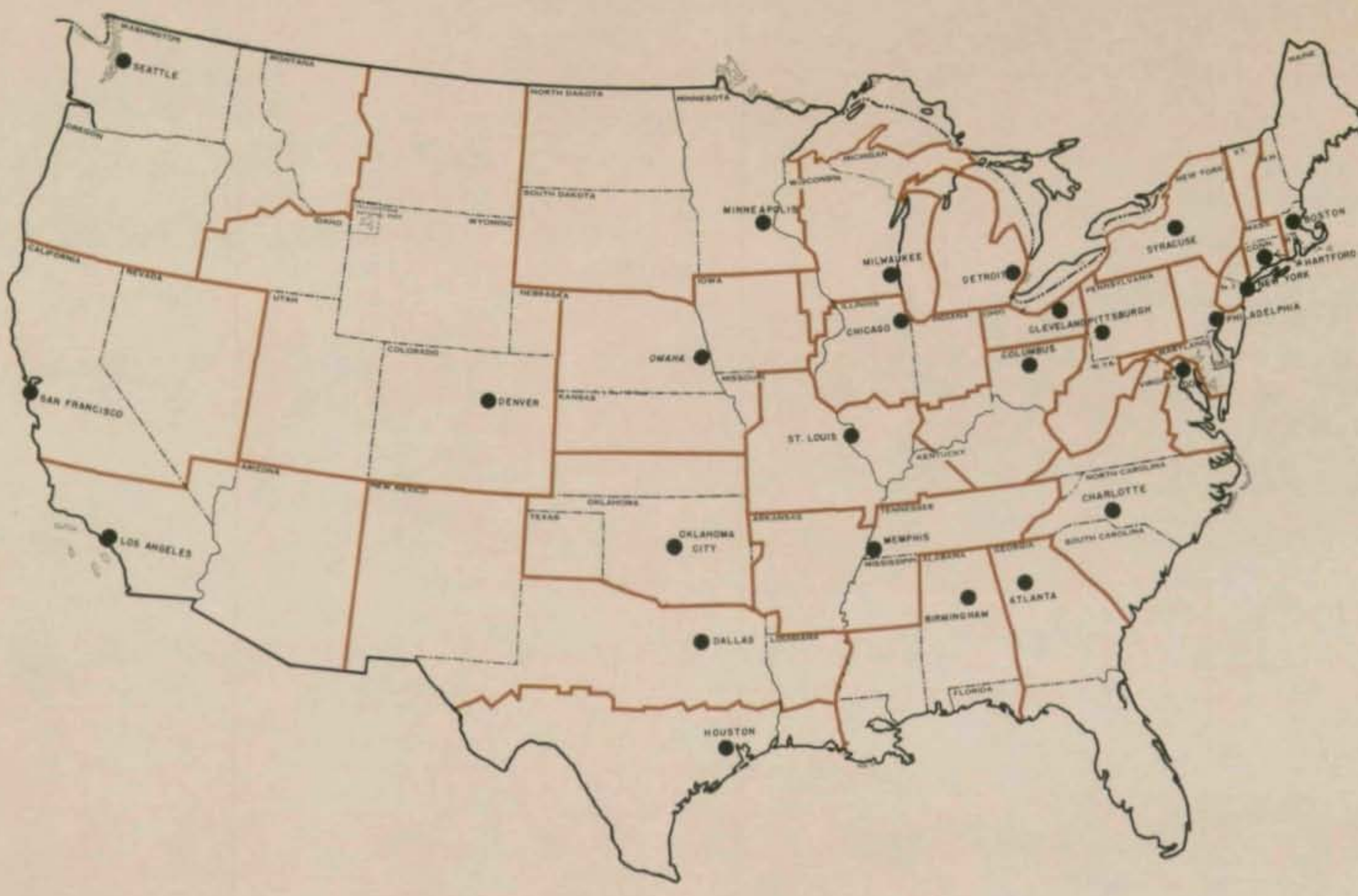
CARILLON, Stone Mountain, Georgia
Architect: Robert and Company Associates



CHARLES F. READ ZONE CENTER BUILDING, Chicago, Illinois
Architect: E. Todd Wheeler and The Perkins & Will Partnership



ESCO CORPORATION ADMINISTRATION BUILDING, Portland, Oregon
Architect: Wolff-Zimmer-Gunsul-Frasca



AISC REGIONAL ENGINEERING STAFF

Pacific Coast Area

LOS ANGELES, CALIF. 90015
714 W. Olympic Blvd.
Charles M. Corbit, *Senior Regional Engineer*
James W. Marsh, *Regional Engineer—Supervising*

SAN FRANCISCO, CALIF. 94111—*420 Market St.*
Howard A. Schirmer, *Regional Engineer*

SEATTLE, WASH. 98104—*1307 Dexter Horton Bldg.*
Elmer E. Gunnette, *Senior Regional Engineer*

Midwestern Area

CHICAGO, ILL. 60603—*176 W. Adams St.*
William T. Wishart, *Senior Regional Engineer*
William Baugher, *Regional Engineer*

DENVER, COLO. 80223—*212 Engineers Bldg.—*
1380 S. Santa Fe Drive
Daniel R. Dunlap, *Regional Engineer*

MILWAUKEE, WISC. 53211—*4465 N. Oakland Ave.*
Willard H. Hart, *Senior Regional Engineer*

MINNEAPOLIS, MINN. 55402—*2507 Foshay Tower*
Lawrence A. Kloiber, *Regional Engineer*

OMAHA, NEB. 68102—*City National Bank Bldg.*
Jack A. Donnelly, *Regional Engineer*

ST. LOUIS, MO. 63105—*230 S. Bemiston Ave.*
Clyde R. Guder, *Regional Engineer*

Southwestern Area

DALLAS, TEXAS 75235—*6434 Maple Ave.*
Frederick S. Adams, *Senior Regional Engineer*

HOUSTON, TEXAS 77002—*Century Bldg.*
2120 Travis St.
V. Dale Lane, *Regional Engineer*

OKLAHOMA CITY, OKLA. 73118
4412 N. Western Ave.
Floyd E. Hensley, *Regional Engineer*

Eastern Central Area

CLEVELAND, OHIO 44113—*Standard Bldg.*
1370 Ontario Street
William C. Keene, *Regional Engineer*

COLUMBUS, OHIO 43214—*4601 N. High St.*
Hayward H. Dick, *Regional Engineer*

DETROIT, MICH. 48226—*980 Penobscot Bldg.—*
645 Griswold
Henry G. Lembeck, Jr., *Regional Engineer*

PHILADELPHIA, PA. 19103—*1617 John F. Kennedy Blvd*
Henry J. Stetina, *Senior Regional Engineer*
David T. Evans, *Regional Engineer*

PITTSBURGH, PA. 15219—*Union Trust Bldg.*
Gabriel M. Bove, *Regional Engineer*

Southeastern Area

ATLANTA, GA. 30305—*3071 Peachtree Rd., N.E.*
Joseph R. Warlick, Jr., *Regional Engineer*

BIRMINGHAM, ALA. 35205—*1200 South 20th Street*
Robert J. Schaffhausen, *Regional Engineer*

CHARLOTTE, N. C. 28203—*P.O. Box 3186*
1409 East Boulevard
R. Gene Ellis, *Regional Engineer*

MEMPHIS, TENN. 38111—*The Century Bldg.—*
3294 Poplar Avenue
Robert W. Green, *Regional Engineer*

WASHINGTON, D. C. 20006—*815 17th St. N.W.*
John Soule, *Senior Regional Engineer*

Northeastern Area

BOSTON, MASS. 02108—*11 Beacon St.*
Frank W. Stockwell, Jr., *Regional Engineer*

NEW YORK, N. Y. 10017—*101 Park Ave.*
Robert J. Beiner, *Regional Engineer—Supervising*
Fred De Falco, *Regional Engineer*
Samuel H. Marcus, *Regional Engineer*
Frederick J. Palmer, *Regional Engineer*

SYRACUSE, N. Y. 13203—*530 Oak St.*
Donald L. Murdock, *Regional Engineer*

WEST HARTFORD, CONN. 06107—*The Clark Bldg.—*
968 Farmington Avenue
Ciprian A. Pauroso, *Regional Engineer*