VOLUME VIII / NUMBER 3 / THIRD QUARTER 1968



# MODERN STEEL CONSTRUCTION

1



2

3

# MODERN STEEL CONSTRUCTION

Published by

**American Institute of Steel Construction**

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





VOLUME VIII / NUMBER 3 / THIRD QUARTER 1968


## CONTENTS



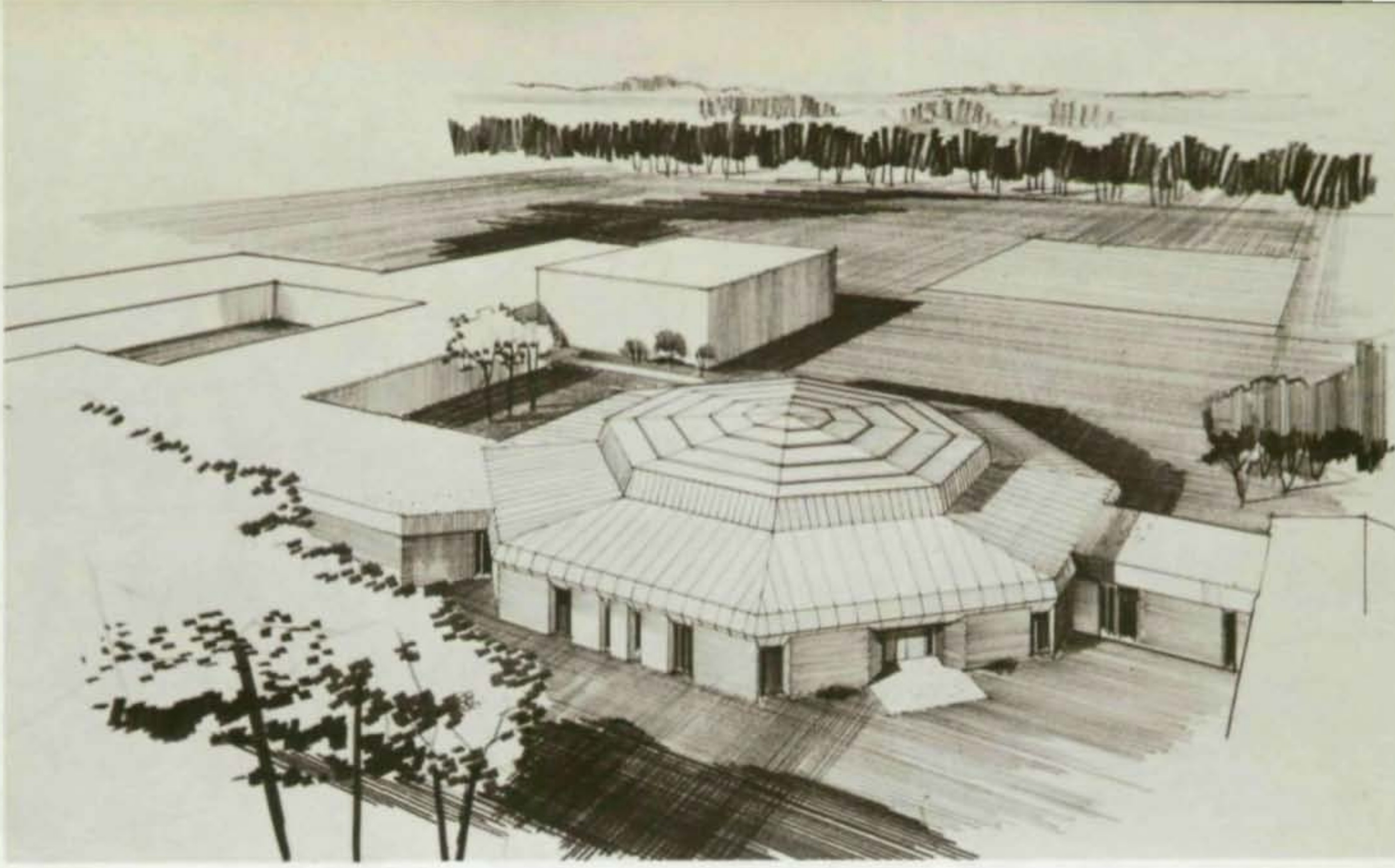
## PLASTIC DESIGN OF BRACED MULTISTORY STEEL FRAMES

*A new 111-page design manual titled "Plastic Design of Braced Multistory Steel Frames" has just been published and is available. The new book is a practical guide for the practicing engineer, and will lead to faster, easier design and more economical high rise steel-framed buildings.*

*Published by the Committee on Structural Steel Producers and the Committee of Steel Plate Producers of AISI, the new manual is being distributed by AISC. Price is $6.00 per copy.*

*To help acquaint practicing engineers with the new design provisions and their use, the AISC Regional Engineering Staff will conduct a series of lectures in 45 cities throughout the U. S. beginning this fall. The lectures will be sponsored jointly by AISC and the American Iron and Steel Institute, in cooperation with the American Society of Civil Engineers. Each program will consist of five 2-hour lectures given by top engineering educators from leading colleges and universities. Details of applying plastic design in everyday practice will be emphasized. The complete design of a 24-story, 3-bay apartment house frame will be explained during the lectures. The fee for attending these lectures is $10 per person, and each attendee will receive a copy of the new design manual, which will be used as a reference throughout the program.*

*Order forms and further information about the new multistory plastic design manual are available from AISC, 101 Park Avenue, N. Y., N. Y. 10017. Information about the lecture series scheduled for your area may be obtained from AISC in New York or your local AISC Regional Engineer.*

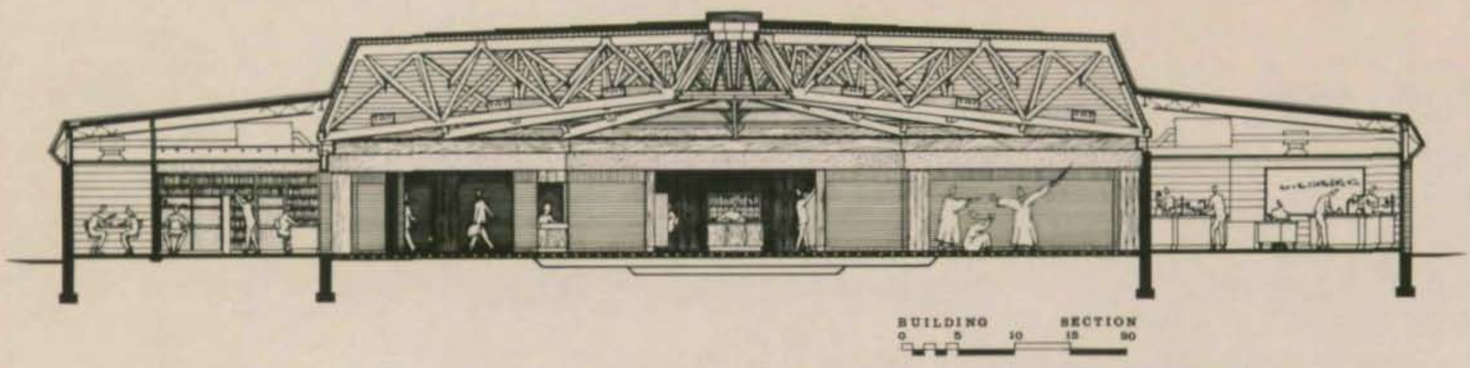


# THE LEARNING CENTER FOR THE DETROIT COUNTRY DAY SCHOOL

"We seek to develop intellectual and social maturity through individual responsibility." This is the educational philosophy offered by the Headmaster of the Detroit Country Day School. Faced with limits on funds and space, the challenge academic became the challenge architectural to Smith & Smith Associates in designing the school's new Learning Center.

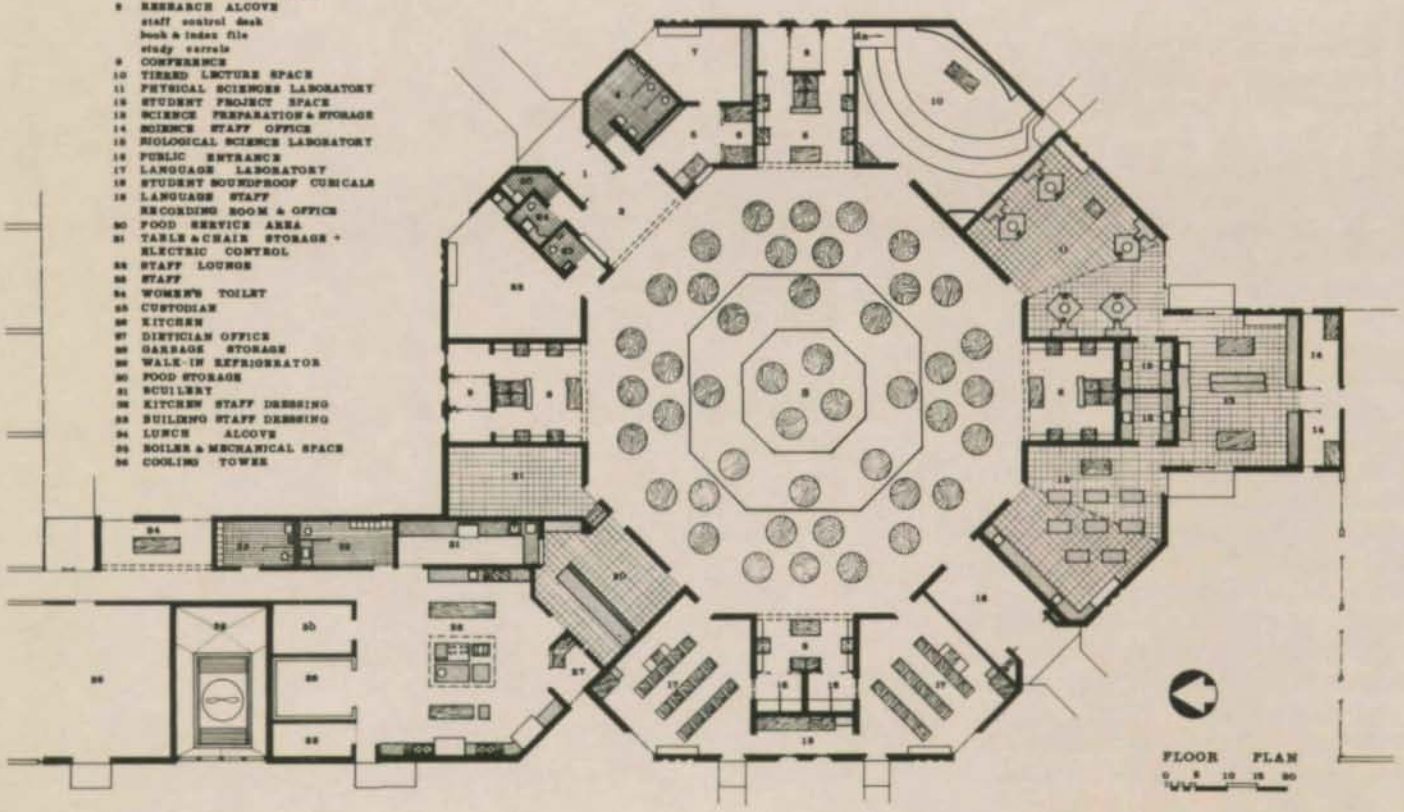
A central octagonal research-study space was the key to providing an area for student and faculty interplay encompassing a variety of related functions, with the emphasis on independent study, self-initiative and diversification in the program. This central space provides a comfortable environment for a combined research-study area, dining room, large group instruction space and drama activities. To achieve complete utilization of the floor area, the plan is organized without corridors or interior columns. All circulation from room to room is achieved through the central space by carefully planned arrangement of furniture and equipment.

Classes are grouped about the central space. Those courses that require special student attention are adjacent to the necessary study and research facilities. These include biological and physical sciences laboratories, a tiered lecture room and two language labora-



BUILDING SECTION

1 STUNDENT ENTRANCE
2 ENTRY ALCOVE & DISPLAY
3 MULTI-PURPOSE SPACE
dining
study
library
dramatics
assembly
4 MEN'S TOILET
5 LIBRARIAN STATION
6 TYPING ROOM
7 LIBRARY WORK SPACE
8 RESEARCH ALCOVE
staff control desk
book & index file
study carrels
9 CONFERENCE
10 TIERED LECTURE SPACE
11 PHYSICAL SCIENCES LABORATORY
12 STUDENT PROJECT SPACE
13 SCIENCE PREPARATION & STORAGE
14 SCIENCE STAFF OFFICE
15 BIOLOGICAL SCIENCE LABORATORY
16 PUBLIC ENTRANCE
17 LANGUAGE LABORATORY
18 STUDENT SOUNDPROOF CUBICALS
19 LANGUAGE STAFF
RECORDING ROOM & OFFICE
20 FOOD SERVICE AREA
21 TABLE & CHAIR STORAGE + ELECTRIC CONTROL
22 STAFF LOUNGE
23 STAFF
24 WOMEN'S TOILET
25 CUSTODIAN
26 KITCHEN
27 DIETICIAN OFFICE
28 GARBAGE STORAGE
29 WALK-IN REFRIGERATOR
30 FOOD STORAGE
31 SCUILLERY
32 KITCHEN STAFF DRESSING
33 BUILDING STAFF DRESSING
34 LUNCH ALCOVE
35 BOILER & MECHANICAL SPACE
36 COOLING TOWER



FLOOR PLAN

*Tubular steel "V" trusses span the 72-ft octagonal central research-study area. The three-dimensional framing has an upper compression ring and a lower tension ring at the center.*

tories connected by a soundproof faculty work area. Adjacent to the main student entry are a faculty meeting room, library preparation areas and lavatories. A public entrance, diagonal to the students' approach, is used for occasions when the community attends special dramatic performances by the children or for PTA activities. The connecting link between the Learning Center and the main school building houses the mechanical plant and a modern kitchen. This kitchen serves over 300 meals per sitting to students in the Learning Center as well as those in the existing building.

A built-in "theatre in the round" for theatrical and group discussions comprises the center of the large space, where a sunken area of two octagonal steps is provided. The steps are placed far enough apart so that tables and chairs may be set up between them for dining, study, or audience seating. The entire floor area is carpeted for this purpose as well as for acoustic control.

Research alcoves with student study carrels, soundproof listening booths, microfilm stations, and book stacks are readily available and accessible to the students and staff in the central area. Each research alcove contains those volumes related to a specific discipline. Consolidation of the student project areas, conference rooms and language booths promotes an inter-relationship of disciplines.

### Structural Solution

One of the major design challenges, according to the architects, was "to span the central space with a structural system that would express the basic educational philosophy of the school, yet respect the economic limitations imposed by private fund raising campaigns." The architects found an economical structural solution that would create the light, intimate, yet dynamic space desired by developing a unique radial "V" type truss based on the octagonal geometry of the plan. Only with steel tube could the delicate web-like structure be economically achieved. All joints were welded, with no rivets, bolts or plates to break the visual continuity of movement around the space or to disturb the impression of structural unity across the 72-ft span of the octagon. To intensify the intimacy of space, the bottom of the steel was held at 10 ft above the floor. At the perimeter supports, the three dimensional truss is approximately 9 ft deep. The top and bottom chords converge toward the center where the depth is approximately 5 ft-6 in. and the bottom of steel is 14 ft-2 in. above the depressed seating area of the floor. The visual pattern of steel members creates a constantly changing modulation of space through the central area without being a heavy dominant mass overhead.

The entire roof frame was fabricated from A36 steel tubing. The structure is composed of 16 lower chord and 16 upper chord tubes, each 6 x 4 x 3/16-in. These are connected by 3 x 2 x 3/16-in. web members. Due to the taper of the truss sections in both plan and section, the system of web members generates a three dimensional compound plane, rather than a simple plane. The truss was designed as a continuous member, using a compression ring at the center top chord and a tension ring at the center bottom chord.

The octagonal compression ring is the smaller one, composed of 8 x 3¼ x ¼-in. tubing with ½-in. plates on each side.

The tension ring is composed of 2 octagons, one upon the other, but rotated in plan to pick up a lower chord member at each of the 16 corners thus formed. The tension rings are made up of 4 x 3 x ⅜-in. tubes. The central "cone" of steel formed by the compression and tension rings, with special accent lighting, provides a dramatic effect over the depressed seating area of the floor. All general lighting for the central space is concealed in three concentric octagonal wood "rings" which parallel the walls of the room and rest upon the bottom chords of the roof trusses, and thread their way through the web members. The rooms surrounding the central octagonal space were framed with standard steel joist and deck. The exterior was most simply and economically handled with concrete block and plywood.

**Fabrication and Erection**

The "V" trusses were shop fabricated in eight sections. Each section consisted of two bottom chord members, one upper chord member, and their connecting web members, all jig positioned for welding. Special "wrap around" cardboard templates were developed to speed up and control fabrication of the compound bevels required at the end of each web member. Four web members converge at each typical upper and lower chord "panel point." Each truss section was 36 ft long, tapered in width from 15 ft-0 in. to 1 ft-10 in., and sloped from 8-ft-5 in. to 5 ft-6 in. in height. The assembled truss sections were trucked to the site, under provisions of a special road permit. The intermediate top chord and web members were shipped loose for field welding. Tolerance on each piece was held to plus or minus 1/16-in.

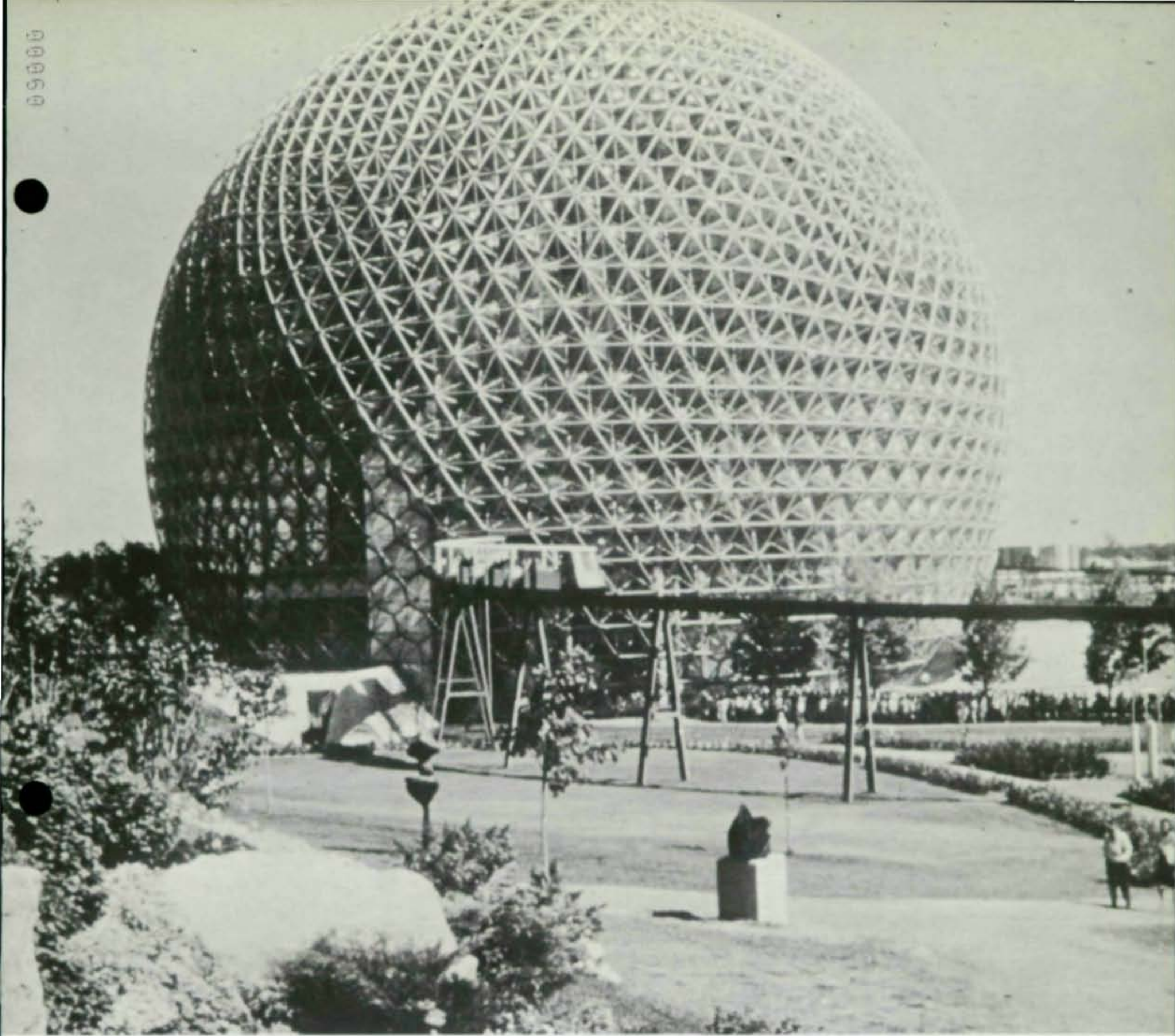
A temporary welded steel tower supported the central compression and tension rings during erection. Each of the eight truss sections were lifted over the lower surrounding roof in an alternating pattern. All shop welding and field welding of loose members was done with low-hydrogen rod. The temporary tower was left in place until all superimposed loads were applied.

There was a total initial deflection of approximately ½-in. No further deflection has occurred, even under unbalanced snow loading. All critical welds were X-ray examined before removal of tower supports.

**Architect:** Smith & Smith Associates
Royal Oak, Michigan

**Structural Engineer:** Harold R. Wright
Livonia, Michigan

**General Contractor:**
Waterford Construction Co.
Pontiac, Michigan



United States Pavilion, EXPO '67, Montreal, Canada

# SPECIAL AWARD FOR EXCELLENCE

The United States Pavilion at EXPO '67 has been named by AISC for a Special Award of Excellence as "an outstanding achievement in technology and aesthetics." In honoring the Pavilion, the AISC Board of Directors paid tribute to the imagination and skill of the men who conceived, designed, and built this unique and exciting structure.

**Architects:** R. Buckminster Fuller, Fuller and Sadao, Inc. and Geometrics, Inc., Cambridge, Massachusetts; George F. Eber (Canadian Associate Architect) Toronto, Canada

**Structural Engineer:** Simpson, Gumpertz and Heger, Inc. Cambridge, Massachusetts

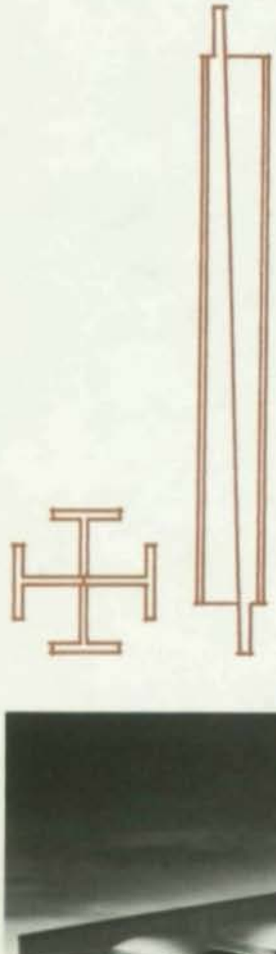
**General Contractor:** George A. Fuller Company, Dallas, Texas

**Steel Fabricators:** Bliss Portland, South Portland, Maine; Atlantic Steel Castings Company Chester, Pennsylvania

**Owner:** United States Information Agency, Washington, D. C.

# Tapered Columns Express the Structure

*The semicircular stair at the entry is designed with steel box stringers, requires no intermediate support between floors.*



*Each tapered column section is made up of four identical tee sections welded stem to stem. The tees were cut from 12WF27 sections, as illustrated.*

The Stark Office Building is a 6000 sq ft, two-story structure in Oakland, Michigan, located on a 125-ft square site fronting on the service drive of a major freeway. The owners, a food brokerage company, occupy the ground floor. The second floor, planned as future growth space for the owners, is presently leased by the architects. The owners desired that the building, though surrounded by larger rental office structures, be recognizable as a distinguished image of their company.

The building rests on a 2-ft high brick-walled base. This podium, to be covered with marble chips, contains five 8-ft diameter saucers. Four are to be planted with flowers, the fifth is a fountain. The glass enclosed entry is accessible from both the street and the parking lot behind the building. Street and parking lot elevations are identical.

The fourteen free-standing columns which support the second floor and roof are primary to the design concept. They were designed in steel to economically achieve the desired shape and lightness and to express the steel-frame nature of the building. The tapered column section was made up of four identical tee sections, welded stem to stem. Each tee was cut from a standard 12WF27. By cutting the web of the WF section on a slight diagonal, tapering of the tees was achieved without waste of steel. The flanges of the columns were eliminated at top and bottom, forming simple X sections where they intersect the roof and base.

Another important design feature is the semicircular stairway in the entry. Conceived, like the columns, as a sculptural as well as functional element, it springs from first to second floor without auxiliary support. The exposed box stringers are made up of ½-in. steel plates. Covered with an orange-red carpet, the stairway is visible from the street as well as the parking lot.

**Architects:** Volk & London Architects, Inc.
Southfield, Michigan
**Structural Engineer:**
Ray W. Covey Associates, Inc.
Detroit, Michigan
**General Contractor:** Muzzin & Vincenti, Inc.
Allen Park, Michigan

# Home is where the h-p is

A radical departure from the "conventional" in residential construction, the home of Mr. & Mrs. C. W. Tarkington is fast becoming a tourist attraction in Hayward, California. Travelers on nearby streets and highways, seeing a soaring roof with a "twist" in it, regularly change course to "find out what it is."

What they find is a unique hyperbolic-paraboloid house, built of steel, that is as attractive as it is unusual.

The 2,500 sq ft roof is supported only at two low points 66.5 ft apart, where it is welded to steel plates anchored to 24-in. diameter concrete abutments. Light steel framing for the exterior walls, although not load-bearing, acts to stabilize the roof.

The h-p roof is constructed of two layers of 24-ga. galvanized steel decking, laid at right angles to each other, then plug-welded together. Edge beams are 6WF15.5 steel members. Fiberglass and asphalt emulsion with a color coat are sprayed on the exterior as a final coating. The underside of the roof, unpainted, serves as the interior ceiling.

According to Oakland designer N. Kent Linn, "the design and building materials simplified the engineering problems and achieved considerable reduction of dead loads. The result was fast and easy construction, plus reduced costs."

"Because of the clear span roof," Linn points out, "all interior walls are non-load-bearing. They do not touch the curved ceiling. This permits a truly open plan. The walls only separate and define different functions of living."

The unique home has one bedroom upstairs and a guest room downstairs. Entry to the main floor is via a curved ramp spanning a reflecting pool. The 1,400 sq ft of living space includes a raised steel fireplace, backed by a steel spiral staircase which connects the two floors. A 2-car garage-carport provides an additional 550 sq ft; and a storage area, below the house, utilizes a portion of the roof as an exterior terrace for the upper floor. The interior features rough-sawn panels of wood, left unpainted, to contrast with the steel.

This economical hyperbolic-parabaloid roof is anchored at two low points 66.5 ft apart. Two layers of steel decking, laid at right angles and plug-welded together, are framed with steel edge beams to form the basic roof structure.

# Architectural EXPRESSION IN STEEL

by H. Samuel Krusé, FAIA

Mr. Krusé is a partner in the firm of Watson, Deutschman & Krusé, Architects and Engineers, Miami, Florida and is Director, Florida Region, AIA.

As a member of the jury that met in New York to select AISC Architectural Awards of Excellence 1968, I was given an opportunity to see how architects from all the nation use steel in the design of their projects. The practitioner, such as I am, is exposed rarely to so broad a representation of the buildings by other designers employing steel construction — or any other construction as a matter of fact. I found the experience personally rewarding and particularly satisfying, for I believe architects are well on the way to developing an exceptionally fine vernacular in steel.

It took architects thousands of years of innovation, experimentation and refinement before the highest order of architectural expression unique to stone technology was achieved. Yet this was a comparatively simple technology, easily adaptable to a variety of expressions through honest statements of structure.

It is surprising that our more complex technology, involving the balance of tensile and compressive forces and the use of manmade materials in new and provocative ways, should find sophisticated architectural expression in such a short time. The entries for the AISC Architectural Awards attested to the mature skill and attention to detail exercised by designers today. There was evidence of consensus. The vocabulary was the same for similar functions, but the statements were varied and crystal clear. The vernacular was that used for steel columns, steel beams, and trusses; the statements were the creations of conscientious designers giving quality, honesty and beauty to the words.

Most of the buildings submitted for judgment were of the exposed steel variety. Some that received awards concealed their steel construction, but did not conceal the fact that they had steel bones covered with flesh. The Minges Coliseum was one such building, showing clearly the two-way truss system and framing for a large clear-span sports arena.

But the majority of the designers preferred the expression provided by a simple framing system of unadorned steel, meticulously detailed. It was this expression which seemed to excite the jury most, and for good reasons. There seemed to be no limit to its application to large and small projects. A variety of forms and details adaptable to many building uses articulate sophistication all too rare during our era. In this respect, one was reminded of the common red-brick, white-trim vernacular of late eighteenth century Georgian architecture that provided aesthetic satisfaction by the designers' skillful articulation of a vocabulary universally understood.

Some of the architects preferred to use the patina of oxidation as the finish of the exposed steel members, exploiting a recently developed metallurgy. Generally, the finish was painted steel using a variety of coatings. Both finishes seemed appropriate for the broad spectrum of building types for which the exposed steel system of construction was chosen.

The quality of the work for AISC Architectural Awards of Excellence indicated the high level of design competence in the general practice of architecture today. Few of the submissions were the designs of award-winning architects, but the greater number were those unsung architects, who in their day-to-day practice do a commendable job of combining aesthetic sensitivity with technical competence to create satisfying designs of commodity, utility and delight.

**C. THURSTON LEARNING CENTER OF EAGLEBROOK SCHOOL,**
Deerfield, Massachusetts
Architects: The Architects Collaborative, Inc., and
Campbell, Aldrich & Nulty, (Associate Architects)

**TOPOROCK STUDIO-RESIDENCE,**
Charleston, West Virginia
Architect: Henry Elden & Associates

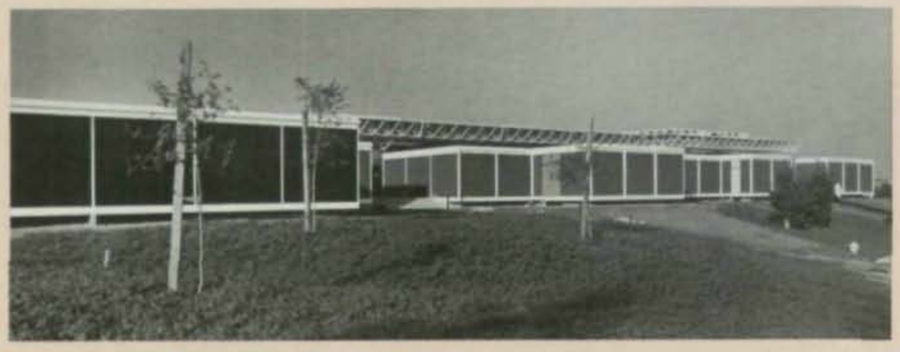
**MANUFACTURING AND RESEARCH FACILITY FOR TELEDYNE SYSTEMS COMPANY,** Northridge, California
Architect: Daniel, Mann, Johnson & Mendenhall

# 1968 ARCHITECTURAL AWARDS OF EXCELLENCE

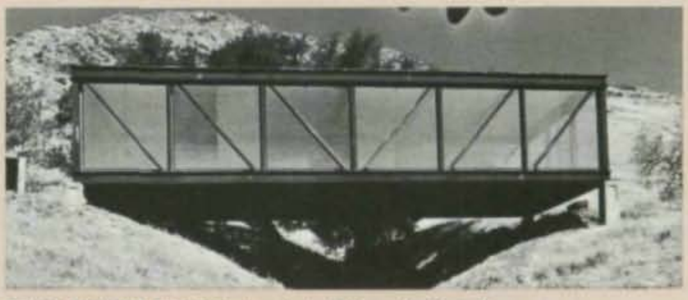
**ABRAHAM LINCOLN OASIS,** South Holland, Illinois
Architect: David Haid

**ENCLOSED ELEVATED CONCOURSE,** Saint Paul, Minnesota
Architect: Hammel, Green and Abrahamson, Inc.

**LOS ANGELES FEDERAL SAVINGS AND LOAN,** Los Angeles, California
Architect: Honnold and Rex, Architects



**SYNTEX INTERIM FACILITIES,** Palo Alto, California
Architect: Mackinlay/Winnacker & Associates

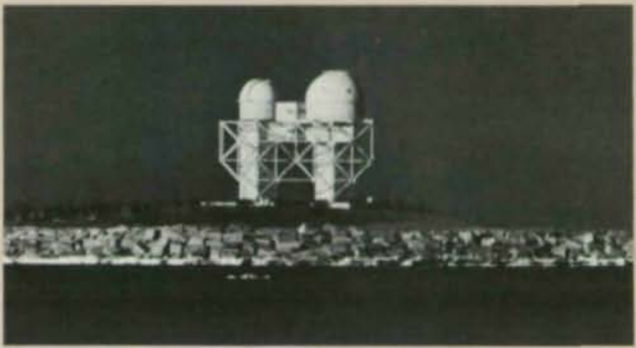


**STEEL BRIDGE STUDIO,** San Luis Obispo, California
Architects: Paul R. Neel, AIA (Advisor) and Students, School of Architecture, California State Polytechnic College

**FORD AUTOMOTIVE SAFETY CENTER,**
Dearborn, Michigan
Architect: Nordstrom-Samson Associates

**FAIRCHILD SEMICONDUCTOR HEADQUARTERS BUILDING,**
Mountain View, California
Architect: Simpson, Stratta & Associates

**ALCOA BUILDING,** San Francisco, California
Architect: Skidmore, Owings & Merrill

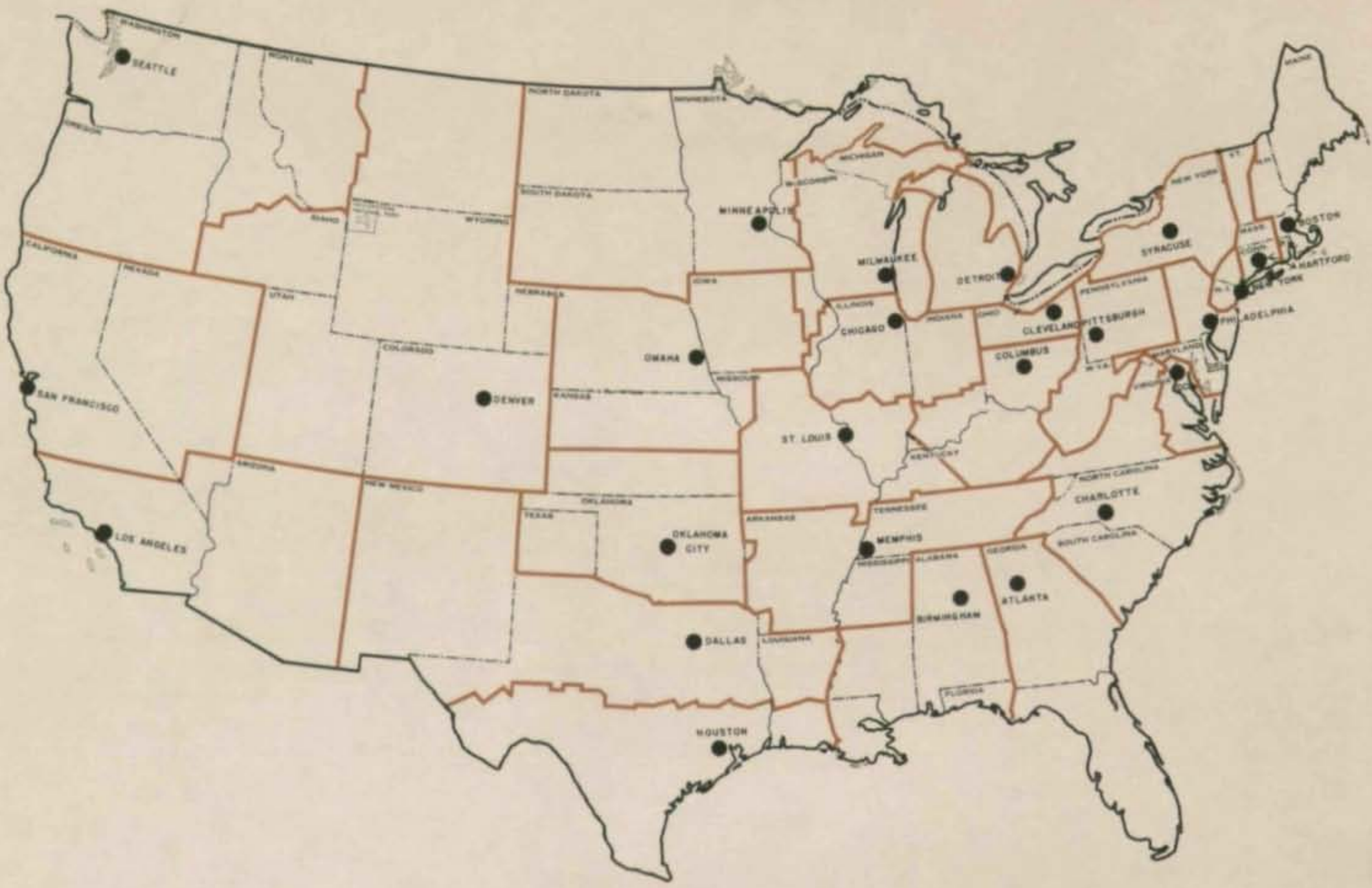


**LINDHEIMER ASTRONOMICAL RESEARCH CENTER,**
Evanston, Illinois
Architect: Skidmore, Owings & Merrill

**SUPERIOR OIL COMPANY GEOPHYSICAL LABORATORY,**
Houston, Texas
Architect: Todd-Tackett-Lacy,
Architects & Planning Consultants

**MINGES COLISEUM,** Greenville, North Carolina
Architect: F. Carter Williams

**BANK OF HOUSTON,** Houston, Texas
Architect: Wilson, Morris, Crain & Anderson




# AISC REGIONAL ENGINEERING STAFF

## Pacific Coast Area

LOS ANGELES, CALIF. 90015
*714 W. Olympic Blvd.*
James W. Marsh, *Regional Engineer—Supervising*
Edward R. Stewart, *Regional Engineer*

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*
Albert C. Nuhn, *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.*
Lewis C. Coxe, *Regional Engineer*
John Soule, *Consultant*

## Northeastern Area

BOSTON, MASS. 02116—*80 Boylston St.*
Frank W. Stockwell, Jr., *Regional Engineer*

HARTFORD, CONN. 06103—*75 Pearl St.*
Ciprian A. Pauroso, *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*