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MODERN STEEL CONSTRUCTION

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NATIONAL ENGINEERING CONFERENCE IN HOUSTON, TEXAS

The 21st annual AISC National Engineering Conference will be held on May 8 and 9, 1969 at the Shamrock Hotel in Houston, Texas. 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.

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

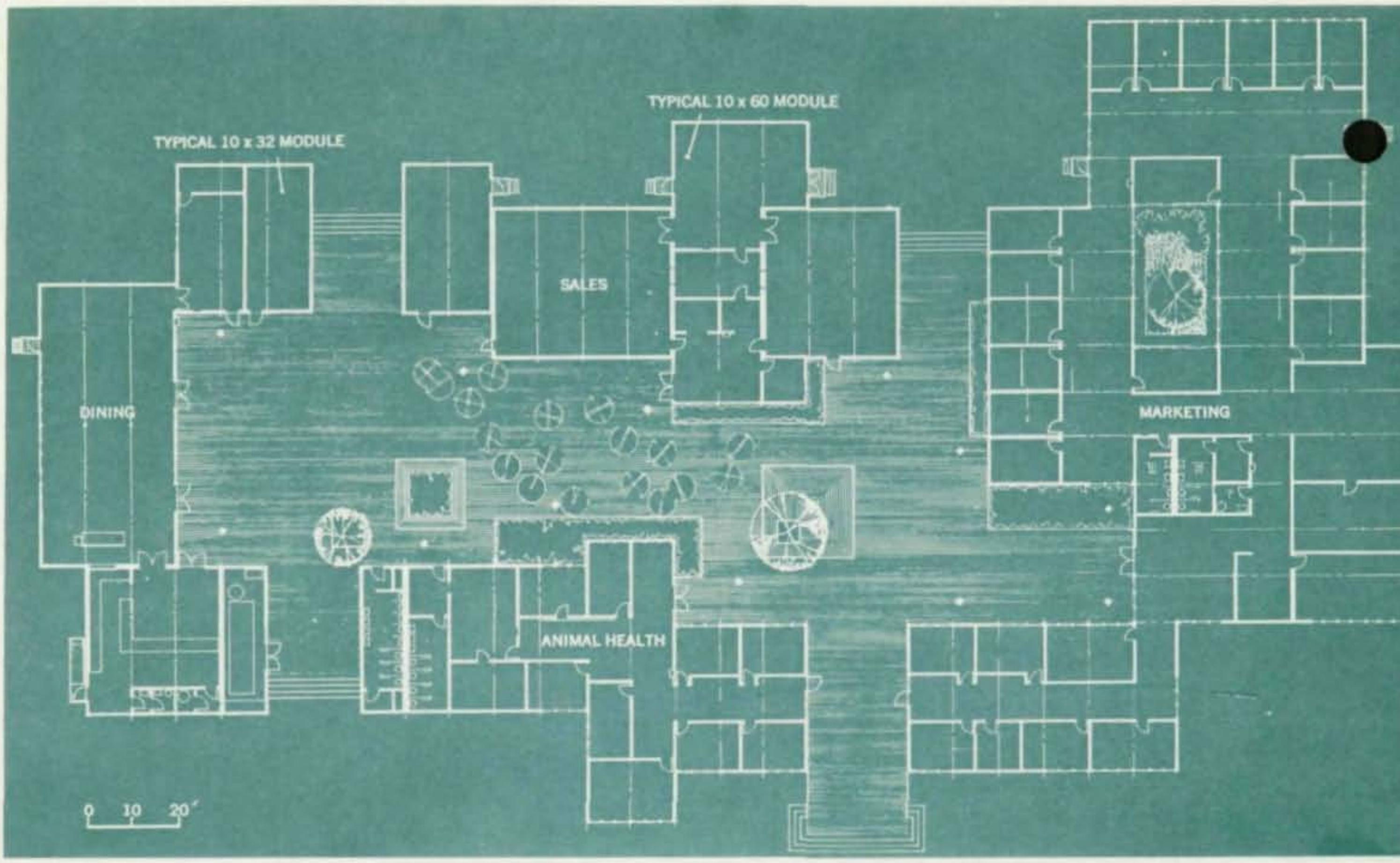
1969 FELLOWSHIP AWARDS PROGRAM

Entries are invited for AISC's Seventh Annual Fellowship Awards Program. These awards serve to encourage expertise in the creative use of fabricated structural steel.

Four $2,500 fellowship awards will be granted to senior or graduate students enrolled in a structural engineering program at an accredited engineering institution. Additionally, the head of the department where each Fellow will undertake his study will receive a further grant of $500 for unrestricted general administrative use.

Students interested should contact the Chairman of the Civil Engineering Department at their institution for Rules and Instructions for Applicants, or write directly to AISC, 101 Park Avenue, New York, N. Y. 10017 for this information.

MODULES FILL NEED FAST



When the fast growing drug firm, Syntex Laboratories, needed interim space until completion of permanent headquarters, Architects Mackinlay/Winnacker & Associates came through with an award-winning prefabricated complex. From conception to completion, the project was built in just six months.

The four building complex comprises 23,000 sq ft of space in two office buildings, a cafeteria and a conference training center. The temporary facility meets the aesthetic and environmental standards necessary in the Palo Alto, Calif. industrial park where the project is located.

CPM Used

A critical path network was formulated which allowed the design and construction of the footings and mechanical and utility work to proceed while 56 modular building components were being manufactured at another location. The architects specified that the modules be modified by removing a wide roof overhang and simplifying the fascia. The result is a handsome form designed to be interconnected at any point on any wall. Each module is a lightweight, rigid steel frame unit, 10 ft wide and 32 or 60 ft long. Upon completion, the modules were moved 400 miles and lifted by crane onto the finished structure.

Interesting Arrangement of Buildings

Deviating from the normal barracks alignment, the architects grouped the modules into four different shaped buildings. Twenty-foot breezeways separate the buildings to meet code requirements. The buildings surround a covered mall which gives an open feeling and a sense of vertical dimension. The mall provides all internal circulation and serves as an informal meeting space designed to encourage the interchange of ideas between the researchers and those from other departments of the company.

Unique Space Frame

A plexiglass-covered space frame protects the mall from rain and the hot summer sun and affords an interesting visual enclosure.

The space frame consists of 4 ft-1 in. long steel channels and specially-formed connector plates. They were shipped to the site in boxes, where large sections were bolted together on the ground and lifted by crane onto the prepositioned steel columns. The space frame's unique structural characteristics permitted the architects to position the columns where they best suited traffic flow.

Impressive Interior

Visitors are impressed by the modern, functional appearance and tasteful decor of the complex. Interconnection of modules creates large expanses of open floor space demanded in the various areas. Glass window walls, distinguished by handsome steel detailing, highlight the facility's aesthetic appeal. Attractive

Architect: Mackinlay/Winnacker & Associates
Orinda, California
Structural Engineer: Pregnoff & Matheu
Palo Alto, California
General Contractor: Syntex Laboratories, Inc.
Palo Alto, California

After modules were manufactured, they were moved to site and lifted by crane onto previously constructed footings.

vertical blinds protect the windows. The ceiling's exposed grid construction supports acoustical tile and recessed lighting.

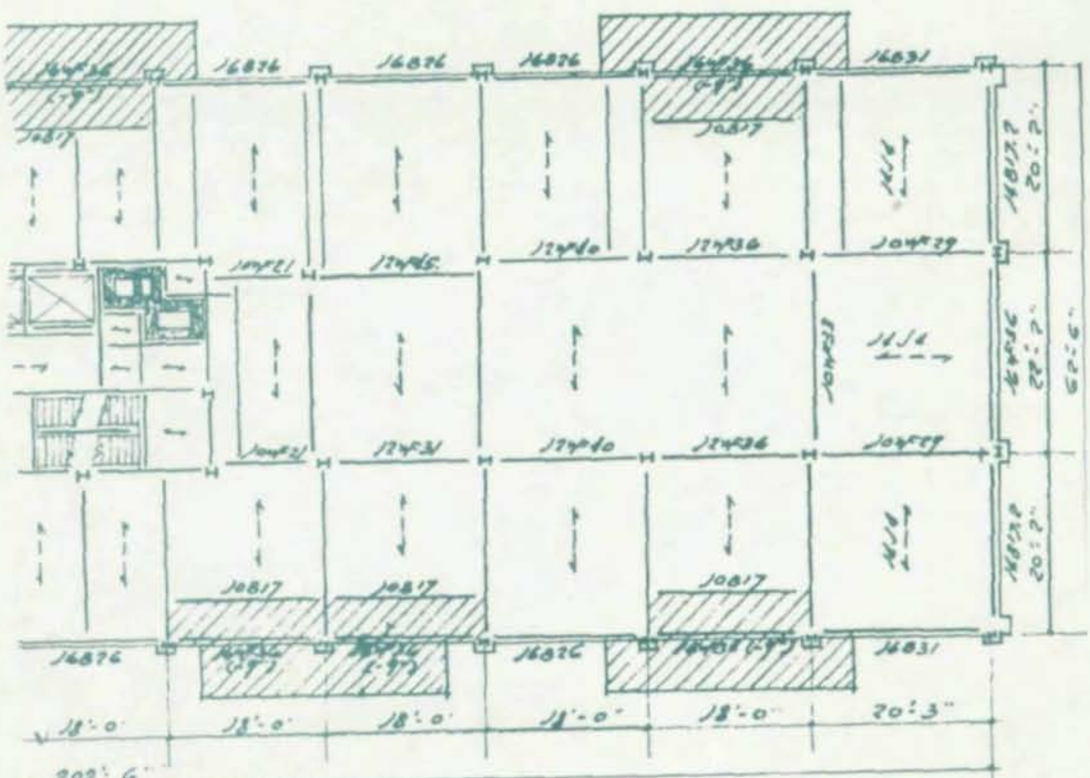
The modified module eliminated individual heating and air conditioning pumps that protruded from the end of the roof, and allowed for a central-fan coil system with mechanical equipment contained in one of the modules.

Room for Expansion

As the facility grows, the relatively simple addition of modules keeps pace with expansion. When the permanent facilities are constructed, this entire interim facility, with the exception of the footings, can be disassembled and sold or moved to another site. The manufacturer estimates the life of the module at 40 years.

Grouping of buildings around a mall proved both attractive and functional.

LOW BID FOR STEEL IN HI-RISE APARTMENTS

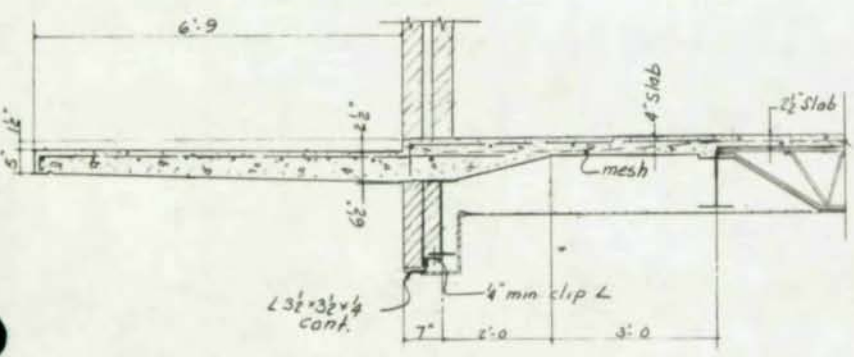


PARTIAL FRAMING PLAN

by Albert Melniker, AIA,
Eugene N. Ho, P.E. and
Samuel H. Marcus, P.E.

Billed as the largest apartment complex on New York's booming Staten Island, "The Fountains" is an outstanding example of quality in residential construction. The complex comprises five 10-story buildings with a total of 720 luxury apartments. Two buildings are completed and occupied and foundations for two others have been poured. Steel erection for the third building begins shortly.

Before the owner-builder, R.G.R. Construction Corporation, Staten Island, N. Y., agreed to the framing system — a combination of structural steel, open-web steel joists, and reinforced concrete cantilevered terrace slab — an alternate flat slab reinforced concrete design was also submitted for bidding. The result from all trades revealed a substantial saving in favor of the steel framing system. A structurally distinctive feature, in addition to the economy involved, is the thin-line balcony which has heretofore exclusively belonged to the flat-plate reinforced concrete structure. It may be that the imaginative combination of the two major structural systems is a first for a major apartment project.



TYPICAL SECTION THRU TERRACE

Each building is situated on approximately 75,000 sq ft and takes advantage of the natural setting surrounded by parkland, a golf course, and ponds. The buildings each have 140,591 sq ft of gross floor area. Bay sizes are 18 ft-0 in. x 20 ft-2 in. with a floor-to-floor height of 9 ft-6 in. Structural steel and open-web steel joists provided flexible pipe and conduit runs, thus allowing more economical electrical, heating and cooling systems.

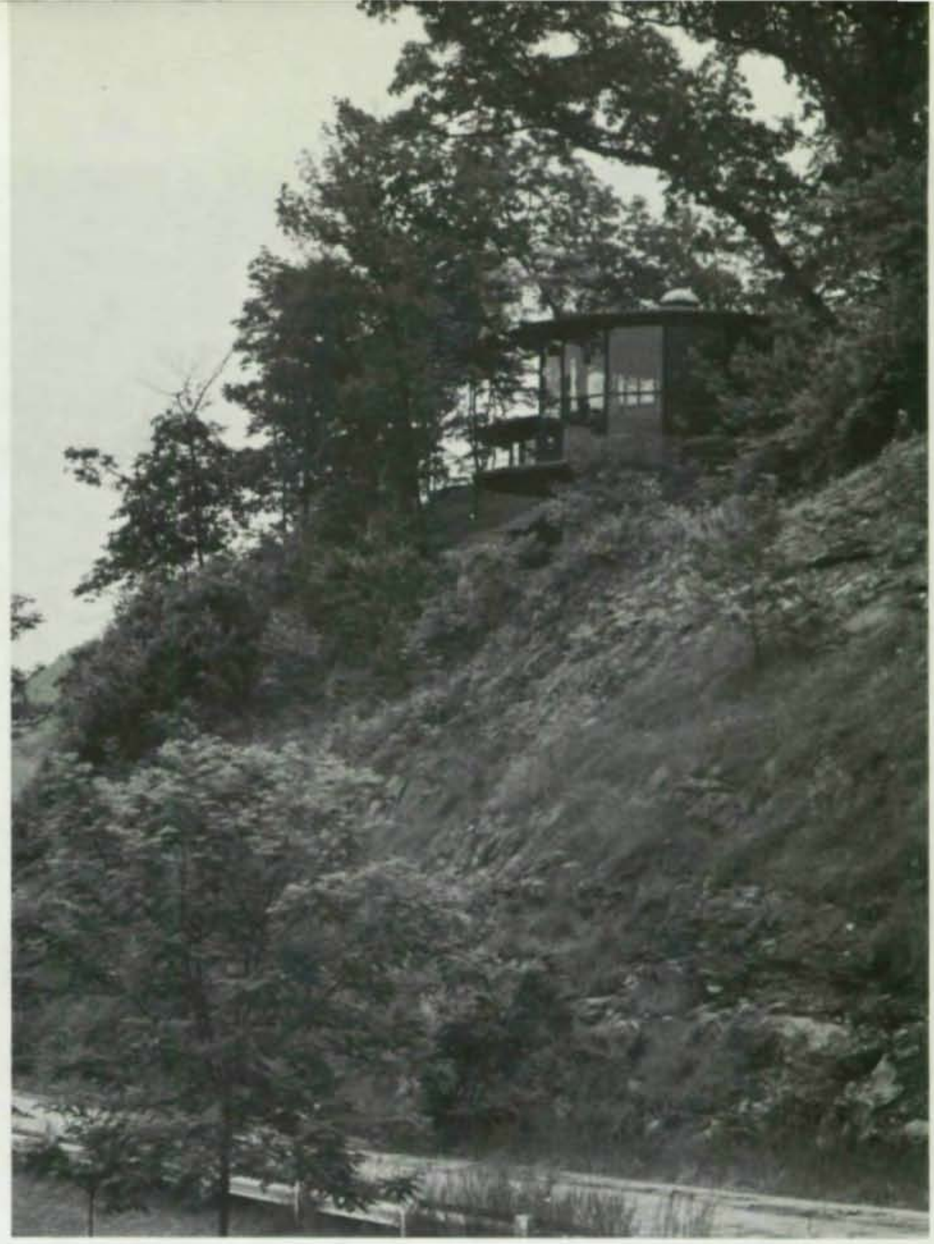
463 tons of A36 structural steel and 160 tons of J-Series open-web floor joists were used for the first building constructed. This most economical design for a 10-story structure required only 8.8 lbs of structural steel and bar joists per square foot. This lightweight system also provided a marked savings on foundation costs. The unit cost was less than $10 per sq ft of gross building area.

All steel columns, flush on the inside of the building, project on the outside, where they are faced with brick. Structural steel is shop welded and field bolted (with simple connections — A307 bolts). The 10-in. exterior walls are cavity type construction (4-in. brick, 2-in. air space, 4-in. block with plaster). Apartments have lath and plaster suspended on resilient clips to cut sound transmission through the walls. The second building has both outdoor and indoor swimming pools. The indoor pool is supported on steel trusses at the lowest level.

Apartment houses do not automatically mean concrete. Think of the savings steel offers: lower foundation costs, faster erection (early occupancy), all-weather construction, and easier pipe and conduit runs. Finally, safety and beauty cannot be forgotten.

Mr. Melniker was the architect on the project. He has offices on Staten Island, N. Y.
Mr. Ho was consulting engineer on the project. He has offices in New York, N. Y.
Mr. Marcus is Regional Engineer for AISC in New York, N. Y.

STEEL ON THE ROCKS



Like Topsy, Toporock just grew – at least it seemed that way to Charleston, W. Va. inhabitants as they watched the progress of Architect Henry Elden's studio-residence rising, wrapping around, and perching upon the Devil's Tea Table, a stony landmark overlooking the city, river and wooded terrain. What finally emerged were two dazzling glass and steel circular forms – one twice the diameter of the other – linked by a curvilinear chain of living quarters.

In an attempt to introduce contemporary residential architecture to Charleston, Mr. Elden became his own test case. His design objectives for Toporock included taking full advantage of the unique properties of the site, allowing minimal disturbance to the terrain, and investigating the potential for steel in residential construction.

Toporock contains 10,000 sq ft of floor space. About 3,500 sq ft comprises the living area, and the balance of 6,500 sq ft is studio space. Throughout the entire project, vast expanses of glass, interrupted only by slender steel framing members, assure that the many surrounding vistas can be enjoyed.

Living Quarters

The residence features a two-story circular living room walled by 21-ft-high panes of bronzed glass, framed with lightweight steel tube. The room cantilevers from a central pedestal and is encircled by a wood deck. Free-standing stairs spiral upward to an intimate cantilevered balcony and to three bedrooms that wind around the knoll and interlock with the four-story circular studio. The bedrooms open to a quiet, wooded side of the terrain. The master bedroom projects into the top level of the studio. On the ground level of this winding link is an entry gallery and a large kitchen.

Studio

Walls of glass enclose the massive 4-story circular studio. The studio roofline continues that of the residence but its location on a steep rock cliff allows the addition of two floors below those of the house. The dominant character of the office is given by the cliff, which is incorporated into the structure. Plants flourish on the rocks and a mature tree even continues through the roof.

The first floor of the studio is at the foot of the exposed cliff. The second level is a broad mezzanine ringing the rocky outcropping, and a conference

A view of the valley below is assured by the wrap-around glass and steel walls of the living room. The winding stair leads to the bedrooms.

Lightweight tubular steel was chosen for the structural frame because it allowed the use of smaller members than could have been employed with any other material.

area is formed by a cantilevered concrete slab perched on the top of the cliff. The ground level houses heating-cooling equipment. The main entrance to the studio is on the second level of the studio (one below the main entrance to the house) which allows traffic to the two buildings to be kept separate. Outside, a series of decks, walks and steps flank the buildings.

Steel Framing

Most of the structural frame, which is entirely of steel, is anchored directly to the rocky outcropping. Mr. Elden chose lightweight tubular steel because it allowed the use of smaller members than could have been employed with any other material. Small delicate sections were part of the basic design requirement to preserve the desired open quality. All the framing is exposed, inside and out.

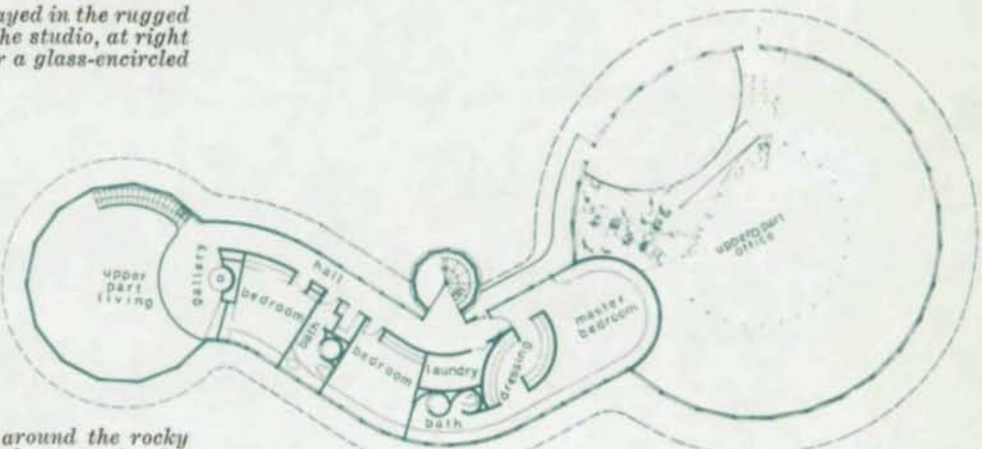
The two-story circular living room rests on a concrete pedestal anchored in rock. The lightweight steel frame was erected on the pedestal and supported by falsework. When everything was in place, the exterior ends of the radial roof members were threaded with a 1¼-in. steel cable. The cable was then tightened to bow the roof structure into place. This tension ring (231 kip stress) eliminated need for a central column in the living room.

Another innovative feature is the central column supporting the studio roof — it also provides the flue for a gas-fired boiler. The balcony of the studio is suspended from the ceiling with ⅞-in. round steel hangers. W. C. Haworth of Charleston, W. Va. served as structural engineer on the project.

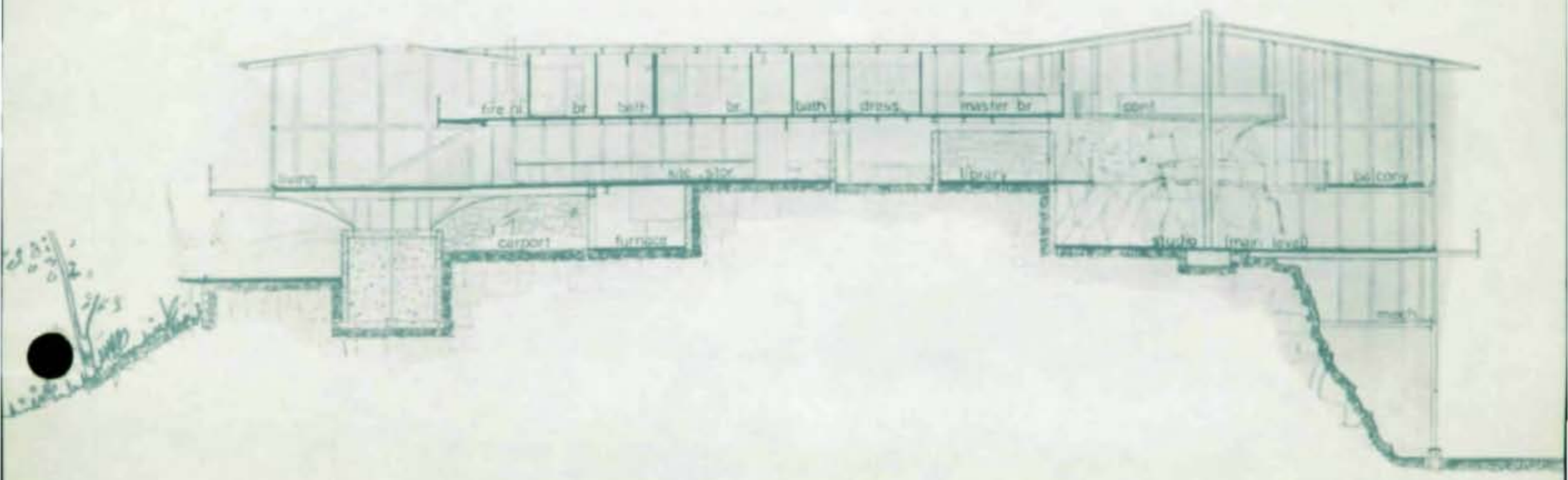
AISC Award Winner

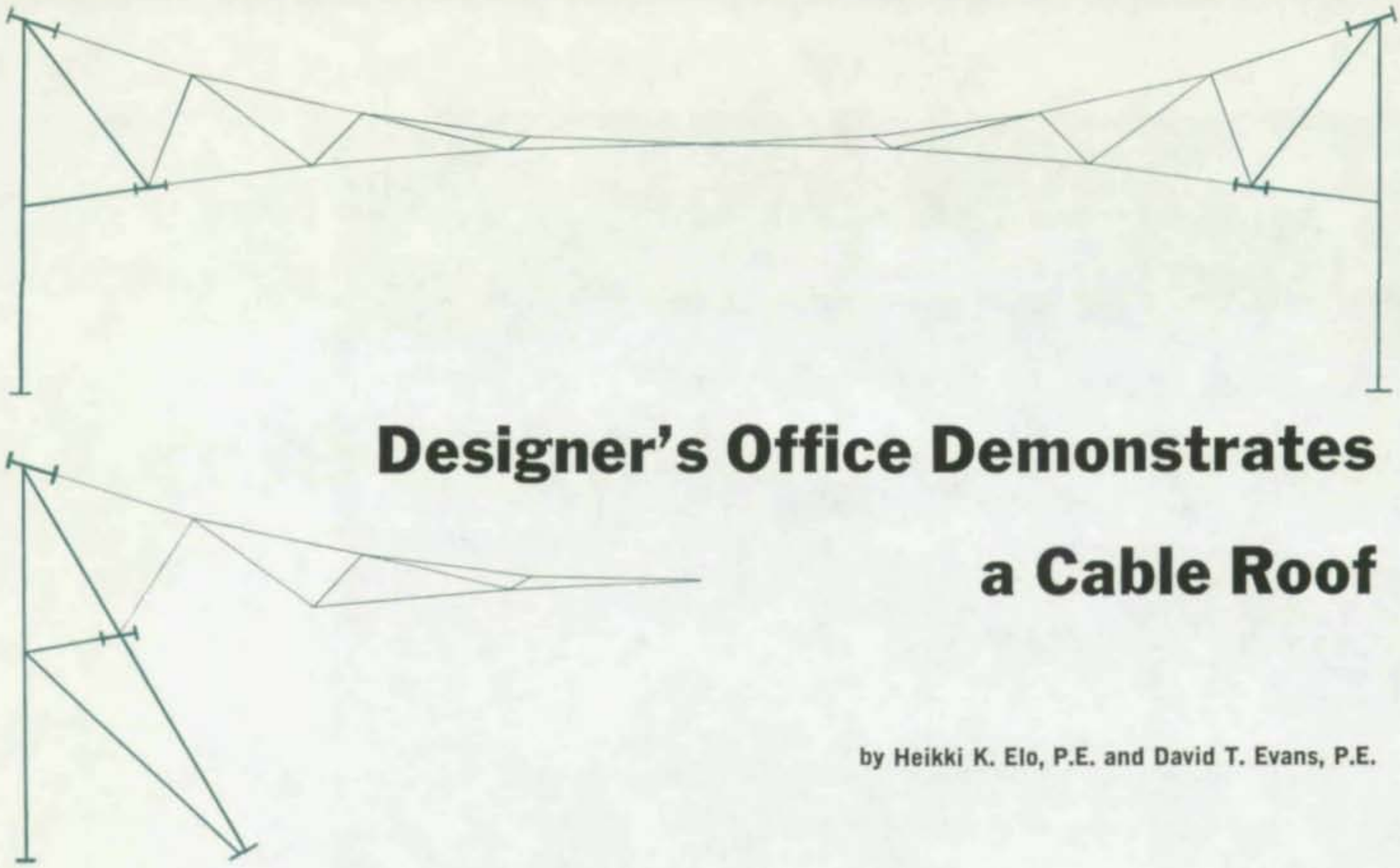
Mr. Elden, acting as architect, as well as contractor, let the five-acre site dictate the shape of the project. The curvilinear form was established by the desire to wrap around the knoll. Toporock was among the 15 winners of AISC's Architectural Awards of Excellence competition. In complimenting Toporock, the jurors said: "This is an interesting and practical solution for a residence on rough terrain and on a steep hill. The light steel frame blends very well with the rugged slope and the open design preserves the beauty of the site and the surrounding scenery."

Steel, stone and glass are interplayed in the rugged contours of Toporock. At left is the studio, at right the living room, and at the center a glass-encircled back stair with skylight.



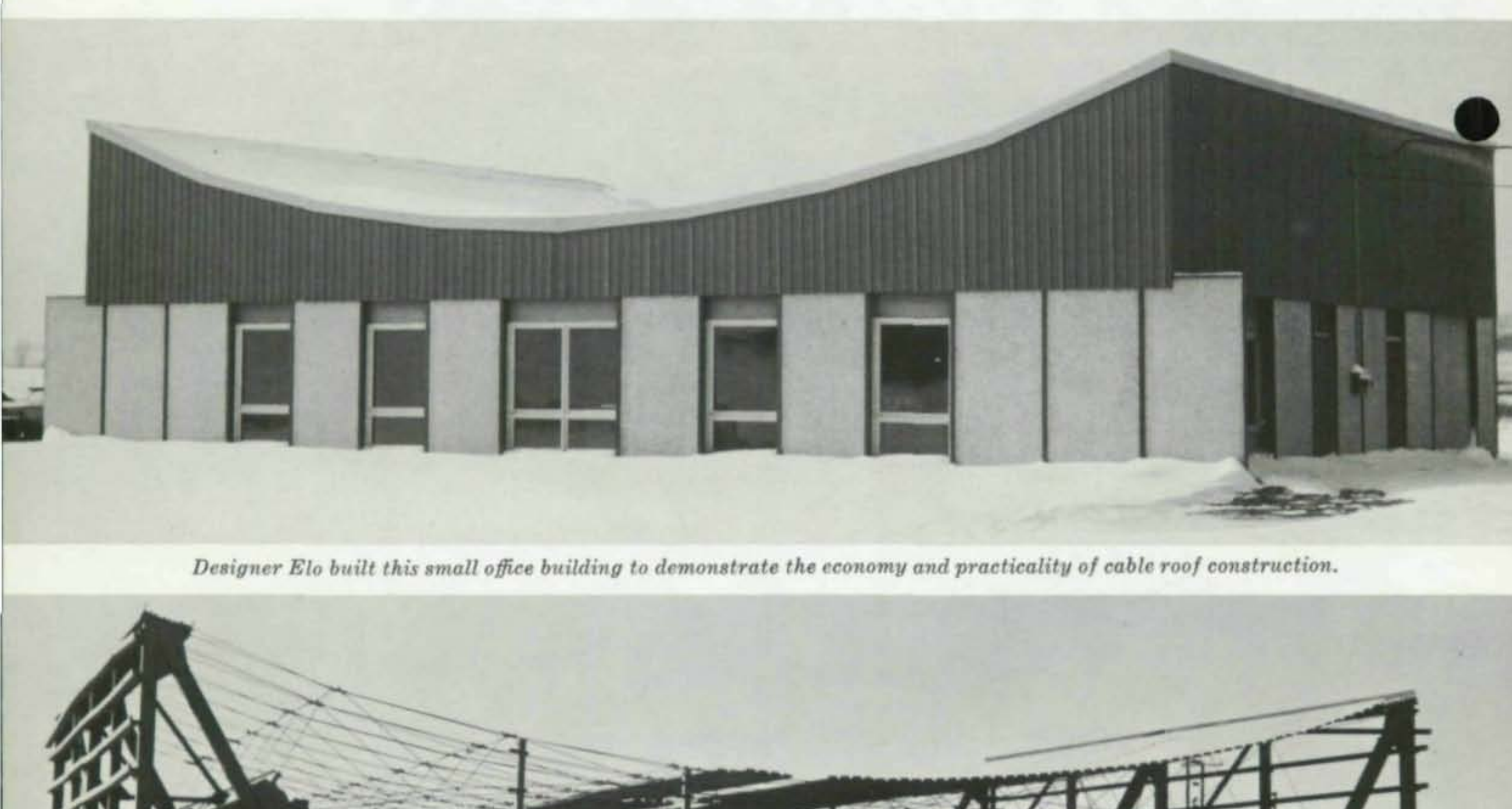
A curvilinear link which winds around the rocky outcropping serves to connect the two circular forms.





Designer's Office Demonstrates a Cable Roof

by Heikki K. Elo, P.E. and David T. Evans, P.E.



Designer Elo built this small office building to demonstrate the economy and practicality of cable roof construction.

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The cable roof of the Helsinki Ice Stadium spans 240 ft. Note that the roof line follows the curvature of the cable trusses.

Located in gently rolling farmland in eastern Pennsylvania, just north of Easton, is an office building — small, one-story, but expressing with dignity and quiet beauty its function — to provide a small-scale example of the practicality and economy of cable roof construction and, of minor importance, to be an enclosure for the office of its owner and designer, Heikki K. Elo.

Mr. Elo decided that this building must be rectangular in plan, have no external ties exposed to the weather, have a roof as lightweight as possible, utilize ordinary component materials and construction procedures, and express the shape of the structural members.

He accomplished this with a 70-ft x 52-ft building by providing a double cable roof in single curvature. The main (top) cables carry all the downward service loads; the bottom cables are stressed, after assembly, to a predetermined tension to introduce a downward pull on the main cables under all conditions of possible uplift. The main and bottom cables are laced together by the truss cables which transmit the tension of the bottom cables to the main cables, and spread stresses caused by unequal loading to lesser stressed parts of the structure. Thus vibrations are dampened in all parts of the structure.

Columns carry the vertical components of the cable stresses at their ends and act as framing for the end walls. Diagonal struts carry the horizontal components into the foundations at the corners of the building and in the main division wall. The roof consists of ordinary 22 ga. formed metal, laid on the main cables and fastened with commercial preformed concrete reinforcing bar tie wires through holes punched in the deck with an electric hammer, 1½ inches of insulation mopped to the metal deck, and a four-ply felt roof with limestone chips. Roof runoff is collected by a short length of exterior gutter on each end of the roof valley. Air conditioning units, duct work, and electrical wiring rest on a system of wooden 2 x 6's suspended from the roof cables. A wallboard ceiling is attached to the underside of the wood framing, and plywood walkways above the ceiling provide easy access for servicing the utilities.

The foundations were designed as grade beams between individual footings which act as dead man anchors.

The roof design was based on the "Tentative Criteria for Structural Applications of Steel Cables for Buildings" by the American Iron and Steel Institute. The elongations of cable members due to prestretching and service loads were taken into consideration.

Erection was extremely simple because each "cable truss" is very light and was lifted into position in its limp state. Only a "one-man" block and tackle was required for the entire roof erection. Even on much larger jobs, heavy cranes would not be required.

The entire cost of the building was $12.00/sq ft, despite its small size. The economy lies in the very light interior partitions, none of which are loadbearing, the ease of installation of utilities, and the strength of the cables — six times that of hot-rolled steel, but only double the cost.

In order to monitor the vertical deflections of the roof, Mr. Elo has placed eight optical deflection gages at various points along the 70-ft span. Movements are simultaneously recorded by a movie camera during high winds. To date the wind has reached a maximum velocity of 40 mph, and the maximum recorded vertical deflection during sustained uplift has been 0.2 in. This is only 1/4200 of the span. The maximum recorded amplitude of flutter has been 0.01 in.

The rectangular shape of this type of structure is generally the most efficient because it is simplest to construct, least likely to invite layout or construction errors, and best utilizes commercially available shapes and materials.

Mr. Elo's experience suggests that this design is economical from 100 to 300 feet due to the extremely light roof construction. The Helsinki Ice Stadium with its clear span of 240 ft is proof of the pudding, but the future will require a substantial increase of other large clear span structures — assembly halls, multi-purpose rooms for schools, industrial buildings of unassigned use, aircraft hangars, covered stadiums — all of which can employ this cable supported roof system, and express the characteristic shape of the suspended roof aesthetically.

Heikki K. Elo is a consulting structural engineer in Easton, Pa.
David T. Evans is Regional Engineer, AISC, Philadelphia, Pa.

PRIZE BRIDGES OF 1968

PRIZE BRIDGE – LONG SPAN ▲

San Mateo-Hayward Bridge
San Mateo and Hayward, California

Designer: Division of Bay Toll Crossings, San Francisco, California
Owner: *State of California, Department of Public Works*
General Contractor: Superstructure: Murphy Pacific Bridge Builders
Substructure: Pomeroy-Gerwick-Steers
Steel Fabricator: Murphy Pacific Corporation

▲ **PRIZE BRIDGE – MEDIUM SPAN, HIGH CLEARANCE**

Fulton Bridges
Over The West Branch of The Susquehanna River, I-80
Clearfield County, Pennsylvania

Designer: Brookhart & Tyo
Owner: Commonwealth of Pennsylvania,
Department of Highways
General Contractor: Penker Constr. Co.
Steel Fabricator: American Bridge Division, United States Steel Corporation

PRIZE BRIDGE – MEDIUM SPAN, LOW CLEARANCE ▲

Eel River Bridge And Overhead
Scotia, California

Designer: State of California
Owner: State of California
General Contractor: Fruin-Colnon Contractor Company
Steel Fabricator: Kaiser Steel Corporation

▲ **PRIZE BRIDGE – SHORT SPAN**

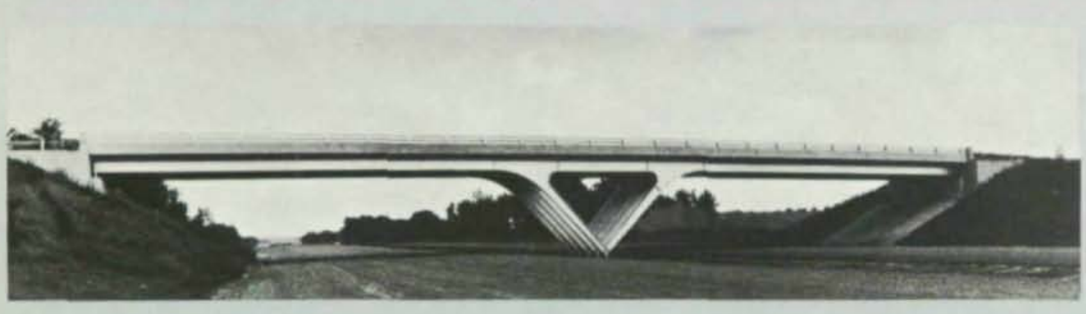
Satsop River Bridges
Satsop, Washington

Designer: Washington State Highway Commission
Owner: State of Washington
General Contractor: Troy T. Burnham Company
Steel Fabricator: Northwest Steel Fabricators, Inc.

PRIZE BRIDGE – HIGHWAY GRADE SEPARATION

Blackwell Interchange
Blackwell, Arkansas

Designer: Arkansas State Highway Department
Owner: Arkansas State Highway Department
General Contractor: H. N. Rodgers & Sons Company
Steel Fabricator: Pidgeon-Thomas Iron Company ▼



PRIZE BRIDGE — SPECIAL TYPE
Guy A. West Bridge
Sacramento, California
Designer: The Spink Corporation
Owner: City of Sacramento
General Contractor: A. Teichert & Son, Inc.
Steel Fabricator: American Bridge Division,
United States Steel Corporation

AWARD OF MERIT — LONG SPAN
South Fork Feather River Bridge
Near Feather Falls
Butte County, California
Designer: State of California
Owner: State of California
General Contractor: Rothschild, Raffin & Weirick, Inc.
and Piombo Construction Company
Steel Fabricator: Bethlehem Steel Corp.

AWARD OF MERIT — LONG SPAN
Poplar Street Bridge
Between St. Louis, Missouri and East St. Louis, Illinois
Designer: Sverdrup & Parcel & Associates, Inc.
Owner: Missouri State Highway Commission and The State of Illinois, Department of Public Works & Buildings
General Contractor: Superstructure: Bethlehem Steel Corporation
Substructure: Dravo Corporation
Steel Fabricator: Bethlehem Steel Corporation

AWARD OF MERIT — MEDIUM SPAN, HIGH CLEARANCE
Corn Creek Bridge
Mossyrock, Washington
Designer: Washington State Highway Commission
Owner: State of Washington
General Contractor: Gibbons & Reed Company
Steel Fabricator: Northwest Steel Fabricators, Inc.

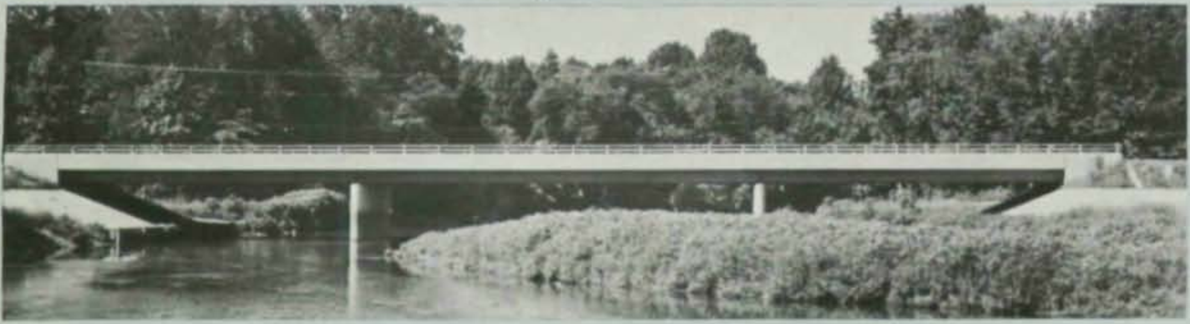
AWARD OF MERIT — MEDIUM SPAN, LOW CLEARANCE
Project I-29-5 (8) 97
Near River Sioux, Harrison County, Iowa
Designer: Iowa State Highway Commission
Owner: Iowa State Highway Commission
General Contractor: Jensen Construction Company
Steel Fabricator: Bennett Industries, Inc.

PRIZE BRIDGES OF 1968

AWARD OF MERIT — SHORT SPAN
Gorge Dam Access Bridge
Near Newhalem, Washington
Designer: Harry R. Powell & Associates
Owner: City of Seattle, Department of Lighting
General Contractor: Lee T. Dulin Construction Co.
Steel Fabricator: Western Steel Company

AWARD OF MERIT — SHORT SPAN
Bridge Over Snake River #2
Jackson, Wyoming
Designer: Wyoming Highway Department
Owner: Wyoming Highway Department
General Contractor: Ellingford Brothers, Inc.
Steel Fabricator: Midwest Steel & Iron Works

AWARD OF MERIT — SHORT SPAN
Conaways Road Over Little Patuxent River
Conaways, Maryland
Designer: Rummell, Klepper & Kahl
Owner: Maryland State Roads Commission
General Contractor: Warfield-Hamm Construction Co. Inc.
Steel Fabricator: Cumberland Bridge Company



AWARD OF MERIT — HIGHWAY GRADE SEPARATION
Route 5/99 Separation
At Wheeler Ridge, Kern County, California
Designer: State of California
Owner: State of California
General Contractor: Tumblin Company
Steel Fabricator: Kaiser Steel Corporation

AWARD OF MERIT — HIGHWAY GRADE SEPARATION
Valencia Boulevard Overcrossing
Valencia, California
Designer: State of California
Owner: State of California
General Contractor: E. C. Young
Steel Fabricator: American Bridge Division, United States Steel Corporation