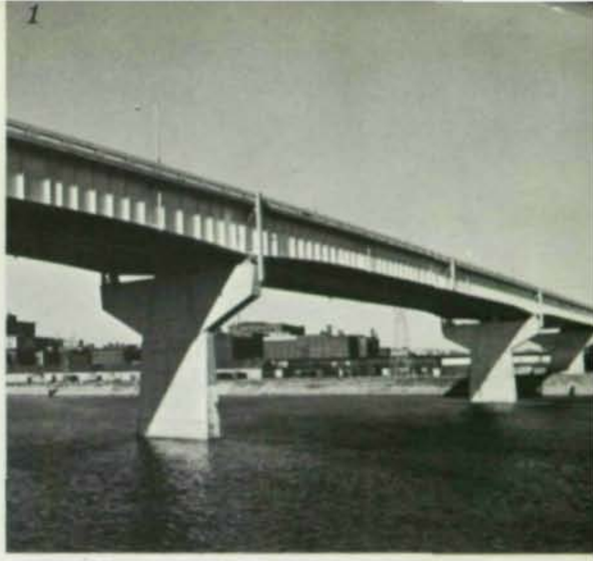
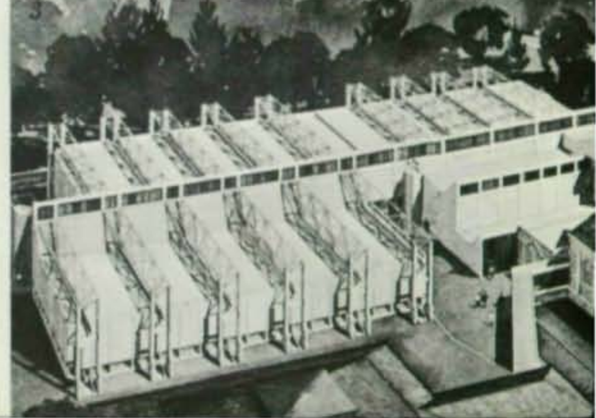
VOLUME IX / NUMBER 1 / FIRST QUARTER 1969

MODERN STEEL CONSTRUCTION





MODERN STEEL CONSTRUCTION

Published by

American Institute of Steel Construction

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

VOLUME IX / NUMBER 1 / FIRST QUARTER 1969

CONTENTS

1969 PRIZE BRIDGE COMPETITION

Entries are invited for the 41st Annual Prize Bridge Competition to select the most beautiful steel bridges opened to traffic during the calendar year 1968.

The Competition will be judged by a panel of five distinguished engineers and architects. The members of the 1969 Prize Bridge Jury are:

Lt. Gen. William F. Cassidy, F.ASCE *Chief of Engineers, United States Army, Washington, D. C.*

Walter S. Douglas, F.ASCE *Vice President, American Institute of Consulting Engineers; Senior Partner, Parsons, Brinckerhoff, Quade & Douglas, New York, New York*

John K. Minasian, F.ASCE *Minasian Associates Consulting Engineers, Inc., Long Beach, California*

Thomas M. Niles, F.ASCE *President-elect, ASCE and Partner, Greeley and Hansen, Chicago, Illinois*

Elliot L. Whitaker, FAIA *Director, School of Architecture, Ohio State University, Columbus, Ohio*

Steel bridges of all types located in the U. S. are eligible. Entries must be postmarked prior to May 25, 1969. Competition rules and entry forms are available from AISC.

AISC FELLOWSHIP AWARDS

Four engineering students have been awarded $3,000 fellowships in the seventh annual AISC Fellowship Awards Program. The program is designed to encourage expertise in the creative use of fabricated structural steel.

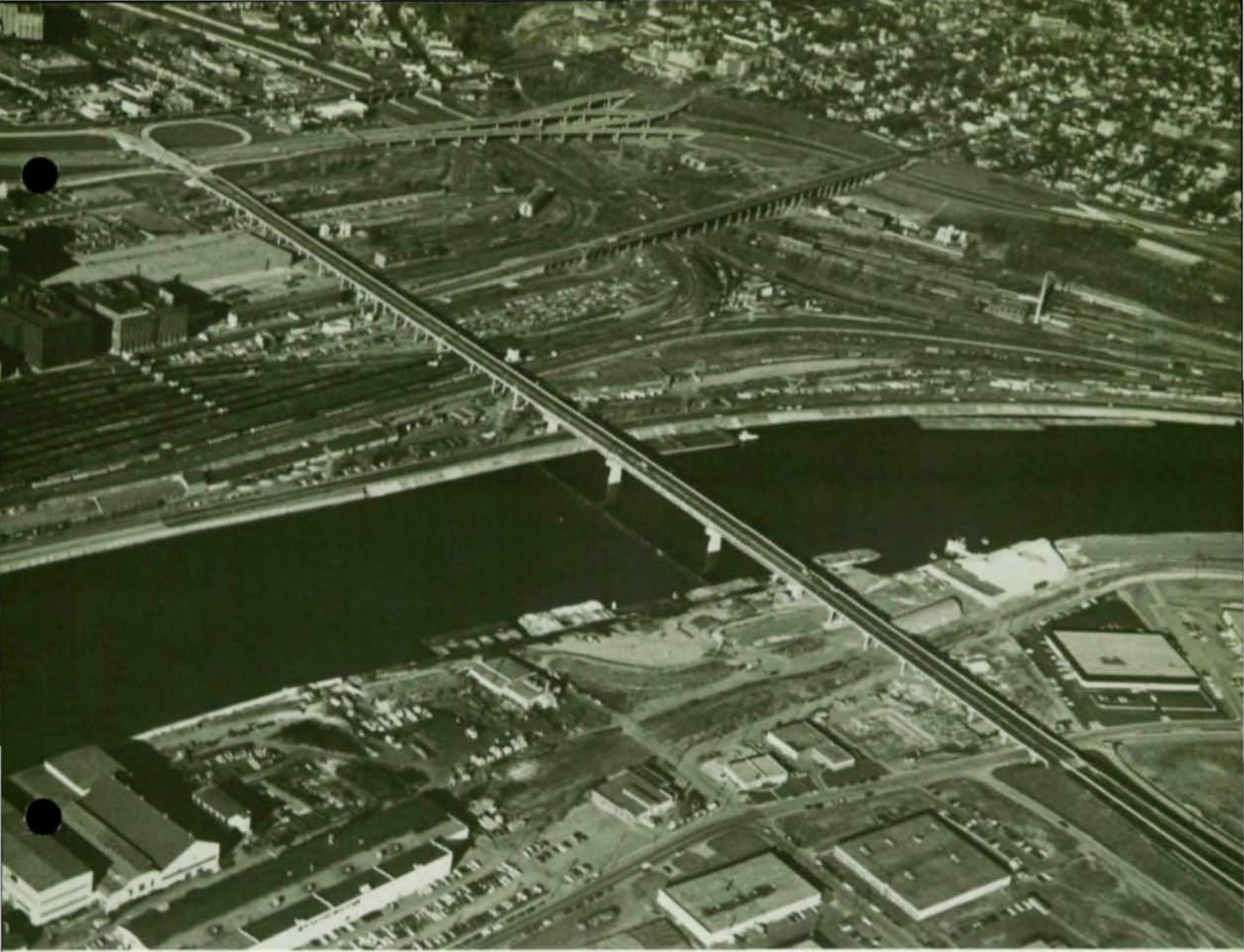
Thomas A. Kirk *Georgia Institute of Technology, Atlanta, Ga. will document a "Case Study in Structural Steel Design."*

Daniel R. Marlow *Arizona State University, Tempe, Ariz. will study the failure of steel tubing by buckling.*

William D. McCabe, Jr. *The University of Texas, Austin, Tex. will study rigid and semi-rigid beam-to-column connections.*

John D. Meyer *University of Colorado, Boulder, Colo. will study the effect of strain hardening on the shakedown of steel structures.*

The selections were based upon the relationship of the graduate study program to fabricated steel structures, the prospective benefits to this industry, the students' records, and faculty recommendations.



Engineers overcame many difficult site problems in designing the graceful 3,366-ft-long Lafayette Bridge at St. Paul.

THE LAFAYETTE BRIDGE

E. L. Gardner,
Chief Structural Engineer
Ellerbe Architects and Engineers

The Lafayette Bridge, crossing the Mississippi River at St. Paul, is unique in spite of the many site problems that hampered the designers. A graceful appearance was obtained by the engineers without loss of strength or durability.

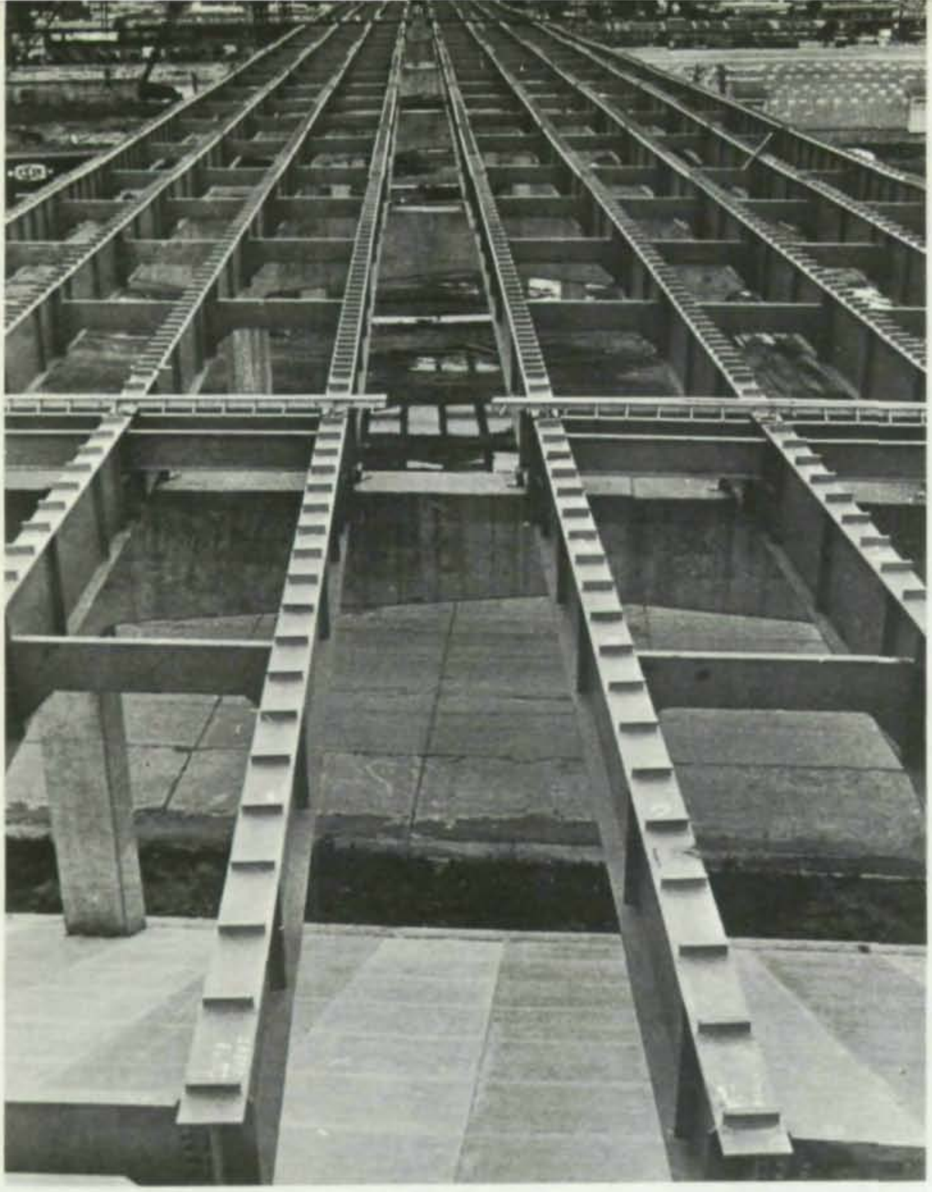
The bridge location is ideal for traffic relief, but encompassed many site features that were major design obstacles. The bridge crossed highways, principal city streets, yards and tracks of several railroads, the Union Depot Concourse, warehouse buildings, underground utilities, and the Mississippi River.

Bridges are the most utilitarian of all structures. No material can be used for aesthetics that does not have a basic functional value; this dictum applies to all materials from bolts to paint. Bridge maintenance is another factor of overriding importance; over a period of years the maintenance of a bridge constructed from a bad design can be more than the original cost. Material quality is so inseparable from safety that most engineers will not chance a design or material that has not been time-tested.

Unusual Design Restrictions

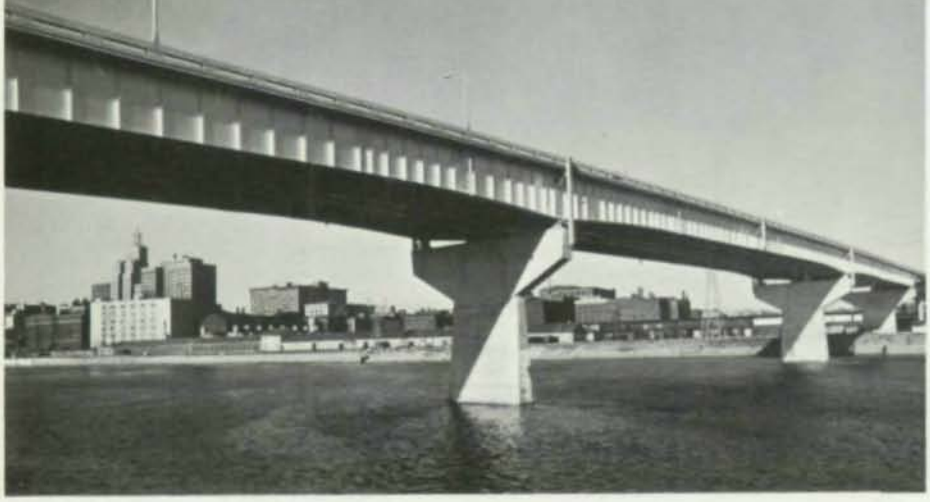
Engineers are, by training and experience, philosophically adjusted to working within the restrictive confines of bridge criteria. The Lafayette Street Bridge project had many times more than the usual number of limiting conditions. One of the most challenging of all design conditions was the lack of vertical space for the structure. River traffic under the bridge and air space above the bridge for planes to the downtown St. Paul Airport limited the structure depth to 18 ft above the piers at the center of the navigational span. This depth included girders, roadway, and bridge railings.

Fitting the structure into the vertical space limited by clearance requirements required lowering railroad track grades and at the same time keeping main line rail traffic moving.



Steel plate girder design was most economical of three deck framing schemes studied.

The Lafayette Bridge is the longest river crossing in the St. Paul area. River spans are 270 ft – 362 ft – 250.5 ft c. to c. of piers.



Engineering design for the bridge was done by computer. The required beam properties for moment, shear and deflections for dead, live and combined loads were obtained at 100 points on the main girders. The influence lines and camber diagrams were made by the computer. The beams are designed for HS-20 highway traffic loading. The dead load deflection over the navigation channel was calculated to be 9 in. and the girder webs were cut to compensate the deflection, so that when the total dead load was applied the bridge would correct itself to the predetermined road grade. The computer computations were theoretically accurate to within ½ of 1%, a performance unattainable by ordinary methods.

Long River Crossing

The structure is 3,366 ft long, the second in length in Minnesota and the longest river crossing in the area. There are two 29-ft roadways, each with two lanes of traffic separated by a 4-ft wide raised median at bridge center. The navigational channel is 350 ft wide between pier faces. The bridge links a freeway system on the north to a trunk highway leading into an industrial complex on the south. There are four river piers and twenty-five land piers.

Pier Construction

Land piers were constructed under the difficult conditions between the rail tracks; precise timing of material delivery and construction operations were calculated to the minute. Steel H-piling was driven 150 ft to rock for pier foundations. Avoiding railroad traffic limited the actual work to approximately five hours per day for each pile driving rig.

River piers were constructed from barges anchored out of the main navigational channel; all inland waterways regulations were adhered to. The foundations for river piers were constructed by the sand island method: a double ring of sheet piling was driven and the space between the rings was filled with earth material pumped from the encircled area. Steel H-piling was then driven 110 ft to rock and capped with concrete. An 8-ft thick concrete seal was placed on top of the pile cap. The pier structure started at the seal elevation.

Steel Construction

Cost analysis was made for three deck beam arrangements. The cost was less on the river spans for four large plate girders, two under each roadway, with diaphragm beams connecting at right angles to girder webs and supporting longitudinal deck beams for concrete deck bearing. Eight longitudinal 4-ft deep all-welded girders compositely designed with the concrete deck were used over the land spans.

The girders over the river weigh 200 tons, are 15 ft deep at the piers and follow a parabolic line to 12 ft deep at the center of span. Flanges are high strength A441 steel, 36-in. wide by 4-in. thick, welded to A441 steel webs. The girders over the land piers are also A441 steel, ⅜-in. thick webs, with an average of 2-in. thick flanges, 14 in. wide at the top and 16 in. wide at the bottom. A36 steel was used for some of the shorter spans. Six spans at the north end of the bridge are framed with 36-in. deep rolled A36 sections. The structure required 4,316 tons of structural steel, and 12 miles of steel H-piling.

Bridge lighting is designed for 2.5 foot-candles at 70° F per square foot of deck area, and is supplied by overhead lighting standards.

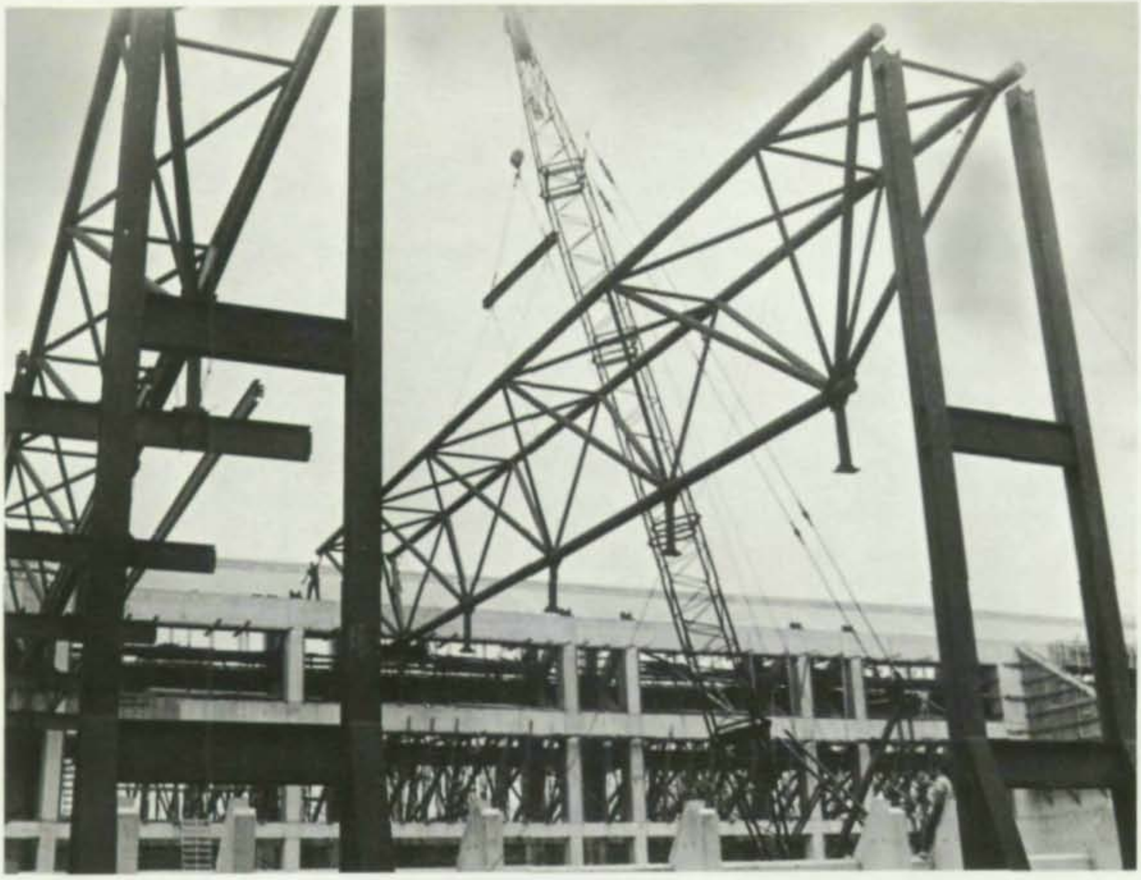
The construction contract was divided into three phases: river piers, land piers and the deck structure. This made extra work for the engineers, but it permitted more competitive bidding. The total cost, including site work was $10,500,000. The structure was designed for the Minnesota Highway Department; and was dedicated by Minnesota's Governor, Harold LeVander, and opened to traffic November 13, 1968.

Structural Engineer:
Ellerbe Architects and Engineers
(David Peterson, Project Design Engineer)
St. Paul, Minn.

General Contractors:
Superstructure:
John F. Beasly Co., Chicago, Ill.
Substructure:
Industrial Construction Co.
Minneapolis, Minn.

Steel Fabricators:
St. Paul Foundry & Manufacturing Co.
St. Paul, Minn.
Pittsburgh-Des Moines Steel Co.
Pittsburgh, Pa.

Two 29-ft roadways, each with two lanes of traffic, are separated by a 4-ft wide raised median at the center.

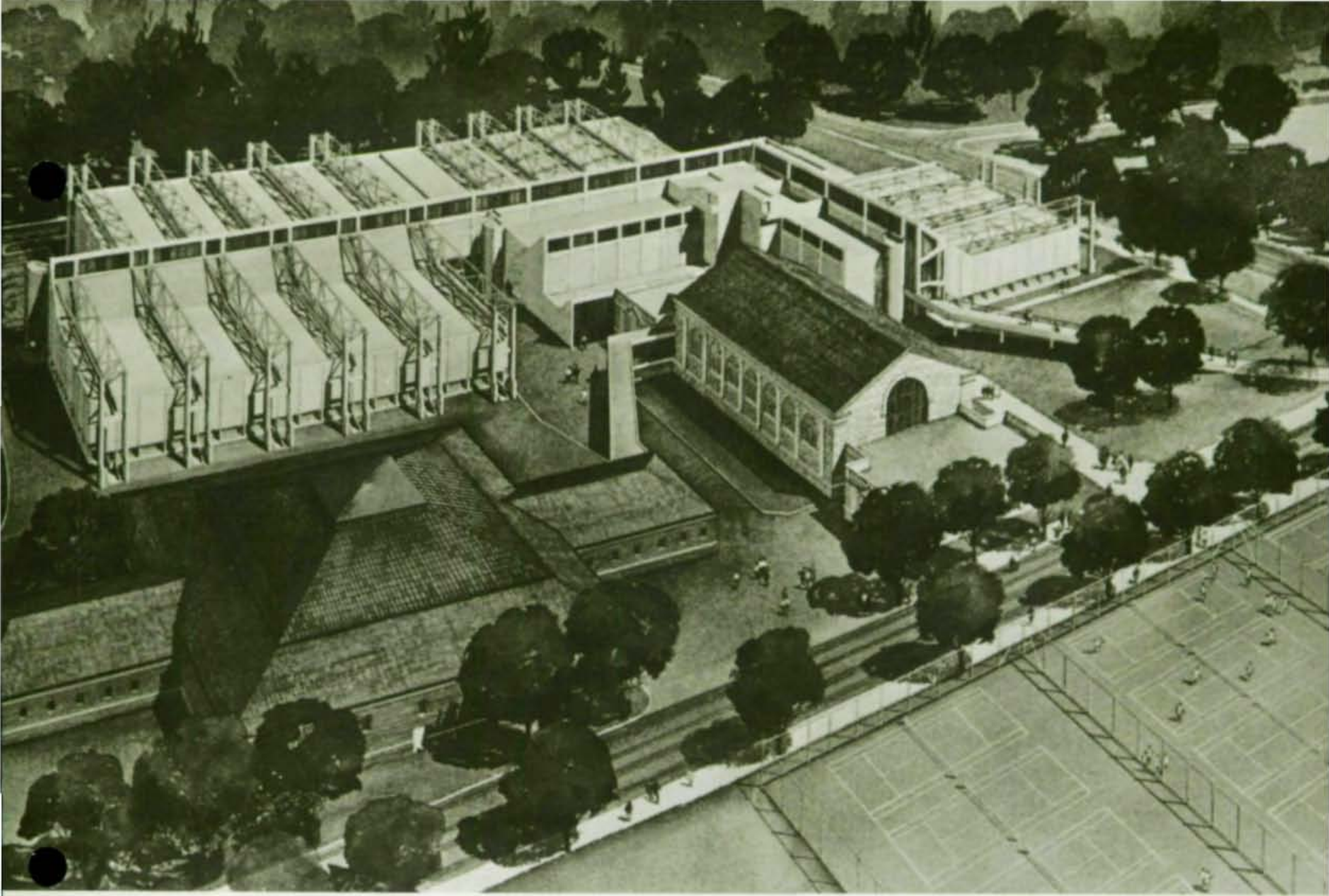


Architect: Kallmann & McKinnell
Boston, Massachusetts

Engineer: Le Messurier Associates
(H. William Hagen, Design Engineer)
Boston, Massachusetts

General Contractor: George B. H. Macomber
Allston, Massachusetts

Steel Fabricator: Bancroft & Martin
Portland, Maine



TRIANGLE TRUSSES FRAME COMPLEX

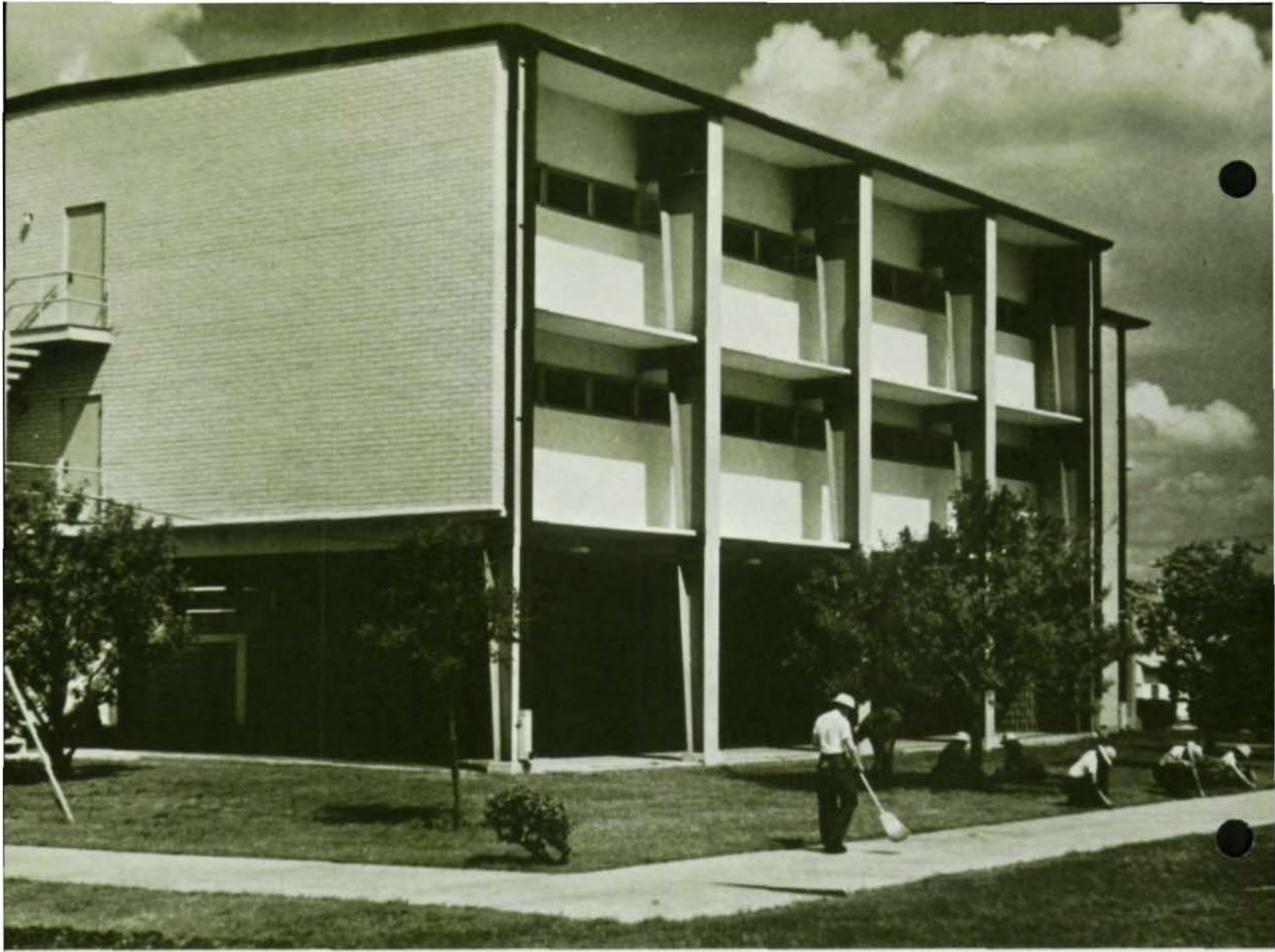
A roof supporting system never before used in this country has been introduced in Exeter, N. H., at Phillips Exeter Academy's new four-building physical education complex which will house: two hockey rinks, a gymnasium, 12 squash courts, a two-level training and exercise room, a swimming pool, locker facilities for 1,000 students, a 60-head shower room, offices, and conference rooms.

Architects Kallmann & McKinnell and structural engineers Le Messurier Associates, both of Boston, suspended the roof from a series of triangular-shaped trusses fabricated from corrosion-resistant high strength steel pipe. All this supporting steel is outside the building. This novel design provides an interior clear span of 120 ft. The special corrosion-resistant high strength steel was selected because it literally paints itself when left exposed to the atmosphere and requires no maintenance.

A 700-ft long, 62-ft high concrete spine extends its length down the center of the structure. The trusses are suspended between steel saddles on the spine and 50-ft high steel columns that stand outside the complex's exterior walls. These columns are also made of corrosion-resistant steel. Steel beams are attached to the trusses by a special truss tube. Light structurals span these beams for roof framing. Floor to ceiling heights average 30 ft in the main sports areas. The spine provides for spectator access to all units and contains administrative offices as well as corridors for connecting all the areas in both the new construction and the present plant.

The trusses were fabricated of 5½-in. O. D. through 12¾-in. O.D. pipe, in a variety of wall thicknesses, and measure 10 ft across and average 17 ft in depth. Eleven of the 15 trusses are 135 ft long and weigh 22 tons apiece. The remaining four trusses are 110 ft long and weigh 15 tons each. Of the 700 tons of steel being used in the project, 275 tons will be in the trusses.

According to the architects, the design provides visual simplicity to the structure. Considerable savings in heating, ventilating and maintenance also will be realized, since the structural members are outside the enclosure. The almost maintenance-free complex is being constructed at a cost of only $25 per sq ft and is scheduled for completion in September of this year.



MORE THAN BARRACKS

PROTOTYPE

Architect-Engineers:
Noonan & Krocker, San Antonio, Tex.
Jerry Rogers, San Antonio, Tex.

PHASE I

Architect:
Hesson & May, San Antonio, Tex.

Structural Engineer:
Johnson & Marquis, San Antonio, Tex.

General Contractor:
Browning Construction Co.
San Antonio, Tex.

Steel Fabricators:
Mosher Steel Co., Houston, Tex.
Capitol Iron & Steel Co.
Oklahoma City, Okla.

PHASE II

Architect:
Hesson & May, San Antonio, Tex.

Structural Engineer:
Bovay Engineers, Inc.
Houston, Tex.

General Contractor:
C H. Leavell & Co., Houston, Tex.

Steel Fabricator:
Mosher Steel Co., Houston, Tex.

Recruit housing and training facilities now under construction at Lackland Air Force Base near San Antonio, Texas, bear little resemblance to the austere barracks of World War II vintage.

The new buildings are highly attractive outside and highly efficient inside. Commonly used activity areas are centralized to save time getting from one place to another. Design and construction of these facilities is under the supervision of the Fort Worth District, U.S. Army Corps of Engineers.

Recruits live on the two upper floors of three-story dormitory wings attached at each floor level to a central core where they study and eat. They train in a large drill area at ground level beneath their living quarters.

All space is allotted on the basis of units or "flights" of fifty men. Dormitory floors are divided into fifty-man units.

Lecture rooms are designed for fifty-man classes. Even the open area beneath the dormitories has space for fifty men to drill and take calisthenics.

The problem of determining how much space to allot for the sheltered drill field was solved in a practical way. A non-commissioned officer put a flight of recruits through close order drill in front of a movie camera. The film was studied to determine exactly how much space had been required.

Researched and Tested

These efficient facilities are the result of years of research, designing, engineering, and testing.

In 1960, the architectural engineering firm of Noonan & Krocker in a joint venture with architect Jerry Rogers was commissioned to design a prototype facility that would expedite recruit training at Lackland. After listing major functions it would have to serve — plus a long list of minor ones — the Air Force pitched the designers a real problem. The facility would have to be constructed within the dollar limit per man laid down by Congress for housing. This meant that classrooms, the sheltered drill field, and other "work" areas would have to be squeezed in without sacrificing the high quality of living quarters.

Rigid Frame Steel Construction

After research and discussions with the Air Force, the designers selected rigid steel frame construction for the dormitory wings with the frame exposed so it would not cut into interior space.

Because interior columns would interfere with the drill area at ground level, and clear span beams would require more space between floors, the two upper floors were hung from the ridge of the frame. Although this required heavier ridge members, the extra cost was made up in lighter floor members and reduced overall height of the buildings.

The rigid frames were designed in steel for two basic reasons: First, the steel framing was found to be considerably less expensive than for reinforced concrete framing for the same conditions. Second, the use of concrete would result in much greater depth of sections and consequent interference with the utility of space.

Research and planning continued until 1961 when a prototype was erected. During the next six years, several more prototypes were constructed. In 1967, the Air Force adopted the design for all recruit training facilities.

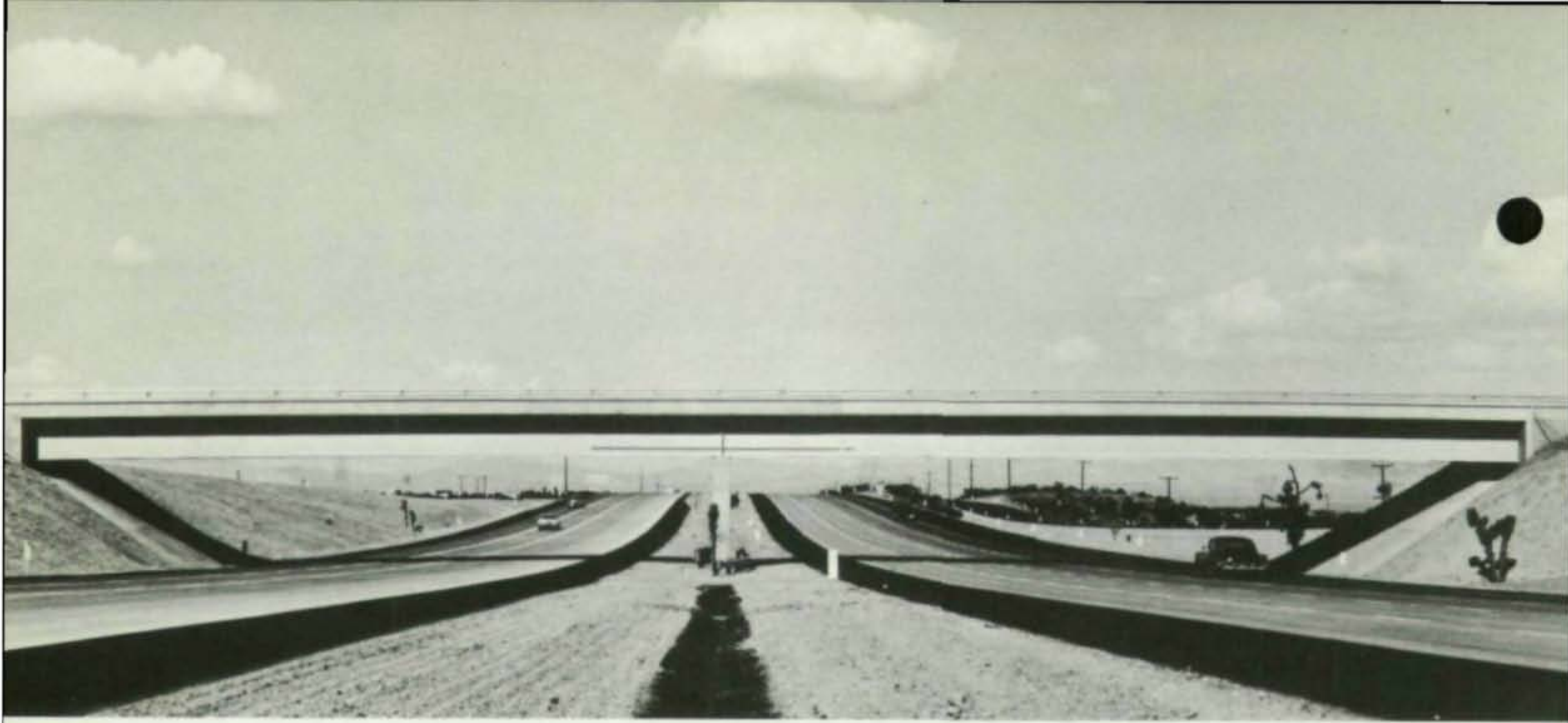
Construction Begins

In 1967, actual construction began, based on the approved prototype design. Two units were completed in Phase I, one for 1,042 men and one for 624 men, each with additional space for supervisory personnel.

Construction of an additional five 1,040-man units (Phase II) began in 1968. These units were slightly redesigned structurally because of soil and foundation problems.

In Phase II, Bovay Engineers Inc. of Houston converted the core structure — which houses the study and dining areas — from reinforced concrete to structural steel framing. For the dormitory wings and the core structures, floor and roof framing were shortspan steel joists. Architectural design of the exterior appearance of the buildings is unchanged.

These five 1,040-man units in Phase II, each housing 171,300 sq ft of floor space, are being built under a tight 16-month schedule. Material suppliers have been required to deliver materials to the job site on a precisely timed schedule. After the first unit was completed, the contractor was scheduled to complete one unit every 30 days.



SAFETY CONSIDERATIONS CAUSE REVOLUTION IN OVERPASS

Prize winning two-span steel beam overpass in San Bernardino County, California has no side piers. Three-span structure requires bents very close to traveled way, causing unnecessary hazard to motorists.

A quiet revolution that began a little more than a year ago and which is continuing is changing the appearance of the familiar highway overpass. These grade separation structures, which occur about one per mile on portions of the Interstate highway system already completed, are now being built so they are longer in span, better looking and – most important – safer for drivers.

The change was stimulated early in 1967 when AASHO officials issued a report entitled "Highway Design and Operation Practice Related to Highway Safety." Known informally as the "yellow book," the report was issued by AASHO's Special Traffic Safety Committee as a set of guidelines for many aspects of safer highway and bridge design.

In May of 1967 the report received endorsement of the U. S. Department of Transportation when Frank C. Turner, Director of the Bureau of Public Roads, stated in a letter to state highway departments: "The Bureau of Public Roads concurs fully in the report's recommendations and conclusions and considers it one of the most important documents ever developed by the joint efforts of the Bureau and AASHO."

As a result of the booklet and the BPR letter, highway designers across the

This article reprinted from Public Works Magazine, August, 1968.

country working on federally-aided projects began taking particular notice of roadside hazards which had been identified in the report and the recommended changes to eliminate them.

One of the report's key recommendations regarding typical overpasses spanning Interstate highways states that 30 ft of unobstructed recovery area are desirable at each shoulder on both sides of the highway. This is about three times the distance commonly accepted as adequate in prior designs.

The report also specifically favors the construction of two-span overpasses instead of the four-span structures that have often been built in the past. A two-span bridge is supported by a single center pier and two abutments. This design eliminates the two piers close to the roadways (at the shoulders) — often

DESIGN

dangerously near the path of moving vehicles — which are used in four-span bridges. The report also recommends that the central pier should stand in a median width of approximately 60 to 80 ft, as opposed to widths of about 40 ft often used in past designs.

Many state highway departments found that they were already meeting many of the recommendations included in the yellow book. In every state a comparision was made between design practice and the new AASHO guidelines. Some designs which had not yet received BPR approval had to be modified to meet the new requirements. Some construction work had to be stopped to await new plans to rise from the engineers' drawing boards.

It is anticipated that many of the safety recommendations will be adopted for state, county, and municipal highways to be built without federal funds.

Statistical Evidence

The need for safer overpass bridges such as outlined in the report is indicated by recent studies into various aspects of highway safety. According to figures released by the California Division of Highways, traffic accidents occurred most frequently in that state in 1966 when drivers lost control, ran off the highway, and hit a fixed object. Bridge abutments or piers were the second most commonly hit objects.

Statistics assembled by the House of Representatives special subcommittee on the Federal-Aid Highway Program (headed by Rep. John A. Blatnik of Minnesota) also indicate that the most common single-car accidents involve an automobile running off the road and crashing into an immovable object. A similar conclusion was reached by the Joint Engineering and Enforcement Project (JEEP) conducted by BPR and the several states served by U.S. Route 66.

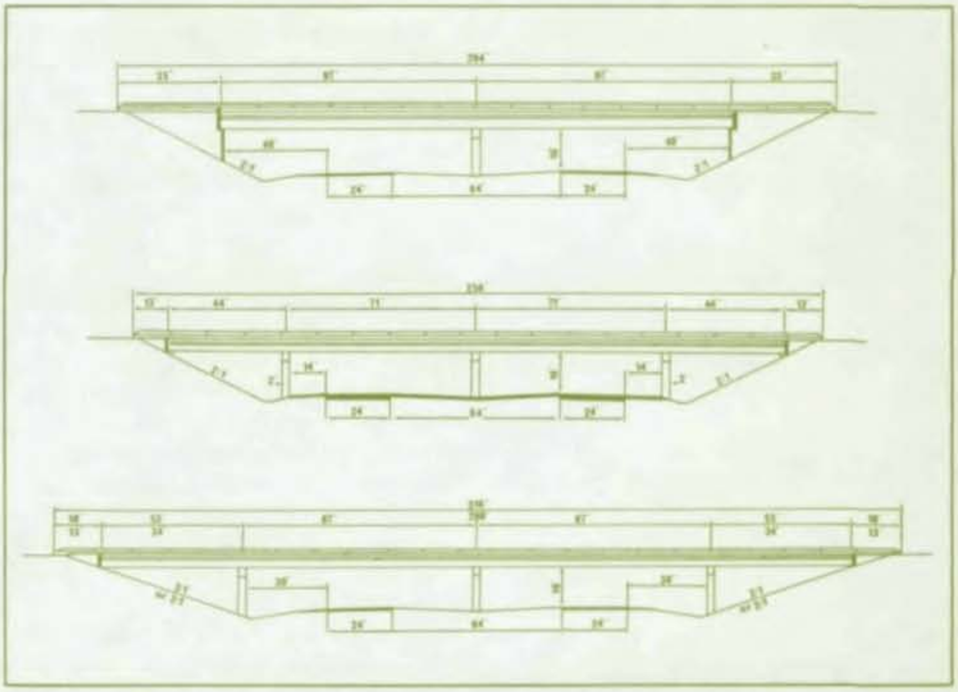
Actually, the problem of cars, even with expert drivers, straying to the side of the road and colliding with fixed roadside objects had been recognized by automotive safety engineers at the General Motors Proving Ground prior to 1963 and reported by them. (See "Priority Needs in Highway Research" by K. A. Stonex, PUBLIC WORKS, April, 1964.)

A Bonus Feature

As well as offering greater safety, the swing from four-span to two-span bridge construction almost invariably produces a bonus in the appearance of the structure. The clean lines of a two-span overpass, standing on only one pier, present a much less cluttered appearance than a four-span structure. This is important in a day when the public awareness of environmental beauty is sharpening. The public is coming to realize also that there is little difference in the cost of constructing a handsome structure instead of one of less attractive design.

For example, an independent study conducted recently by the J. E. Greiner Company, a Baltimore consulting engineering firm, for the American Institute of Steel Construction, compared the costs of typical two- and four-span structures. The Greiner report concludes that a two-span steel overpass bridge designed for soil conditions, grade and alignment least favorable to this type of structure can be built for a cost about ten percent higher than the typical four-span bridge. As span lengths increase — and when soil and other conditions are more favorable to the two-span design — the difference in costs becomes even less.

Construction figures pinpoint the trend toward longer, safer overpass spans. In 1965, more than half of the 3,042 bridge designs approved by the Bureau of Public Roads for construction on the Interstate system contained spans in the 50 to 99-ft range. An official of the BPR says today that if 65 ft were the average span length before the AASHO safety report, it would approach 100 ft in present designs. He sets the current range of spans at 75 to 105 ft.



Typical bridge elevations offered in BPR memorandum as suitable for new AASHO requirements. Based on design in structural steel for HS-20 live load on 30-foot roadway, estimated costs are $75,000 each for the top two and either $79,000 or $91,200 for the other structure, depending upon the sideslope and length required.

THE GOVERNOR'S RESIDENCE

Architect-Engineer:
George M. Ewing Company
Philadelphia, Pa.

General Contractor:
H. B. Alexander & Son, Inc.
Harrisburg, Pa.

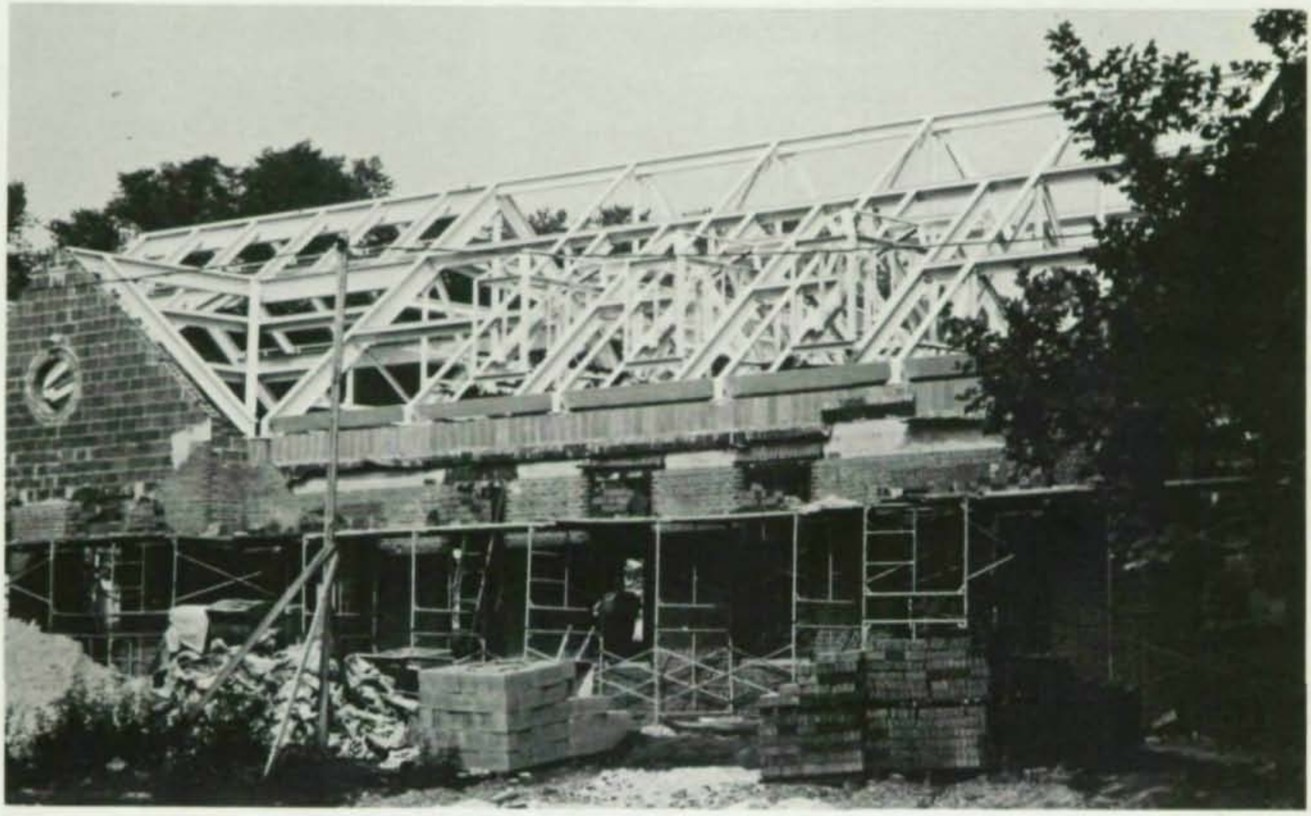
The new Governor's residence at Harrisburg, Pa. reflects the best of both worlds. The building's classic design characterizes the richness of Pennsylvania's history, while the use of modern materials sets the pace for future trends.

Although thoroughly traditional in character, the residence nevertheless incorporates structural steel to its best advantage. Steel was chosen for its durability, strength, safety, and ease of accomplishing aesthetic dictates. One hundred thirty tons of structural steel were utilized in the skeletal system of this important residence. Roof support members consist of steel trusses, simple rafters, and three-hinged steel frames with rigid knees. Dormers were formed with lighter structural shapes. The structural steel floor beams and girders without shear connectors were designed to act compositely with the concrete fireproofing encasement. Thus, the necessity to provide a high degree of fireresistance was used to effect economy in the structural steel design.

The residence is of Georgian design with colonial rose brick walls. Symmetrical treatment of the main facade forms a conspicuous and decorative feature of the exterior composition. The central doorway is flanked by columns supporting an entablature and a simple pediment carved from white marble. The Palladian window surmounting the doorway consists of a central arched opening adjoined by rectangular windows. The main cornice of the mansion carries modillions which give a feeling of richness and provide a repeating accent of light and shade.

A belt course of brick separates the first and second floors. Fenestration is generally symmetrical and massive wood windows are treated with flat arches of brick set on end and white marble sills.

The main or central portion of the house is two and one-half stories high covered with a steep-hipped roof of grey slate with dormers. Two large chimneys contribute to the sense of scale and to the monumentality missing in the

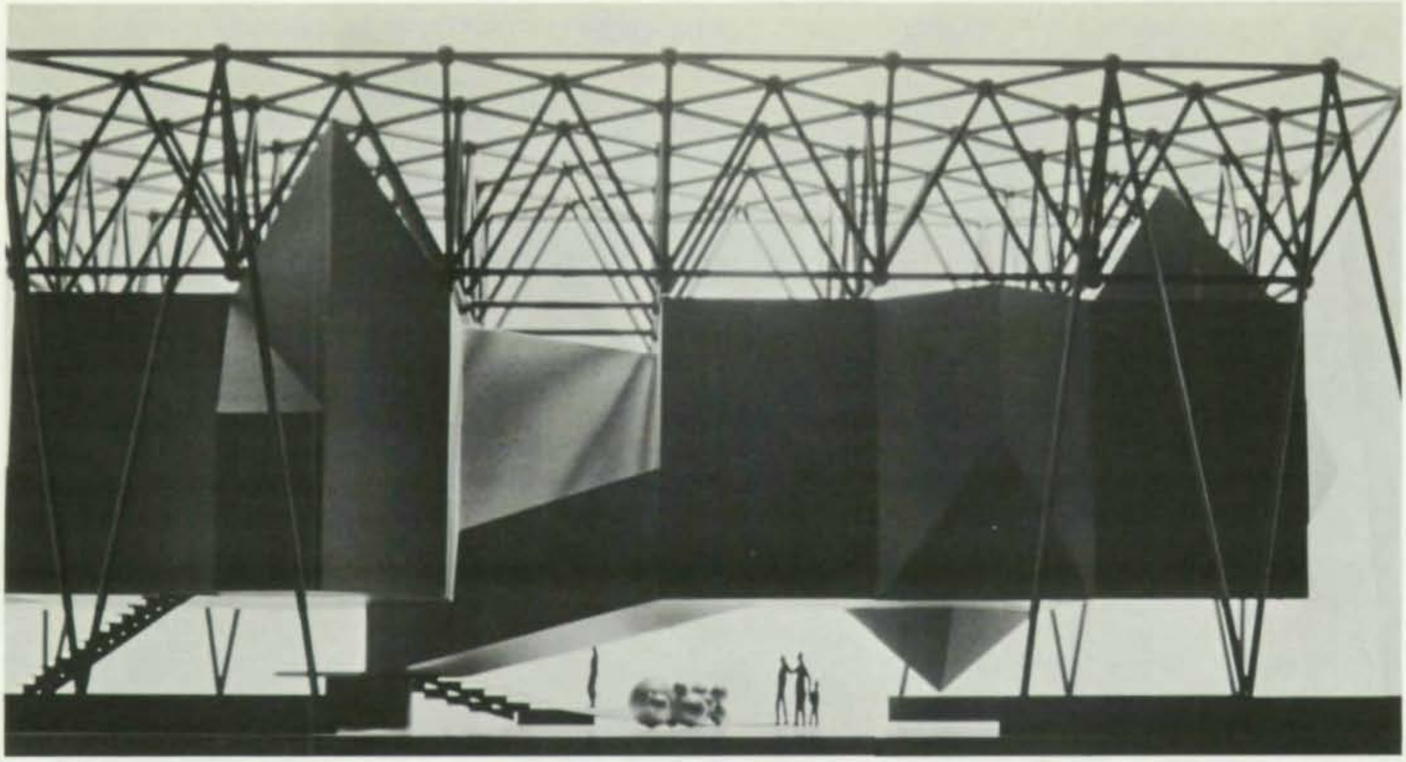


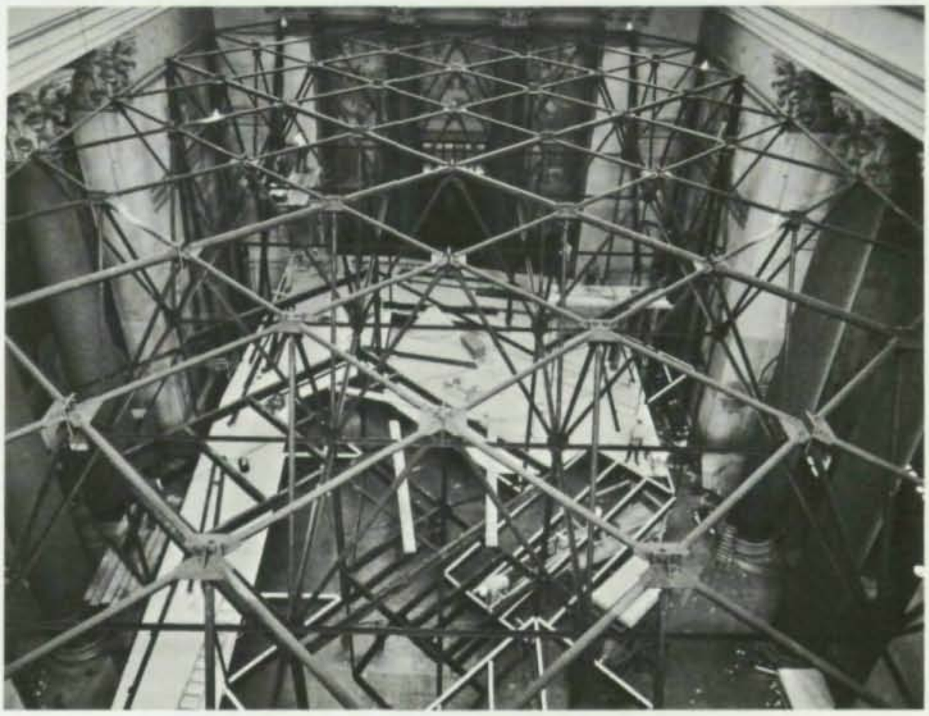
more modest Georgian-type residences located in the area.

The central unit of the residence is flanked by north and south wings connecting outbuildings or dependencies located at some distance from the central unit. The south dependency houses the State Dining Room, Reception Hall, and modern kitchen facilities. The north dependency encloses the residential services and garages.

The interior treatment of the major rooms, stair hall, and fireplaces is typically Georgian in the character of various architectural motifs. Included here are the familiar mantels and overmantels with crosslets, paneled dados, and fully-paneled doors — all to be found in the best examples of Eighteenth Century mansions.

The materials, the craftsmanship and the systems used throughout the edifice were skillfully combined to create a Governor's residence which not only utilizes the latest technology, but preserves tradition as well.





Space Frame For An Exhibit

The large clear-span space frame from which the Centennial Exhibit, of The American Museum of Natural History, "Can Man Survive?", will be suspended is the first of its kind in the United States. It was brought here from Japan by Dr. David Geiger of Columbia University, engineering consultant to Dimensional Communications of Paterson, N.J., designers and builders of the exhibit.

The truss, now being installed in Roosevelt Memorial Hall of the 100-year-old Museum, costs $80,000 and weighs 50 tons. Overall cost of the exhibit is about $700,000, overall weight 110 tons. The exhibit is 110 ft long, 62 ft wide, 45 ft high.

The Takanaka truss has application to many kinds of large, steel-framed buildings such as convention halls, theaters, field houses or any space with up to a 600-ft span. It is supported only at the perimeter of the structure. When used as a structural element, it offers savings both in materials and cost.

Numerous buildings in Japan have used the new construction, which is patented in Japan but not in this country. It is usually employed as a roof truss or as part of a floor framing system.

Erecting the truss inside an existing building, as at the Museum, is much more complicated, and, of course, more costly. Gordon A. Reekie, Chairman of the Museum's Dept. of Exhibition and Graphic Arts, and Joseph Wetzel, Vice President of Dimensional Communications, are supervising the installation.

The "Can Man Survive?" exhibit is a highlight of the year-long Centennial celebration and will open to the public on April 11, 1969.

21ST ANNUAL AISC NATIONAL ENGINEERING CONFERENCE 1969

MAY 8, 9, 1969 • THE SHAMROCK HILTON • HOUSTON

Eminent authorities on design, construction and contemporary research in steel will gather in Houston May 8 and 9 to exchange ideas with leaders in the fields of architecture and engineering. This conference will provide comprehensive information on many new aspects of building design. It is a "must" for any one who designs structures.

Program Highlights

REDUCING THE COST OF BUILDING CONSTRUCTION

HIGH RISE APARTMENTS Charles S. Le Craw, U.S. Steel Corp.

NEW WELDING TECHNIQUES A. L. Collin, Kaiser Steel Corp.

DESIGN FOR ECONOMICAL FABRICATION John F. W. Koch, International Steel Co.

THE HARTFORD SCHOOL PROGRAM — DESIGN TEAM APPROACH
James R. Cagley, Caudill, Rowlett and Scott

RESEARCH — PATH TO PROGRESS

HEAT CURVED GIRDERS — SPECIFICATION DEVELOPMENTS Richard S. Fountain, U.S. Steel Corp.

EXPOSED STEEL FRAMING ON HIGH RISE BUILDINGS Anthony F. Nassetta, Weiskopf & Pickworth

AISI EARTHQUAKE RESEARCH L. H. Daniels, Kaiser Steel Corp.; I. M. Viest, Bethlehem Steel Corp.

MOMENT-ROTATION CHARACTERISTICS OF SHEAR CONNECTIONS
D. J. Laurie Kennedy, University of Toronto

PUSH-UP STEEL CONSTRUCTION Robert J. Hansen, Massachusetts Institute of Technology

DEVELOPMENTS IN STEEL DESIGN AND CONSTRUCTION

A COMPARATIVE ANALYSIS OF HIGH RISE STEEL OFFICE BUILDINGS
J. T. Jacobsen, Bethlehem Steel Corp.

DESIGN AIDS FOR END PLATE MOMENT CONNECTIONS David Baker, Dalton-Dalton-Little

PLASTIC DESIGN BY COMPUTER George C. Driscoll, Lehigh University

AN INDUSTRIAL PARK Craig Ellwood, Designer

MADISON SQUARE GARDEN J. A. Sterner, Bethlehem Steel Corp.

AISC PROGRAMS

QUALITY CRITERIA AND INSPECTION STANDARDS John K. Conneen, Bethlehem Steel Corp.

THE 1969 AISC SPECIFICATION REVISION T. R. Higgins, American Institute of Steel Construction

THE AISC STEEL CONSTRUCTION MANUAL — 7th EDITION
Mace H. Bell, American Institute of Steel Construction

THE AISC COMPUTER DESIGN AID PROGRAM
Frederick J. Palmer, American Institute of Steel Construction

Special Ladies' Program — Field Trip to the Astrodome — Reception and Banquet

Contact AISC, 101 Park Avenue, New York, N. Y. 10017 for information about registration

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
101 Park Avenue • New York, New York 10017

Address Correction Requested

BULK RATE
U.S. POSTAGE
PAID
DANBURY, CONN.
PERMIT NO. 97