VOLUME XXIII NUMBER 4/FOURTH QUARTER 1983

MODERN STEEL CONSTRUCTION

Steel Key to Tudor-Gothic Revival
A Break *for* Tradition
Computer Promises Fire Test Savings
Rack-Supported for Function/Design
A School for Today—and Tomorrow
1983 AISC Architectural Awards Winners

DECK DESIGN DATA SHEET

NO. 3

DESIGNERS CHECK LIST FOR DECK

Composite Floor Deck

☐ Check fire rating requirements.... Designs Dxxx in U.L.
☐ Check relative costs of lightweight and normal weight concrete.
Note: Light weight concrete can usually fulfill fire rating needs with thinner slabs.
☐ Check pour stop requirements—see Deck Design Data Sheet No. 1.
☐ Check hanger requirements—for ceilings, ducts, pipes, etc.
☐ Check maximum unshored spans to select deck gage and pattern.
Note: It usually costs less to have unshored construction.

Cellular (electrified) Floor Deck

☐ Check fire rating requirements... Designs Dxxx in U.L.
Note: If floors are to be accessed for electric power (and/or telephones) and a fire rating is required, then the deck must be 'fireproofed'; therefore a 2.5" cover of concrete (over the top of the deck) is usually chosen. Galvanized steel is always required for cellular deck.
☐ Check to determine which blend of cellular and non cellular deck will provide the needed wiring... blending of units saves money.
☐ Check load requirements in the trench header spans. Since the trench header interupts the slab, the loads must be handled by:
(1) shortening the deck span that carries the trench; or (2) increasing the deck gage; or (3) reinforcing the slab as a cantilever on each side of the trench; or (4) placing the trench over (or close to) a beam; or (5) a combination of any of these methods.

Roof Deck

☐ Check fire rating requirements... Designs Pxxx in U.L.
☐ Check loads for:
(1) snow drifting; (2) additional dead load from ballasted roof systems; (3) maintenance loads... use SDI criteria.
☐ Check any other insurance requirements such as Factory Mutual.

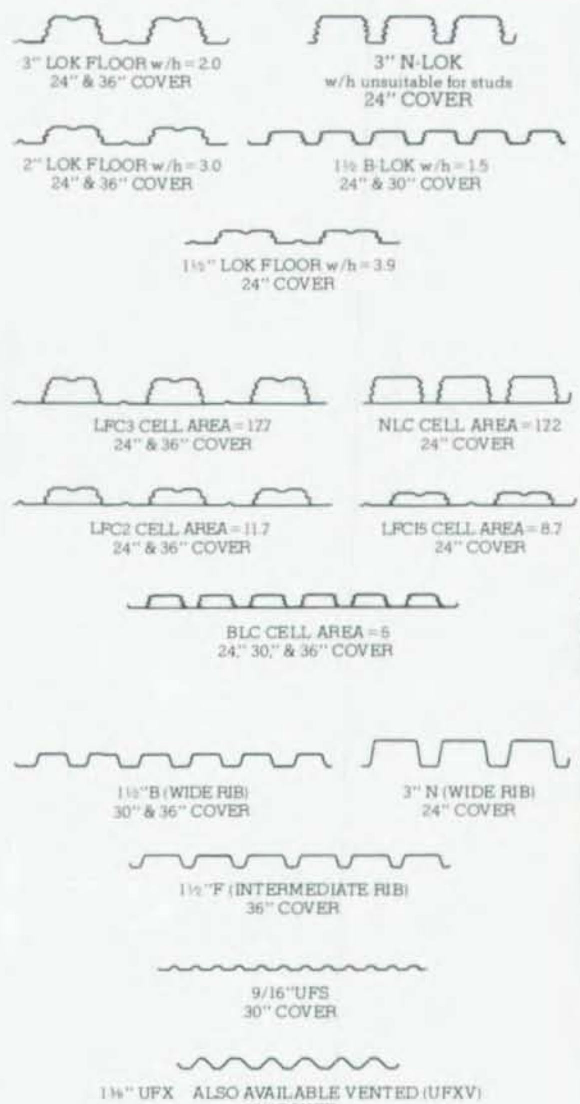
Form Deck (Centering)

☐ Check fire rating requirements... Designs Gxxx in U.L.
☐ Check requirements for finish. (If deck is galvanized it will last the life of the structure and will always carry the slab weight; if the deck is uncoated the slab should be reinforced to carry the slab weight as well as the live loads.
☐ Check venting requirements if the deck is supporting an insulating fill... always use galvanized deck for this purpose.

All Deck

☐ Check material specifications. The proper specification for galvanized steel is ASTM A446; for steel that is to be left uncoated or painted (but not galvanized) the ASTM specification is A611; minimum acceptable yield point of steel is 33 ksi. The proper specification that covers the galvanized coating is ASTM A525.

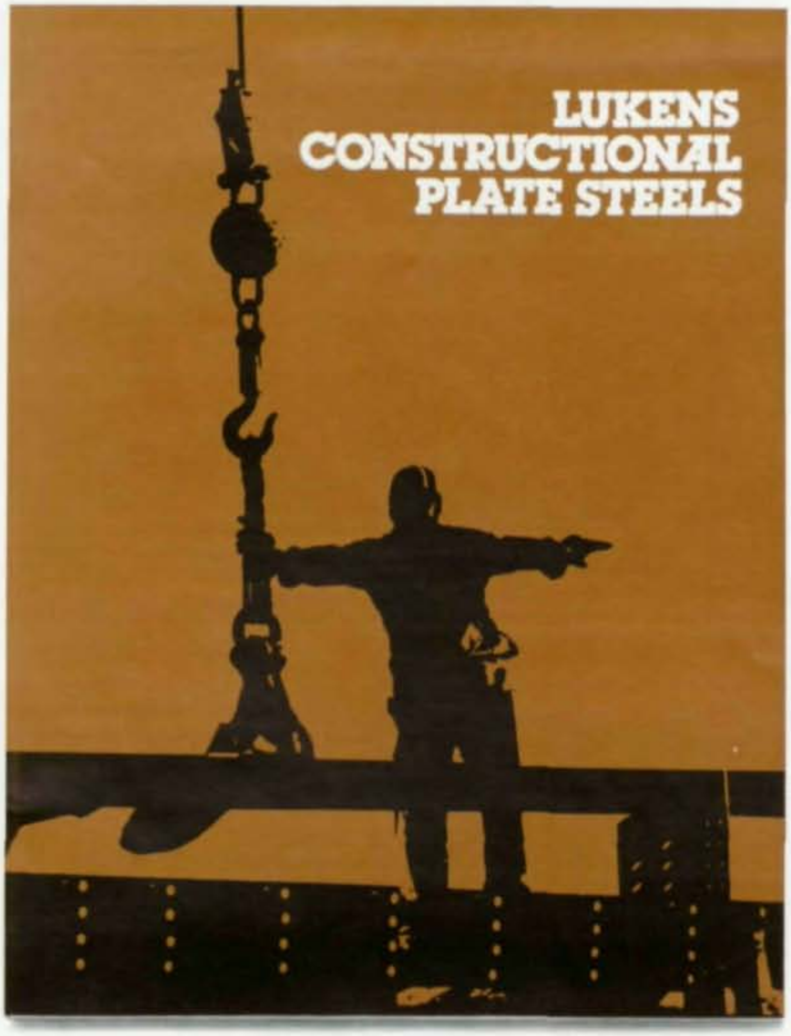
United Steel Deck Inc. Profiles



☐ Check Nicolas J. Bouras, Inc. for any deck information—prices, delivery, design data.

NICHOLAS J. BOURAS, INC.
P.O. BOX 662, 475 SPRINGFIELD AVE.,
SUMMIT, NEW JERSEY 07901 (201) 277-1617

USD · ASSOCIATE MEMBER · MEMBER STEEL DECK INSTITUTE sdi



When it comes to constructional plate steels, we wrote the book. This current edition features Lukens' capabilities with regard to:

Sizes. Standard specification plates available in widths to 195," lengths to 1250" and thicknesses to 25." A size card shows details.

Specifications. Mechanical properties and chemistry of the various grades of steel most frequently found in bridges and buildings. Displayed in chart form.

Heat Treating. Offered on plates up to 890" long.

Stripped Plate. An alternative to universal mill *plate in applications such as fabricated bridge* girders. Produced in lengths from 120" to 1250," widths 12" to 48" and thicknesses ¾" to 12."

Lukens-Conshohocken. A rolling mill and shipping complex designed to meet your needs for light-to-medium thickness carbon plate and our Sure-Foot® safety floor plate.

Lukens Fineline.® A family of low-sulfur constructional steels particularly effective when used in fracture critical applications.

For your copy of this brochure, illustrated with photos of our facilities and our products in use, just fill out the coupon below.

LUKENS STEEL

Write right now.

LUKENS STEEL COMPANY
586 Services Building
Coatesville, PA 19320

Please send me a copy of your brochure, LUKENS CONSTRUCTIONAL PLATE STEELS.

NAME ____________________

TITLE ____________________

COMPANY ____________________

ADDRESS ____________________

CITY __________ STATE __________ ZIP __________

MODERN STEEL CONSTRUCTION

Published by

American Institute of Steel Construction
The Wrigley Building
400 North Michigan Avenue
Chicago, Illinois 60611

REGIONAL OFFICES

NORTHEAST REGION	
New York, NY (Hdq.)	212/695-4291
Boston, MA	617/329-7417
Philadelphia, PA	609/858-9354
Pittsburgh, PA	412/443-8840
NORTH CENTRAL REGION	
Chicago, IL (Hdq.)	312/670-2400
Detroit, MI	313/352-5558
Minneapolis, MN	612/888-3791
SOUTHEAST REGION	
Atlanta, GA (Hdq.)	404/458-7679
Charlotte, NC	704/541-0960
Tampa, FL	813/879-0429
SOUTHWEST REGION	
Dallas, TX (Hdq.)	214/630-5236
Houston, TX	713/270-6363
St. Louis, MO	314/721-1332
WESTERN REGION	
Los Angeles, CA (Hdq.)	213/444-4519
Denver, CO	303/831-4622
San Francisco, CA	415/495-3550
Seattle, WA	206/624-5460
AISC HEADQUARTERS	
Chicago, IL	312/670-2400

VOLUME XXIII NUMBER 4/FOURTH QUARTER 1983

CONTENTS

NEW FORMAT FOR 1984 NATIONAL ENGINEERING CONFERENCE

AISC's 1984 National Engineering Conference will be held in Tampa, March 28–30. In addition to its exciting location, a new format will make attendance a unique experience. The conference starts with a half-day general session on Wednesday afternoon. The session highlights the advanced computer-aided structural steel technology available, as well as AISC's research program aimed at advancing the state-of-the-art of structural steel design. The conference then switches to a seminar/workshop format for the next two days. Seven seminars run simultaneously, each aimed at a particular aspect of structural steel design and analysis where new information is available.

Because of the new format, seminar speakers will be able to go into sufficient detail so that engineers can apply the information immediately to day-to-day operations. The half-day seminars will be repeated four times so that each person can select a program to best fit his needs. Also, the format permits better dialogue with participants.

The program includes subjects of interest to practitioners in building and bridge design. But also, it will aid educators in updating design courses, and indicate to researchers what additional data should be developed. Plus, a seminar on suggested design and detailing procedures for connections should be of special interest to fabricators.

ENGINEERING FOR STEEL CONSTRUCTION SOON TO BE RELEASED

An all-new Engineering for Steel Construction is expected to be available by Feb. 1. Advanced material from Structural Steel Detailing *was combined with new material to create a brand-new text for advanced detailers and design engineers. Keyed to the 8th Edition* Manual of Steel Construction, *it contains design and detailing procedures for more complex connections and structures. A must for every designer's reference shelf. 320 pgs. (est). $52. See ad on pag. 12, or the enclosed Publications List for ordering instructions. Order now for early delivery!*

Mid-Continent Tower:
Steel Key to Tudor-Gothic Revival

by R. Keith Hinchey

The 50-year old Reading and Bates Corporation purchased the Mid-Continent Building in Tulsa in 1977. The recent surge in oil exploration brought about rapid expansion of their offshore drilling operations and a corresponding need for additional office space for their corporate headquarters. This 15-story, terra cotta-clad concrete-framed building, completed in 1918, was hailed as the world's tallest reinforced concrete building west of the Mississippi. Restoration of this classical Tudor-Gothic structure began immediately after the acquisition. Under the direction of HTB, Inc., architect/engineer, the old building once again became an important part of Tulsa's downtown and was placed on the National Register of Historic Places.

The 80-ft by 100-ft lot immediately east of the building has been used for parking over the years. An old rendering found in the archives revealed that a twin had been considered for this adjacent lot. The need for more office space prompted Reading and Bates to consider expanding the building.

The architect was again commissioned to study the needs and present several solutions which implemented both the existing building and the adjacent lot. An 80-ft by 100-ft tower proved inefficient, because such a large percentage of each floor was required for stairs, elevators, restrooms, mechanical, electrical and telephone chases.

However, it was determined if the building was 40-ft wider above the existing building for 22 floors no additional core space would be needed, and efficiency would be greatly enhanced. Since the 15-story building had not been designed to support any additional levels it would be necessary to support the portion extending over the existing building from the new tower.

After preliminary studies were made, structural steel trusses, two stories high, were selected to cantilever out 40 ft to carry the 16th to 37th floors. A framed tube of structural steel, 80 ft by 80 ft, was designed to resist all lateral loads on the tower and the entire weight of the cantilevered floors.

Mid-Continent Tower (top), Tulsa, Okla. Author R. Keith Hinchey shows model of tower (above) in juxtaposition with other buildings in background photo.

R. Keith Hinchey, P.E., is a senior vice president of HTB, Inc., Architects, Engineers, Planners, and Director of HTB Structures, Tulsa, Oklahoma.

Structural Frame Blends with Architecture

The decision was made by the owner and the architect to maintain the classic, historical beauty of the original building, with its delicately molded terra cotta exterior facade and to extend it to the top of the new 37-story tower. The existing building with its 20-ft by 20-ft basic column grid was divided into 10-ft wide panels around its perimeter by intermediate mullions of terra cotta between the large double pane tinted tempered glass windows which had replaced the original glazing during 1977 retrofitting of the historical landmark. Along with the intricately detailed spandrel sections, the width of mullions and column covering dictated spacing of all exterior columns—and at the same time limited their size. New floor heights matched the existing 11 ft for the first 15 stories, then were extended to 13 ft, 6 in. above the 16th level to more easily accommodate current requirements for contemporary offices and mechanical equipment needs.

The one-story high by 10-ft network of terra cotta thus produced an architecturally pleasing cover for a structurally efficient vertical and horizontal grid of steel columns and girders which form the framed tube.

The 80-ft by 100-ft new tower was placed immediately adjacent to the original 60-ft by 100-ft building, with the 80-ft by 80-ft framed tube set back one bay from the Fourth Street front wall. At the 16th level, the north wall of the new tower was pulled back one bay to the north line of the 80-ft deep framed tube section and cantilevered 40 ft westward over the existing building. This produced a 20-ft wide roof terrace for the dining rooms at that level along the north and west sides of the tower. The plan dimension of the tower becomes 80 ft by 120 ft from the 16th to the 36th floors. Another setback at the 36th floor results in a terrace extending around three sides of the executive suite to permit an unencumbered view of the entire city.

Above the executive floor are three levels of mechanical equipment rooms topped by cooling towers. A copper-clad steel tube grillwork encloses and screens the cooling towers, and tops off the standing seam copper cover for the truncated pyramid walls enclosing the mechanical rooms (see Fig. 1).

Lateral Forces Resisted by Framed Tube

Several factors were considered of great importance during selection of the lateral-force resisting system. First, the existing building is relatively rigid and would move very little due to lateral forces. At the same time, office layouts may have the joint between the buildings in the middle of a room. Therefore, little movement could be tolerated at the lower levels.

Secondly, the owner was very specific about his requirements. Comfort was very important. Excessive amounts of sway or periods of oscillation which could be felt by building occupants would not be acceptable.

A third factor which influenced selection of the type of structural frame is the large amount of torsion induced by north-south winds on the cantilever section of the building. The line of columns in the tube, which is immediately adjacent to the existing building, resists two-thirds of the total wind load on the building. Therefore, these columns are proportioned for both axial load and to minimize drift. Thus, the frame is very stiff. Other frames in the tube were adjusted so that the north-south deflections of each frame are about equal. The framed tube design was chosen because of its ability to respond to all of these factors.

The monograph recently published by the ASCE on *Planning and Design of Tall Buildings* presents a comparison of structural systems with respect to the height of the building. Also discussed in this reference are drift limitations used by the profession. Exterior framed tubes serve well to resist lateral forces up to 85 stories if the height-to-width ratio is not too great.

The framed tube for the Mid-Continent Tower is 80-ft square, with a height of 530 ft and a corresponding slenderness ratio of 6.6 to 1.

Tulsa has adopted the BOCA Code, which requires graduated wind pressures for tall buildings. This building had wind loadings which varied from 14 psf to 48 psf at the top. The maximum computed lateral displacement at the 36th floor of 14 in. occurs with an 80-mph basic wind speed blowing from the east (opposite side of the cantilever) with full 80-psf live load on all floors of the cantilever. This is a drift ratio, Δ /H of 0.0022H. The range of normally accepted drift limitations in engineering practice is 0.0014H to 0.004H.

Interior columns were not designed to provide any resistance to lateral forces. They were sized only for axial load. Therefore, the compressive stresses in these columns approached allowable design limits, and consequently a computable amount of shortening was forecast. This contrasted to the relatively small amount of shortening expected in the framed tube columns, since the high bending moments caused by lateral loads resulted in large sections and low axial compression stresses.

To preclude a "dish effect" in the upper level floors, the interior columns were lengthened to account for the differential shortening, which would occur under dead loads, between the interior and tube columns. Concrete floors poured on the steel decking were uniformly flat.

The framed tube was fabricated in two-story high column and beam "trees" (see Fig. 2 and Photo 1). The beam splices at mid span consisted of bolted web plates which transmitted the shear and moment forces at that location in the beam. Flange splice plates were required at a few locations to resist calculated bending stresses which exceeded those that could be accommodated by the web splice plates.

These tree column-beam elements were made up of three plates welded together. Double-bevel partial penetration welds reinforced the web-to-flange connection in the vicinity of the beam connection. Elsewhere, automatic fillet welding accomplished the necessary force transfer.

The steel fabricator used specially designed hydraulically operated jigs to hold the steel in its dimensionally accurate position while temporary steel braces were attached. These braces kept the three-plate weldment in line during partial penetration and fillet welding. Full-penetration welds connected beam flanges to column flanges (see Photo 2). The electroslag welding process was used in this location due to the thickness of the plates to be joined. Some flanges were 2¾ in. thick. Thick copper backup bars were used on each side of the weld to permit easy removal and reuse.

Fig. 1. Copper-clad grillwork encloses mechanicals, tops off truncated pyramid walls.

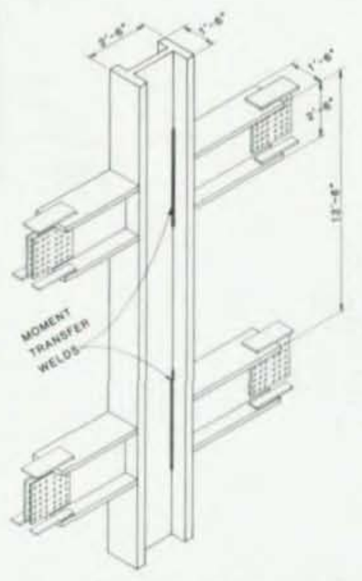


Fig. 2. Typical column-beam tree. Photo 1 (r., above) shows huge tree being hoisted. Photo 2 (r.) shows full-penetration weld necessary to massive structure.

Ordinary structural steels are not tested for yield strength in the Z-axis direction under ASTM specifications, and in certain use conditions can tear along the Z-axis if highly stressed. These failures are commonly called lamellar tears. When welded web stiffeners are installed in columns to transmit flange forces from girders through column sections, high Z-axis stresses are induced in the column flanges as the weld which attaches the stiffeners to the column cools. All columns were reviewed for stiffener requirements and the number of stiffeners minimized. Where stiffeners had to be installed, the connections were tested for lamellar tears.

Plates rolled to the thicknesses required for the columns and girders of the tower will have sections which are delaminated. Ultrasonic testing of the plates was necessary to assure that no delamination was present in the vicinity of the girder connection. Those discovered were repaired prior to fabrication, and retested.

In addition to the extremely high quality control fabricating procedures, carried out by the fabricator, United States Testing Company was employed to retest all shop welds. They also provided inspection and testing of the field erection procedures. Field welds were checked with ultrasonic and dye penetrant methods. Bolted connections were tested for proper tightness, using calibrated torque wrenches. Friction-type bolted connections were used on all of the framed tube and cantilever truss connections. Bearing-type connections were used for floor beam connections.

Column reactions that approached 6,000 kips required special base plates to transfer the load to the foundation. The large 28-in. by 30-in. columns were centered 18-in. from the face of the existing building. This restricted the width of the base plates to 34 in. Columns behind the elevator were further restricted to a 20-in. width so they would clear the shaft. Allowable concrete bearing stresses produced base plates which were 34-in. by 111-in. by 25½-in. thick; and 20-in. by 96-in. by 20-in. thick. Since the thickest plate rolled by American steel mills is 15 in., it was necessary to stack plates of two thicknesses to develop the required bending capacity. Fillet welds of the appropriate size were used to transfer the shear and bending moment from the upper to the lower plate. The upper plates were shorter than the bottom plates, resulting in a stepped unit. Three-inch dia. A449 anchor bolts with 8-in. square by 2-in. thick washers on the bottom end extend three feet into the foundation.

There is in excess of 6,300 tons of structural steel in the building. With the exception of the lower tier of columns next to the existing building, which is ASTM A42, all steel is ASTM A36. Since deflection and drift criteria were paramount, the reduction in size and weight, which could have been realized by using high-strength steels, was determined as undesirable.

200-Ton Steel Trusses Support Upper Tower

The upper 21 stories rest entirely on the five 200-ton trusses which extend through the framed tube at the 16th to 18th floors and cantilever 40 ft westward over the existing building.

Construction of Mid-Continent Tower is unique in many ways. But the owner's understanding of the importance of teamwork, gained through many years of constructing offshore drilling rigs, allowed the design, fabrication, erection and construction people to work together during the early planning stages to develop a design that was more constructable and more economical. Even the size and type of crane required to erect the structure was selected very early in the design phase. This provided information to the engineers for locating field splices in the large trusses. The largest piece lifted at one time—50 tons—was the top chord of one of the trusses. Splice locations were generally tension and compression only.

There are two truss designs for the building. The two exterior trusses include the vertical and horizontal members of the framed tube in addition to the diagonals required to improve their efficiency (see Fig. 3 and Photo 5). The three interior trusses are much heavier because two panels at the elevator lobbies and two panels at the stairs do not have diagonal members (see Fig. 4 and Photo 3). This results in large bending moments in the vertical and horizontal elements, requiring significant increases in section properties and steel weight.

New structure's position (Photo 5, below) shown next to existing building, without transferring any load. Workers (Photo 3, bott.) construct 200-ton interior truss which cantilevers over existing building.

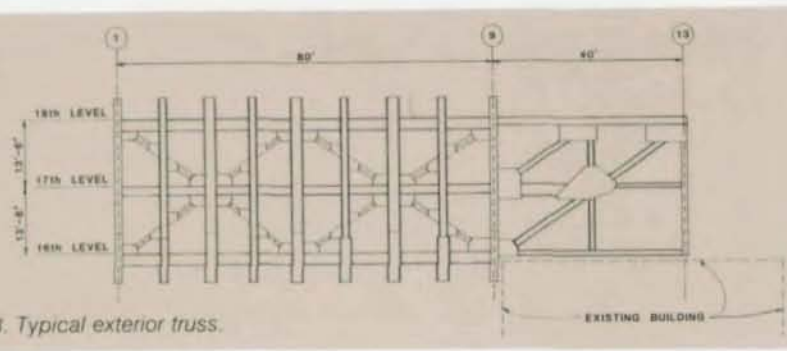


Fig. 3. Typical exterior truss.

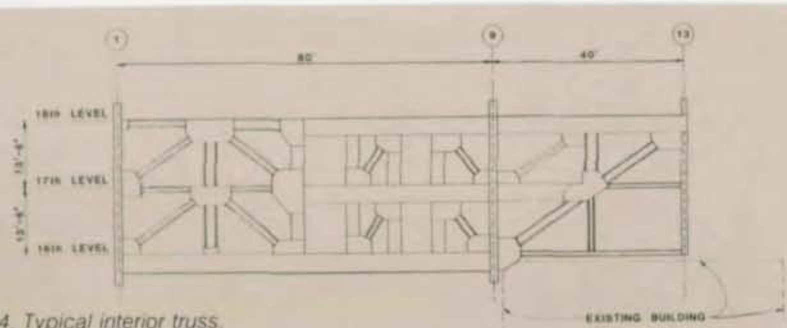


Fig. 4. Typical interior truss.

The elevators also set limits on the width of the two trusses which were on either side of the shafts. Careful calculations of the splice plate thicknesses, along with bolt head depth and the required amount of cementicious fireproofing, were other details of the design to clear the shafts.

Massive rolled sections transmit the enormous forces produced in the cantilever trusses. The main diagonal that extends to the end of the 40-ft cantilever from the 16th to the 18th floors is a W14x665 section. The connection of this diagonal to the bottom chord at the 16th floor is fabricated like a column with a base plate. This permitted the use of steel shim plates to adjust for the desired upward camber at the end of the cantilever.

The chord sections located at each of the three floor levels were required to resist much axial and bending stress. Working closely with the steel erector and the fabricator, the engineer designed a tube section made of thick plates which had superior properties to a wide-flange shape and simplified the bolted connections, which had as many 116 1⅛-in. dia. A490 F bolts at one joint (see Photo 4).

Seven columns bear on the top chord of each of the interior trusses. Two are on the cantilever, one at each of two support columns and three on the back span of the truss. They transfer all the loads from the 19 stories above the truss. The interior trusses are supported on only two columns, one at the spring point of the cantilever, adjacent to the existing building and one at the far east side of the building. The 15th-story columns were deleted between the support columns, making a truss with an 80-ft backspan and a 40-ft cantilever. This allowed much better deflection control at the end of the cantilever and also provided clear space on the 15th floor for an auditorium and racquetball court.

The maximum deflection at the west end of the cantilevered trusses when an 80-mph wind is blowing from the east and full live and all dead loads are in place was calculated to be 2.0 in. The bottom chord of the trusses is 12 in. above the top of the existing building.

Floor slabs, which serve also as diaphragms to transmit horizontal forces produced by torsion in the framed tube, are of 2½-in. hard rock concrete over 3-in., 20 ga. composite metal floor decking. Cellular deck units are inserted at 5-ft centers to provide total flexibility for electrical, communications, telephone and computer connections. The floor system provides the two-hour fire resistance rating required by the BOCA Code. All columns, beams and girders are sprayed with the amount of cementicious coating required to meet code.

Drilled Piers Used in Foundation

An extensive geotechnical investigation was performed by Mason-Johnston and Associates, Dallas, to determine the appropriate foundation system for this unconventional structure. Six core borings were extended to depths of 130 to 150 ft below street level. Drilled piers extending 130 ft below street level were used to support loads of over 6,000 kips through end bearing of 92 tons psf and side shear of 28 tons psf. Pier diameters of 4 ft, 0 in., 4 ft, 6 in. and 5 ft, 0 in. were required. Concrete for them had a compressive strength of 6,000 psi at 28 days.

All columns are centered directly over drilled piers with the exception of those on Grid 9 adjacent to the existing building (see Fig. 5). Since these columns are centered over the projection of the existing building spread footings, it was necessary to provide a transfer girder to spread the load to the new piers between the existing footings. The girder varies in width from 5 ft, 10 in. at the place where an 8 ft, 3 in. x 8 ft, 0 in. passageway is cut through to 2 ft, 4 in. where the elevator encroaches. The existing footing at the southeast corner of the existing building made it necessary to cantilever two transfer girders more than 7 ft, 5 in. in each direction to provide support for the heaviest loaded column in the entire structure.

Special consideration had to be given to the eccentricity between the center of the columns adjacent to the existing building and the center of the drilled piers. The columns are centered 1 ft, 6 in. east of the old building while the piers are centered 3 ft, 0 in. from the building. This 1 ft, 6 in.-eccentricity required the torsion-resisting buttress walls which extend eastward and are held down by the gravity load of the first interior columns and the massive weight of the 105-ft long, 4-ft dia. drilled piers.

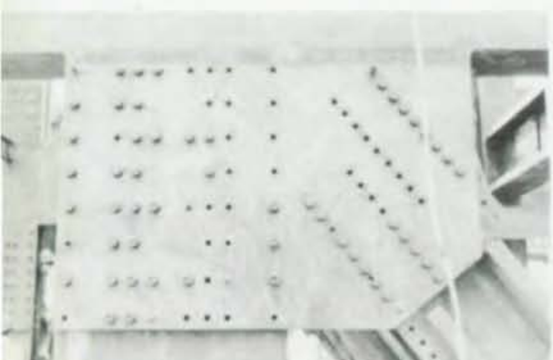


Photo 4. Closeup shows large bolted connection on interior truss.

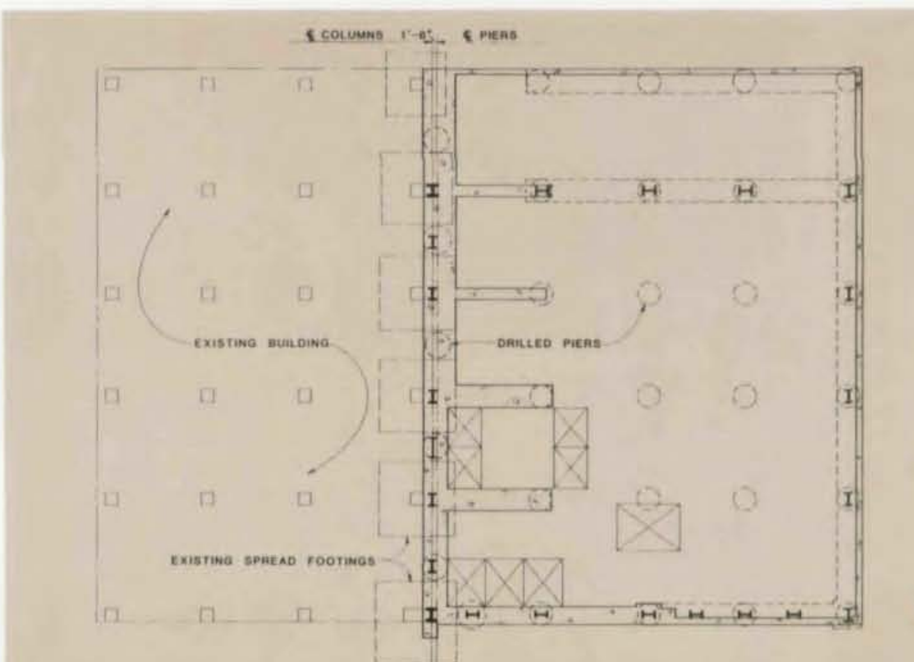


Fig. 5. Foundation plan

Terra Cotta—*Old Material, New Method*

During a period in the early 1980's, when buildings constructed at the turn of the century and clad in terra cotta were being demolished to make room for shining new reflective glass covered steel framed skyscrapers, it is truly unusual to find an architect and owner willing to enclose a high-tech building with terra cotta.

However, the owner had just completed the repair of their 1918 terra cotta facade, and liked its appearance. Therefore, the architect and the contractor set out to find a manufacturer capable of producing the 13,524 handmade pieces of oven-baked clay material, along with 71,446 pieces made by machine. Gladding and McBean, Lincoln, Cal. agreed to upgrade their production facility to meet the schedule of the fast-track course.

The material ordered, the next thing to do was to install it on the building so it would last for the next 100 years, thus eliminating major maintenance every few years.

Up until Mid-Continent Tower, terra cotta was installed on a structure, usually concrete, like the brick veneer on a house—except with a clay tile or block and plaster backup. This made a very thick, heavy and rigid wall system. The *thick* is good for energy conservation. The *heavy* is not so good on a 40-ft cantilever. The *rigid* could be risky on a nearly rigid structural steel frame. The cost of scaffolding 37 stories in downtown Tulsa was also a drawback.

One of the reasons that failures and deterioration of terra cotta have been so common is the nature of the material of which it is made. Clay naturally swells as it takes on moisture. When new terra cotta is placed on a building it is just out of a kiln, and as small as it will ever be. It will then begin to grow as rain and high humidity work their way into the joints and the unglazed portion of the clay shape. This is not detrimental to the wall covering until it is stacked 20 to 30 stories high, and a very small increase in size of each piece is multiplied many times. Then, it moves the top part of the facade far enough to shear off its anchorage, and major replacement must begin.

Eliminating the scaffolding could be done by using a crane to lift the pieces. Attaching many pieces together into a large panel would reduce the number of "picks" made by the crane. The question then became, "how do you fabricate terra cotta panels?"

The contractor teamed with Milcor Division of Inryco and GFRC of Texas to develop and test terra cotta panels connected together with stainless steel pins and tied back to cold-formed galvanized light gage steel channel frames with galvanized hooks (see Photo 6). Finally, the hooks were held in place and the terra cotta bonded into one large piece by packing and spraying with glass fiber reinforced concrete. After proper curing, the panels are turned over, backer rod removed from between the individual pieces and conventional mortar installed in its place while the panel is still in the fabrication yard.

The terra cotta panels are attached to the steel frame of the building in the same manner a precast concrete panel is: set screws at two places on the bottom for vertical adjustment and two adjustable tieback anchors at the top (see Photo 7). These connections are flexible enough to isolate the rigid terra cotta panels from any slight distortion of the building frame and thereby preclude cracking. Finally, the space between the terra cotta panels is filled with a compressible backer rod and a resilient caulked joint matching the mortar in the balance of the panel. Thus any small amount of growth during the life of the building will be absorbed in the caulked joint.

Effect of Wind to be Monitored

Wiss, Janney, Elstner and Associates installed a data acquisition system on Mid-Continent Tower to determine response of the structure to winds from various directions and at different speeds. The wind speed, direction and temperature will be monitored continuously by an anemometer mounted on a tower 60 ft above the roof of a building of similar height located across the street 150 ft away.

Wind pressure will be measured at pressure taps located on the centerline of each face of the building and at each corner of the building at elevations approximately one-half and three-fourths of the height of the building. The intent is to measure mean values which are effective over a large surface area, as opposed to local fluctuations. When the wind direction is aligned

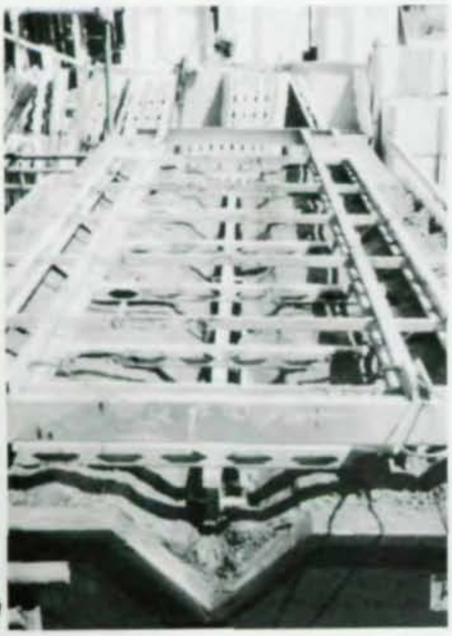


Photo 6 (l.). Inside face of prefab terra cotta panel shows backup system used to attach panels to structural steel frame. In Photo 7 (r.), one-story panels are attached to steel frame. Prefab technique was key to matching old and new structures.

with the building, the distribution of mean pressure on the windward and leeward sides can be estimated roughly from existing data. This distribution can be adjusted to the building using the measured magnitude at two elevations, and can then be used to determine the total mean wind drag. In a sense, the entire building is used as a wind velocity sensor, which may even prove more useful than the anemometer velocity reading. For certain wind directions there should be a very close relationship between the two measurements, i.e., pressure and velocity, which provides a means of checking the validity of both.

When measuring surface pressures on a large building, the problem of a reference pressure must be addressed. If the intent was to determine the wall loading, differential pressure transducers would be used to measure the difference in pressure between the exterior surface and that in the adjoining room. The interior or "reference" pressure may vary by several psf throughout the building, so that exterior pressures measured in this manner cannot be combined to determine a total building load.

A solution to this problem is the use of differential transducers, with plastic tubing connecting the reference ports of all transducers. The tubing system is linked to the open air of the instrument room, which then becomes the common reference pressure. This involves a lot of tubing installation, but also provides a very convenient means to check and calibrate all transducers simultaneously. The building response to the measured pressures and wind velocity will be recorded in the X and Y directions using the National Bureau of Standards optical device. This light source is installed in the service elevator at the 26th floor, with the receiver located in the same elevator pit.

Structural member strains will be measured on two columns, near their bases, which have high wind-load stress compared to dead-load stress. Four strain gages have been placed on each column so that bending moments and axial force may be distinguished. Temperature is measured at several locations, including inside and outside air temperatures, plus the temperature of the structural frame within the exterior walls. Four locations have been instrumented, at about the midpoint of each building face on the 27th floor.

The data acquisition system is operated in two modes: standby and active. Standby is the normal operating mode, which is in effect at all times. Its purpose is to provide temperature response and wind speed information, and to provide a trigger for switching to the active mode. All instruments, or channels, are monitored for a five minute period once each hour. The mean of the wind speed channel is compared to a predetermined threshold. When it is exceeded, the trigger will be tripped, sending the system into active mode. Initially the wind speed threshold has been set at 30 mph, but will be adjusted as data and experience are accumulated.

The active mode feeds detailed measurement information during high wind situations to the computer located in the instrument room. A Hewlett-Packard 9816 computer is programmed to assimilate the data and produce hard copy of the information received from each of the channels. A plot of movement in the X-Y plane of the 36th floor is also printed (see Fig. 6) from data sent from the NBS optical device. Acceleration, oscillation and other building responses are obtained following a complex data reduction procedure. It is possible to see the plot of the building oscillation on the CRT as it responds to wind pressures and temperature effects.

After three months of data acquisition, the assimilated information will be studied to determine if any response is exceptional to the design.

Deep-drilled piers, massive cantilevered trusses, a solid structural frame and Tudor-Gothic facade panels work in concert to successfully meet a stringent set of owner requirements and make the Mid-Continent Tower a distinct contribution to the Tulsa skyline. □

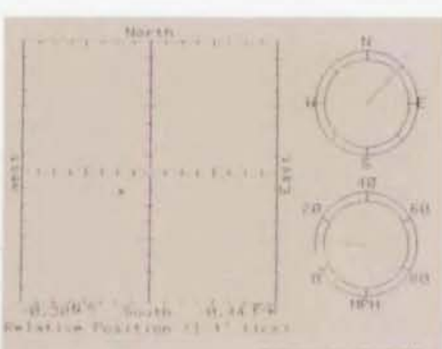


Fig. 6. Monitor system plot shows position of structure's top as related to bottom in center of graph. Wind speed is indicated on right. Composite Photo 8 (r.) shows Mid-Continent Tower in all phases of construction. Existing building is in bottom right-hand corner.

Architect
HTB, Inc.
Tulsa, Oklahoma

Structural Engineer
HTB Structures
Tulsa, Oklahoma

General Contractor
Flintco
Tulsa, Oklahoma

Steel Fabricator
Flint Steel Corporation
Tulsa, Oklahoma

Steel Erector
American Bridge Division, USS Corp.
Chicago, Illinois

Owner
Reading & Bates Corporation
Tulsa, Oklahoma

3/4" HIGH-STRENGTH LOW ALLOY STEEL

70 FT-LBS CHARPY @ − 50°F

IN SUB ARC WELDING, LINDE OFFERS YOU MORE.

If you're not thinking Linde for your sub arc operation, you're missing out.

Missing out on an array of exclusive products. Missing out on exclusive services. Missing out on a chance to make your job faster and easier.

HIGH QUALITY WELDS – COMPETITIVE PRICES

As developers of the submerged arc welding process, we offer you more of what you want sub arc for — from semi-automatic to multi-wire equipment systems with either tractor or manipulator mounting for higher productivity. We also offer a full range of power supplies, up to 1,500 amps. Each is equipped with the latest solid state controls and advanced features you need to assure consistent, high quality welds — all at competitive prices.

ONLY U.S. MANUFACTURER OF BONDED AND FUSED FLUXES

What's more, we offer the bonded fluxes you need for welding over the mill scale and light rust that is common to structural steel plate fabrication.

And we offer the fused fluxes you need to meet the special mechanical property requirements of vessels, pipe,

critical bridge members, machine parts, and ships. Their special resistance to moisture pick-up is added insurance against cracking.

In addition, we offer you a choice of 19 carbon steel and low alloy sub arc wires to match our 15 fluxes.

REGIONAL AND NATIONAL TECHNICAL SUPPORT

If you need back-up support, we're there to help. Linde regional and national technology together with knowledgeable distributors provide you with the industry's best resource to keep your operation running at peak efficiency — whether you need equipment, materials, or technical support.

Add it up for yourself. *More* systems. *More* fluxes. *More* wires. *More* service. It's no wonder more and more users are turning to Linde for all their sub arc needs.

FREE CATALOG

Send for our Submerged Arc Process, Equipment and Materials catalog. It's yours FREE! Write J. M. Bilderback, Union Carbide Corporation, Linde Division, Section R2, Old Ridgebury Road, Danbury, Connecticut 06817. In Canada contact Union Carbide Canada, 123 Eglinton Ave., East Toronto, Ontario M4P/1J3. Or contact your local Linde distributor.

LINDE
UNION CARBIDE

4 New BOOKS FROM AISC . . .

1

Manual of Steel Construction—Lightweight Edition—a go-anywhere traveling companion for field or business trips. Only half as thick—and half the weight of standard 8th Edition *Manual*. Yet complete in every detail! 832 pgs. $48

2

Detailing for Steel Construction (1st Edition, 1983). Brand new textbook geared to beginning detailer's needs. Comprehensive guide includes chapters on: Fabricating Techniques; Drafting Equipment/Procedures; Analysis of Stresses; Bolted and Welded Connections; Column Details; Framing for Industrial Buildings. 332 pgs. $32.

3

Torsional Analysis of Steel Members (1983). Text helps reduce computation time required for complete analysis of loading of structural members. Tables/charts solve torsion problems and investigate restraining effects of continuous framing conditions. 84 pgs. $16.

4

Engineering for Steel Construction (1984). Completely updated and keyed to advanced detailer or design engineer. Text covers suggested design procedures for more complex structures and connections. Soon to be released. (Jan.1984). $52.

Note:
Detailing for Steel Construction and *Engineering for Steel Construction* are self-contained texts—and have some common material.

American Institute
of Steel Construction
P.O. Box 4588
Chicago, IL 60680

Enclosed is $ ______ for the following books:

1/ ____ copies @ $48.—$ ____ 3/ ____ copies @ $16.—$ ____

2/ ____ copies @ $32.—$ ____ 4/ ____ copies @ $52.—$ ____

Name ____ Co. ____

ADDRESS ____

CITY ____ STATE ____ ZIP ____

Please include sales tax in NY, IL and CA.

Pacific Lumber Company: A Break *for* Tradition

by James E. Koentopp

James Koentopp, architect, is project manager, associate and manager of field services for Environmental Planning & Research, Inc., San Francisco, California.

Not so long ago, many of the designers of American office buildings broke with tradition and rejected architectural history and urban context. Up went the glass-and-steel towers of the International Style. Down went many smaller 19th Century buildings—some architecturally distinguished, some not. Often whole blocks were vanquished, and with them disappeared a particular sense of style and place.

Today, much of this has changed. Many architects have revolted against the Modernist revolution. And again they are embracing and preserving the historical context of this city core. Nowhere perhaps is this more apparent than in the recently completed design for the Pacific Lumber Company Building, San Francisco—truly a break *for* tradition.

In scale and materials, the eight-story, 120,000-sq ft structure responds directly to its architectural surroundings, the low-rise 19th-Century brick buildings in San Francisco's first historic district, Jackson Square.

A Good Neighbor Policy

The project partnership began when the client, located in San Francisco for more than a century, asked the architect to design a building for a site long used as a parking lot. Pacific Lumber specified that it wanted to be a good architectural neighbor in Jackson Square, once San Francisco's brazen Barbary Coast, and now an elegantly restored design showroom district.

After two years of working with the client, city officials and Jackson Square merchants, EPR developed a contextural architectural solution that reduces the new building scale in several ways. Angled setbacks at the third and sixth stories cut down bulk, while a small building module creates a sense of human scale. Within the module, the architect devised a faceted window configuration. This creates shadow patterns on the facade, strongly relating the new building to the rich, sculptural exterior wall treatments of nearby turn-of-the-century masonry construction.

Unusual Form

The building plan geometry begins at ground level as a square bisected by a diagonal walk open to pedestrian traffic. The separated areas are interconnected at the third, fourth and fifth floors by glazed bridges, resulting in arrow-shaped plans. The sixth, seventh and eighth floors are boat-shaped. This play of form also yields usable landscaped roof terraces at the third and sixth floors.

The introduction of the ground level walkway enabled the building tower to extend three stories above the prevailing height limits, yet fall within the prescribed bulk limits of the site. The Pacific Lumber Building thus creates a cityscape that moves gradually upward—from Jackson Square's two- and three-story brick build-

View of Pacific Lumber Company Building (l.) looking toward famed Telegraph Hill. Completed structural steel frame shown (r.).

ings, to the new building's eight stories—and on upward to the towers of the nearby financial district, including the Transamerica Pyramid. "The building relates to two contexts—one historical, the other contemporary," said EPR's president, Darryl T. Roberson. "What we have created here functions as a transition between architectural eras."

Trustworthy Steel Skeleton

The building, located in a highly active seismic region, is within several miles of the San Andreas Fault. Because of its unusual shape, a ductile moment-resisting steel frame was chosen to resist lateral seismic and wind forces. The frame members were sized in response to building code requirements and to a dynamic computer analysis simulating the modeled behavior of the structure during a seismic event. The exterior precast cladding panel types include vertical column covers, horizontal spandrels and on the diagonal faces, flat panels with "punched" window openings. Connection details were developed to allow for planar rotation of the panels while still resisting design forces.

Historic Setting

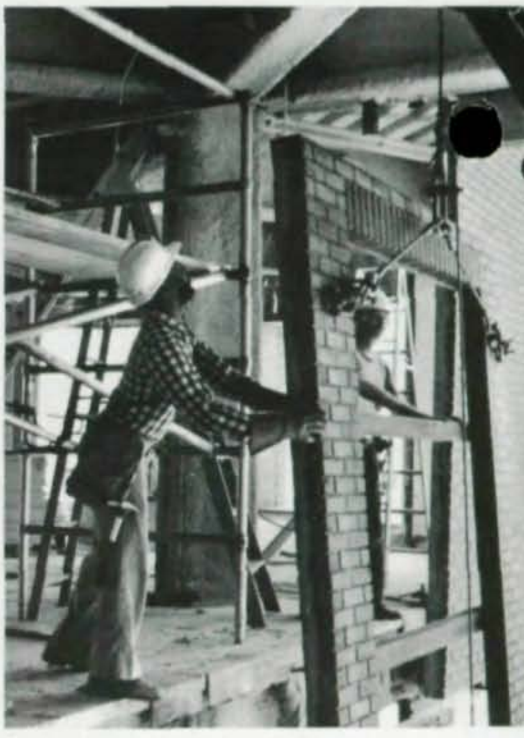
The choice of brick-faced precast concrete panels further enhances the building's relationship to its neighbors. The selected multi-hued bricks were manufactured in Colorado to blend with the brick facades of Jackson Square. The thin brick was hand-inserted into precast panel form liners which included a raised grid to simulate the brick grout pattern. Corner bricks were cut from full units to achieve integral returns. As a result, the glazing is held back over four inches to contribute to the strong play of shade and shadow on the facade. In addition, the glazing at most windows is faceted, both to increase the extent of shading and to introduce greater visual interest into the interior. The soffit and sill at the window recesses were integrally cast into the panel shapes.

The corner site at the base of a rise is underlaid by bay mud and landfill dating back to the Gold Rush. The supporting driven concrete pile foundation meets a plane of resistance ranging from 55 to 80 ft in depth. Sheet piles set back from the site boundaries were driven adjacent to the two existing, abutting historic structures to avoid interference with their foundations. The basement level, below the prevailing water level, was designed as a concrete tub, waterproofed where possible, and dewatered by two permanent wells.

A Redwood Showcase

The building has other noteworthy elements besides its contextural design. Brick is the key to its exterior; dramatic ornamental redwood is featured within its diagonal pedestrian walkway, on exterior decks and in the two-floor, 24,000-sq ft Pacific Lumber Headquarters. A 20-ft red-

Handsome interconnecting stairway and reception area.



Precast panel installed under floors spanning across walkway.

wood sculpture, by the noted New York Sculptor Linda Howard, is suspended three stories above the diagonal walkway. Space adjacent to the walkway contains 10,000 sq ft of retail facilities.

The building lobby is lined with redwood fashioned in an enlarged version of traditional v-joint plank paneling. For Pacific Lumber's fifth- and sixth-floor offices, EPR used the finest lumber from the client's mills to create a showcase for redwood. The glowing richness of redwood is featured throughout. Meticulous detailing and craftsmanship reminiscent of traditional wood usage are evident in the central staircase between Pacific Lumber's two floors, and in the adjacent reception area. Both rough and smooth finish boards are combined in the interior to create a subtle play of texture and light. □

Architect
Environmental Planning & Research, Inc.
San Francisco, California

Structural Engineer
Cygna Consulting Engineers
San Francisco, California

General Contractor
Swinerton & Walberg
San Francisco, California

Owner
The Pacific Lumber Co.
San Francisco, California

Steel's Computer Model Promises Fire Test Savings

by Richard G. Gewain

At a former Nike missile site in Gaithersburg, Md., steel industry research has moved another step toward a less costly, more accurate alternative to traditional methods of designing interior steel frames to meet fire code specifications. Three full-scale fire tests at the National Bureau of Standards indicate that a computer program, FASBUS II, may be used to predict the performance of steel framing systems exposed to fire—just as computers are commonly used to predict a building's resistance to wind and earthquake forces.

The tests, co-sponsored by NBS and American Iron and Steel Institute, with help from the Institute of the Ironworking Industry, involved building and instrumenting a $100,000, two-story, four-bay steel structure to represent a section from the middle of a 20-story building. In each test, one bay of the frame, below a composite concrete and steel deck loaded to 80 psf, was enclosed to serve as a fire chamber.

The goal was to verify predictions made by FASBUS II, a computer program developed by Illinois Institute of Technology Research and engineers Wiss, Janney, Elstner and Associates.

Code Acceptance to Cut Costs

While some test data has yet to be analyzed, preliminary results point to FASBUS II as an alternative to the American Society for Testing and Materials fire testing procedure, ASTM E119, long recognized by model codemakers and building officials. Code acceptance of FASBUS II, expected to take at least two years, will cut the cost of testing new building system designs. In some cases, it will also reduce the amount of fire protection needed, without sacrificing building safety.

In recognition of these preliminary results, ENR nominated the program's principal inventor, Boris Bresler, and AISI researcher David Jeanes, for its "Construction Man of the Year" award.

Meanwhile, the computer program is already being used on a new 42-story office building in Portland, Ore., where the local building official has agreed to accept a properly documented computer analysis to determine the thickness of protective material needed on the steel frame to achieve code-required two- and three-hour fire ratings. Early results show reductions in thickness, compared to that called for by traditional fire test standards, with potential savings as much as $100,000.

Other AISI-sponsored research has tested this "rational approach" to fire protection on exposed exterior steel framing, and has used computers to calculate the heat the combustibles in a building can unleash. But FASBUS II is the first computer design tool developed to calculate fire load and its effect on conventional steel framing.

40-Years of Research

AISI's fire research program began by collecting information on conventional fire protection. In 1944, the first edition of *Fire Protection Through Modern Building Codes* reviewed not only structural steel fire protection, but also the entire state-of-the-art in fire codes and standards. The book, in its current 1981 edition, remains one of AISI's most requested publications.

The next step was to start from scratch with an engineered approach to steel fire protection that could accommodate any new material or technology. In 1965, a Fire Technology Subcommittee began a formal research program to create a rational, analytical method for designing structural steel fire protection. Because of demand from designers, and available international research, the group started with a more limited goal: a mathematical model to fire-protect exposed, exterior structural steel. This model first appeared in the late 1970's under the name FS3 (Fire-Safe Structural Steel).

Full-scale burnout test at NBS simulates high-rise office fire. Early results confirm computer's ability to predict steel frame performance in a fire. U.S. Steel photo.

Meanwhile, AISI has published detailed information on protecting steel beams, columns and trusses—much of it based on sponsored research at Underwriters Laboratories, in Northbrook, Ill. Some of this research has dealt with a newer type of steel structure—lightweight studs and joists cold-formed from steel. A recent publication, *Fire Resistant Steel Frame Construction*, provides a summary of protection methods for all of these steel products, plus steel floor deck, ductwork and recessed light fixture enclosures.

Occasionally, the steel industry has challenged basic assumptions about fire behavior and severity. For example, statistical studies of parking structures, and full-scale burnout tests with real cars, established that open parking garage fires are rare, hardly ever affect more than one car, and almost never result in temperatures that could do structural damage. Today, enormous parking structures like the one at New York's La Guardia Airport use bare steel, with no reduction in structural or life safety.

Active fire protection, primarily through steel pipe sprinkler systems, has prompted different kinds of research. Recent tests at the National Bureau of Standards, for instance, have established more favorable friction factors for steel pipe—which is expected, in turn, to reduce the code-mandated size and water demand of steel sprinkler systems, and make them more economically attractive.

Steel's main concentration, however, has been on an analytical approach to fire protection of whole structures. The Fire Safe Structural Steel (FS3), a calculation method for fire protection of exposed exterior structural steel published in 1978, provides a step-by-step method for calculating needed fire protection. Based both on theoretical thermodynamics and actual fire experience, it interrelates room temperature, flame temperature and shape and the exterior steel's proximity to the fire, to determine whether or not steel temperature will remain safe.

As in structural design, if the steel is overloaded with heat, the designer can try several protection methods to lessen the load, such as moving the steel away from the flame, shielding or covering it or reducing the size of window openings. Ultimately, all these measures must result in a balance of heat gain and loss and a safe temperature, via the equation developed by Engineer Margaret Law, sometimes referred to as "Law's law." Model building codes increasingly accept the new method, and several buildings that use bare steel embody its principles. The list includes such famous European examples as Paris' Centre Pompidou, office buildings like One Liberty Plaza in New York and the U.S. Pavilion at the Knoxville World's Fair.

Generalize Analytical Approach

Building on the FS3 design method, and the 15-year body of fire research that preceded it (including full-scale mock-up fire tests such as U.S. Steel's for One Liberty Plaza), AISI's next step is to generalize the analytical approach to both interior and exterior steel design. A research project at Worcester Polytechnic Institute is extending the analogy with structural design, developing a complete theory of fire as a structural load. Heat transfer in building structures may, with the aid of a computer, become as understandable as the effects of snow or wind load.

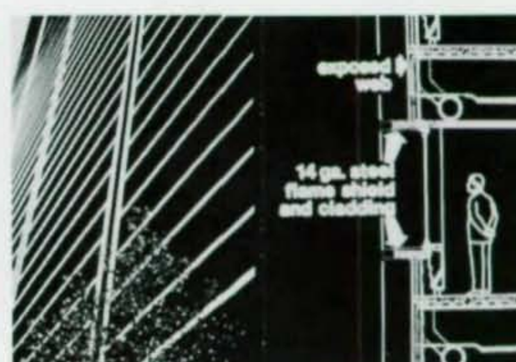
At the same time, the AISI/NBS project of David Jeanes, Boris Bresler and others is going after a less theoretical but essential objective: a reliable computer model of what happens to a steel-framed structure in a fire.

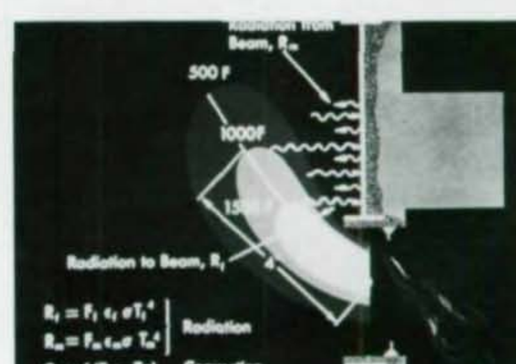
FASBUS II promises to provide the most direct solution to the problem that prompted AISI to launch its research program over 20 years ago: the time and expense of testing each new building system. The hoped-for result will be more economical and safer ways to build with all materials, in all types of buildings. □

Note: *We are indebted to AISI for permission to adapt this material.*

Richard G. Gewain is chief fire protection engineer, American Iron and Steel Institute, Washington, D.C.

Mockup for truss protection within a hotel wall erected for UL fire test.





Cutaway of One Liberty Plaza Building (r., top). FS-3 theory diagramed at right.

Fay's Drug Co. Warehouse: Rack-Supported for Function and Design

by Arnold A. Bitterman

Arnold A. Bitterman, P.E., is a partner in the architect/engineering firm of Sargent-Webster-Crenshaw & Folley, Syracuse, New York.

Planning for Fay's Drug Co., Inc.'s rack-supported warehouse in Liverpool, N.Y. began with defining the precise volume of material to be stored. The next step was to design the most effective arrangement of racks to meet those specific storage requirements.

Walter Frederick Friedman & Co., Inc., a materials-handling consultant, determined the precise number of pallets, pallet-loading positions and the storage racks' dimensions for proper interfacing with 40-ft high, swing-reach forktruck vehicles. Design and placement of the structure's super-flat concrete floor slab is critical to the proper functioning of these vehicles.

Sargent-Webster-Crenshaw & Folley designed the warehouse—227-ft long and 162-ft wide, with 8,000 pallet positions, two positions per shelf. The typical load height is 59 in. Cross-aisle ties accommodate a storage machine height of 47 ft 10 in., and an 8-in. clearance between the fully extended mast and cross-aisle ties.

Structural Design Requirements

The rack stucture was designed in accordance with the New York State Building Construction Code and the Rack Manufacturers Institute. The racks carry all live, dead, snow, wind, seismic and building

Typical end wall (l.) of Fay's Drug Co. warehouse, Liverpool, N.Y. Photo (r.) shows typical 4-in. structural channels, beams and columns. Photos by Klineberg.

loads; and in addition, the rack supports the roof deck metal siding.

Various loading combinations were considered to determine the governing forces. Three-dimensional "X" bracing was designed within the rack system to carry the entire imposed load from all directions and transmit them down to the superflat floor.

Design uniformity was required to ensure that the rack components could be easily bolted together using simple connections. Forces are uniformly distributed throughout the rack system; as a result, all 1,036 rack columns and three span beams are C 4 X 5.4 structural channels.

Allowable Tolerances

The rack system meets specified tolerances required to operate the swing-reach forklifts. Maximum width or length of structure accumulation does not exceed one inch in either direction, measured from the building's center line. The maximum upright frame height accumulation does not exceed ± 1/2 in. Vertical plumbness of uprights along the aisle is 1/8 in. in 10 ft, with a maximum of 1/2 in. Shelf beams have a maximum length of ± 1/16 in., and each shelf level does not vary ± 1/4 in. unloaded; variance between opposing shelves is less than 1/2 in. throughout the entire structure and maximum deflection for shelf beams is 1/4 in.

Cost Advantage

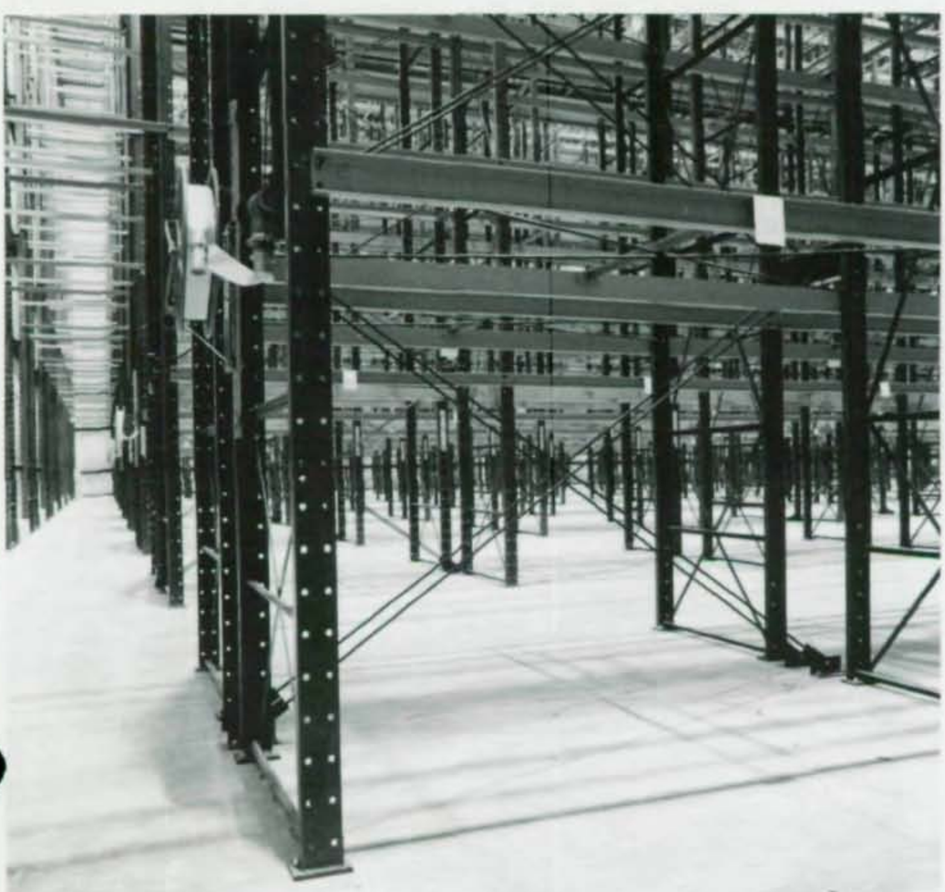
Although particular tax savings vary and must be confirmed by regional IRS offices, the rack-supported warehouse has a considerable tax advantage because it is classified as equipment. About 70 to 80% of the building can be claimed as machinery and, therefore, can be depreciated over five years as opposed to 15 years for conventional warehouses. Property cost tax savings are also achieved because a rack-supported structure uses less land than a conventional warehouse.

Architect/Engineer
Sargent-Webster-Crenshaw & Folley
Syracuse, New York

Construction Manager
Cleverly C. M. Associates
Syracuse, New York

Steel Fabricator
Hilton Steel, Inc.
Liverpool, New York

Owner
Fay's Drug Co., Inc.
Liverpool, New York



McMichael Middle School: A School for Today and Tomorrow

by Geoffrey Harrison

and

William Paxton

The old McMichael Middle School in Detroit, Mich., was over 50 years old. Lack of flexibility in the old building resulted in makeshift facilities for the new programs necessary to educate students with today's methods. With a rare opportunity to sell the old property in hand, the Detroit Board of Education was able to realize a replacement building having not only up-to-date program facilities, but also, and more importantly, the flexibility to grow and change in the future.

The new building reflects the board's philosophy toward the educational needs of today, with particular emphasis placed on facilities for specialized learning, the introduction of careers and vocational skill development. The school includes not only classroom space, but also special purpose spaces for homemaking, art, journalism, industrial arts, music and typing,

Geoffrey Harrison is chief designer for the architectural firm of Sims Varner and Associates, Detroit, Michigan.

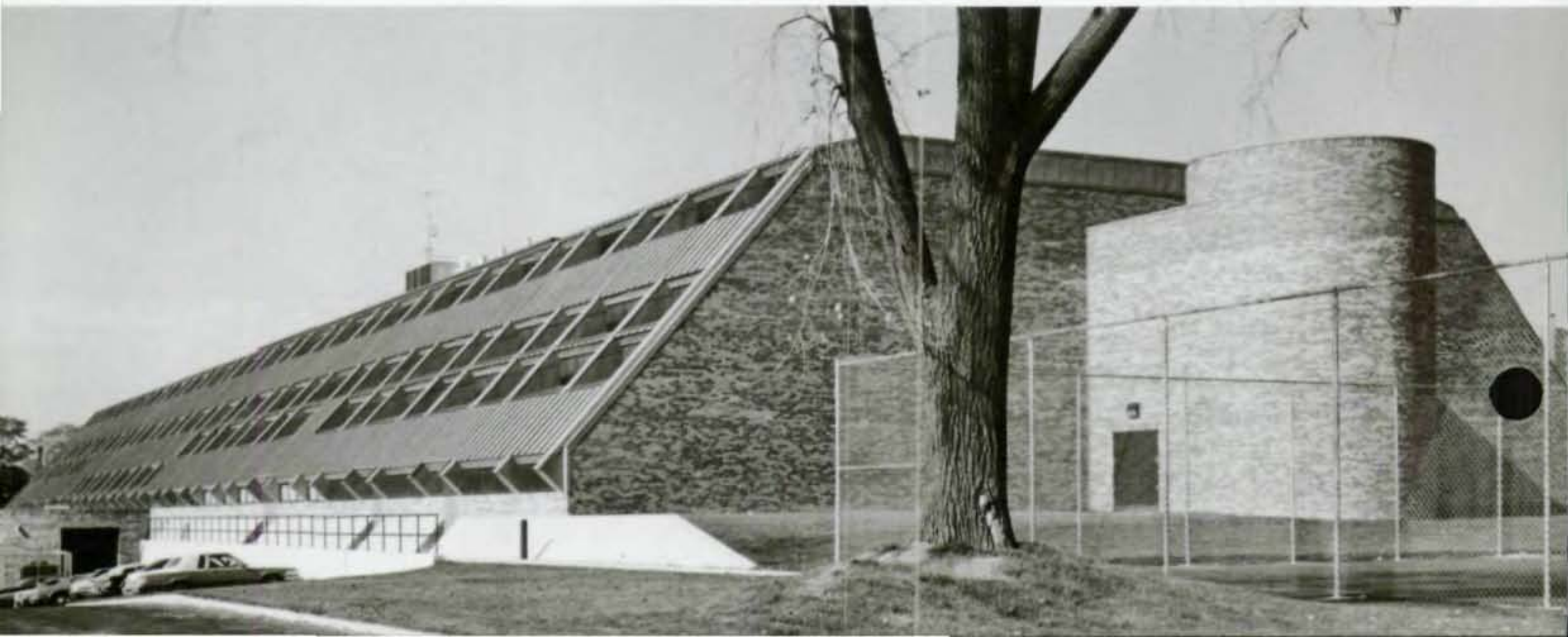
William Paxton is a principal in the structural engineering firm of William Paxton and Associates, Tampa, Florida and Detroit

plus a mathematics laboratory, an electronic teaching laboratory, a social sciences laboratory and three science laboratories. The library contains a suite with an audio visual facility, and a cafetorium combines dining with a stage for assembly use. The gymnasium provides for an auxiliary gym space. School services include administration facilities, a teacher work area and lounge, a health center and a base kitchen to serve eight schools. All of this is provided in just a little over 100,000 sq ft, with a capacity for 1,024 students in the three grade-levels served.

From Study to Reality

This project was founded in the national energy consciousness of the late 1970's. The architects undertook studies for the American Institute of Architects Research Corporation and HUD/DOE to provide data for establishing national standards for energy usage in schools. The studies showed that schools have two significant modes of energy usage: artificial illumination and cooling (related elements) when occupied; and heating when unoccupied. Energy usage of existing schools was analyzed, followed by the theoretical redesign of one using all conservation techniques available within the constraints of the building's function and budget. Simulation of the annual operation of the redesign (using the Axcess computer program) predicted significant energy savings. The Board of Education sought to test these principles in reality by directing the architects to construct a replacement building for an existing middle school, using the theoretical studies as a basis.

The primary principle of the design of McMichael Middle School is its use of daylight for natural illumination. Configuration of the building solves the problems of traditional school design without losing the benefits. Older school designs called for large, high windows for natural lighting, with the problems of uneven light and heat distribution, as well as heat loss in winter and while the school was unoccupied. Windowless schools had high illumination costs, as well as a negative reaction from occupants. The solution to these problems is to illuminate the classroom through two small strip windows, one low down to illuminate the front of the classroom, and one high up/set-back to illuminate the



McMichael Middle School (l., below), Detroit, is model of flexibility for future growth, energy consciousness and natural illumination for economy of operation. *See diagram on next page.*

back of the room. Studies developed a form which, for minimum window area, would give an even distribution of daylight throughout the depth of the classroom without glare or overheating near the windows. The windows also answered the problem of heat loss with their small size and insulated glazing.

Forming Energy Savings

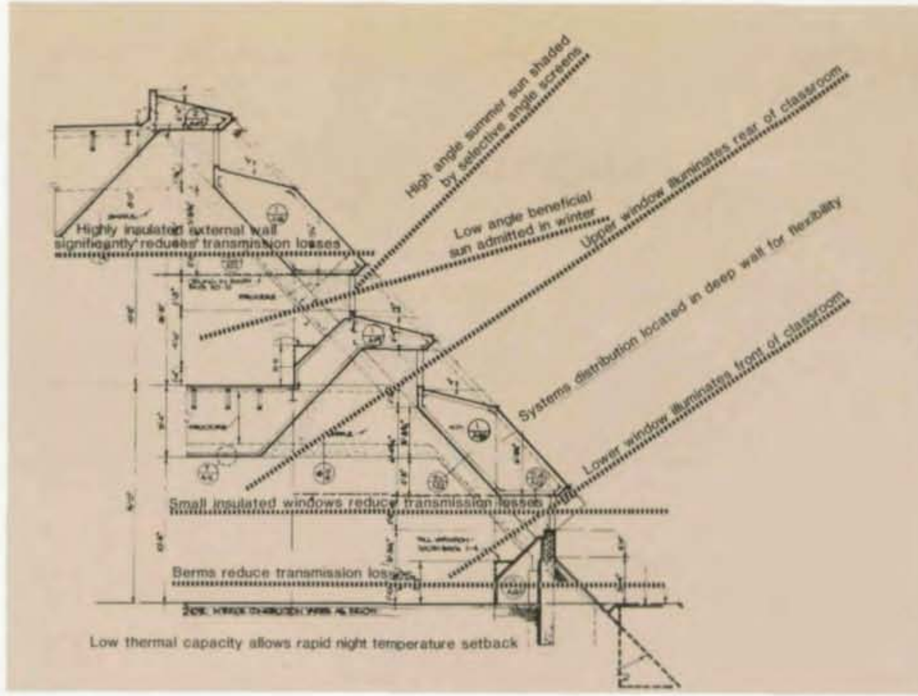
The twin-window form of the typical space arranged in a "deep" linear plan generated the form of the building. Studies showed that such a form reduced the surface-to-volume ratio, and thus thermal transmission losses when unoccupied or in winter. The linear form, desirable for control within the school, minimized the east/west exposures which are detrimental in a building with a significant cooling season.

The external envelope of the building was carefully developed to have the necessary characteristics for the pattern of energy usage in the building. For unoccupied and winter periods of heat loss, the lower level of the building was bermed. The lower floor containing kitchens and service spaces was built below ground. The main construction of the building allowed high insulation standards to be achieved. Construction and placement of insulation also produced an interior with a low thermal capacity to permit rapid cool-down when unoccupied, thus lowering temperature differentials with ambient and heat flow through the skin.

Introduction of windows into the design offered the opportunity to use solar energy for heating, when beneficial. Spaces were categorized by their occupant density, one of the major influences on the space "balance temperature." High-density spaces, with the maximum internal heat gains, require cooling even at low outside ambient temperatures. Not having the potential for significant use of solar heating, these spaces were located on the northern facade. The larger, less-dense spaces, shown to be capable of using solar heating during spring, fall and winter, were located with a southern exposure. To avoid solar heat gain in these spaces when detrimental, selective angular shading was installed on all south-facing windows, admitting low-angle beneficial sun, but shading detrimental high-angle sun during the cooling season.

Steel Framing Chosen

The form of the building, generated by the energy conscious design, posed both a challenge and an opportunity for the structural engineer. The requirement for flexi-



Cross section illustrates external wall energy conservation strategies.

bility dictated deep-span spaces. A structural system was conceived using a 25-ft primary building module. Large-span, truncated A-frame steel trusses supported on concrete buttresses at ground level, in turn, support the deep spandrel trusses which form the framework of the external wall. Budget studies showed that use of the structure directly as wall framing offset the cost of the unique structure and ensured compliance with the project's cost plan.

Main roof members span 40 ft on the horizontal using a 4-ft deep welded truss, then bolt in the field to a 5-ft deep, 35-ft long sidewall truss sloping at a 15/16 bevel. The truss system, using WT12 sections for the chords and angle framing for the web, spans a total of 63 ft 4 in. from the center column row to the perimeter abutment.

The second floor is supported by 50-ft long, 4-ft deep trusses spanning from the center column to the bottom chord of the sloping sidewall truss. The floor is comprised of 25-ft long steel bar joists spanning between floor trusses, spaced at 2-ft 6-in. centers. Three-span galvanized metal formdeck 15/16 in. deep carries a 3-in. concrete slab reinforced with welded wire fabric.

The roof has conventional bar joists at 5-ft centers with a 1½-in. metal roof deck. A mechanical penthouse, 250 ft long by 30 ft wide, is centered on the building. It is framed with wide-flange beams for the floor and bar joists for the roof. At the penthouse location, the center column row is moved 15 ft to either side, with a corresponding decrease in length of the floor and roof trusses. A 90-ft long truss replaces these columns along one section of the south side to create a 90-ft x 90-ft column-free space.

Spandrel trusses of light channels and angles span the sidewall trusses to frame window openings, sun shielding, mechanical spaces and support for the curtain wall. The exterior facade, a zinc metal surface called Microzinc, is attached to a plywood backing covered with 30-lb. felt. Behind the plywood is R-19 fiberglass insulation and a drywall interior surface.

Efficient Design—Today and Tomorrow

Many design considerations were interwoven to arrive at the final design. The emphasis on energy consciousness, combined with functional and aesthetic criteria for the project, produced a stimulating environment for students. Planning of the building, with compact form and deep space, produces the flexibility needed for the school to function efficiently today—to adapt to tomorrow. □

Architect
Sims Varner and Associates, Inc.
Detroit, Michigan

Structural Engineer
William Paxton and Associates
Tampa, Florida and Detroit, Michigan

General Contractor
Etkin Johnson and Korb, Inc.
Oak Park, Michigan

Owner
Detroit Board of Education
Detroit, Michigan

1983 AISC Architectural Awards of Excellence

The 1983 Architectural Awards of Excellence have been presented by AISC to the designers of 13 structures judged technically and aesthetically the most outstanding—and whose design used fabricated structural steel to its maximum advantage. The 13 were chosen by a widely respected jury from a record 169 entries.

The awards were presented November 1 in Chicago at AISC's Third Annual Awards Banquet. Leading architects, structural designers, developers, contractors, steel fabricators and suppliers to the construction industry gathered to recognize the architects responsible for the design of the winning structures.

Plaques adapted from the Joe Kinkel-designed bronze sculpture, "The Long Reach," were presented by John H. Busch, chairman of the board of AISC, to representatives of the winning firms. The sculpture symbolizes steel's contribution to all Architectural Awards of Excellence and Prize Bridge Awards given by AISC. Here are the winning structures:

THE JURY OF AWARDS

GUNNAR BIRKERTS
FAIA, Principal, Gunnar Birkerts & Associates
Birmingham, Michigan

STANLEY D. LINDSEY
President, Stanley D. Lindsey & Associates
Nashville, Tennessee

GEORGE M. NOTTER, JR.
FAIA, President, Anderson Notter Finegold, Inc.
Boston, Massachusetts and President, AIA

WAYNE R. BISHOP
AIA, Vice President of Design, Ellerbe Associates
Minneapolis, Minnesota

GEORGE SCHIPPOREIT
AIA, Chairman, Department of Architecture,
Illinois Institute of Technology, and
President, Schipporeit, Inc., Chicago, Illinois

"The Long Reach"—a single-edition bronze by Sculptor Joe Kinkel. Winners receive a bas relief of the original sculpture which is displayed at AISC's Chicago headquarters, along with engraved names of AAE and Prize Bridge Award winners.

PRUDENTIAL INSURANCE CO.
Western Home Office

Westlake Village, California

Set in the excavated saddle of an existing hill site, this 400,000-sq ft structure employs natural lighting as a strong design consideration. An atrium provides long-range flexibility and a visually pleasant circulation area. Steel-framed open stairways provide a sculptural-structural element for the exterior. Detailing and fabricating exposed steel trusses over the central atrium were critical to maintaining alignment on an east-west axis while accommodating a 45° offset.

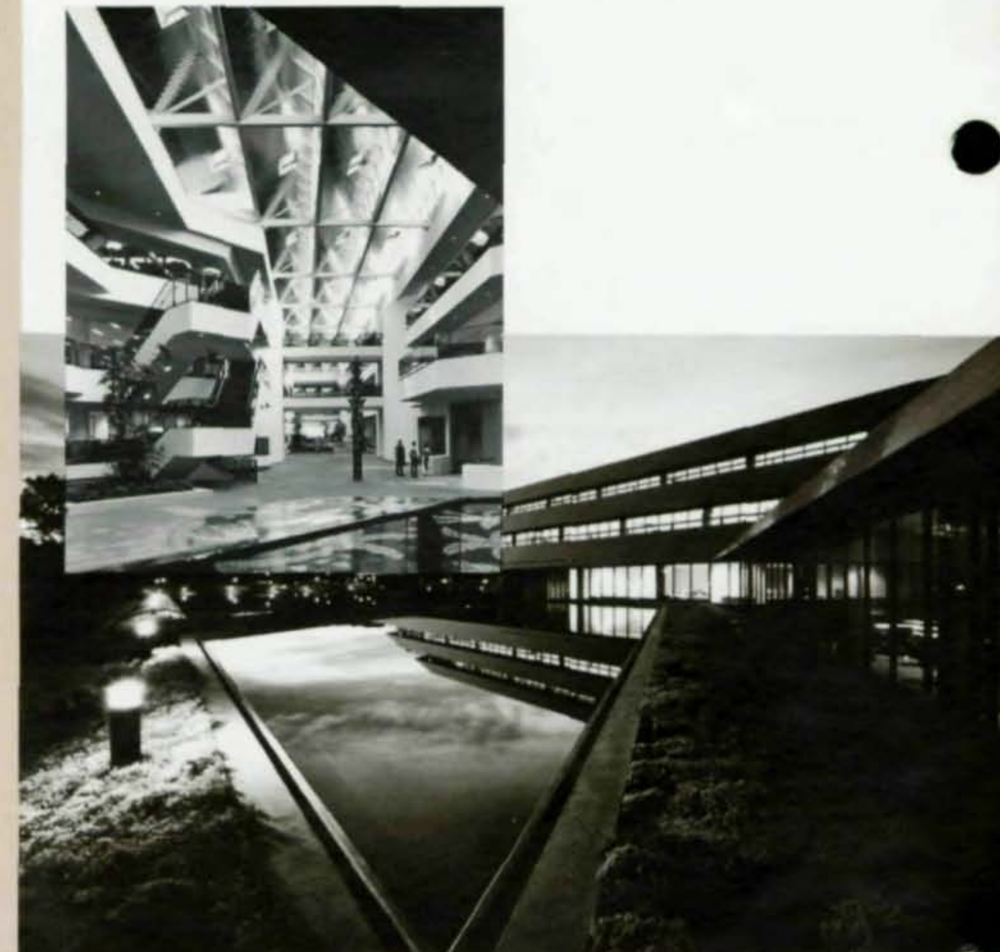
Jurors' comments: *"Exceptionally well-sited and very refined . . . a highly qualified building because of its quality of detail."*

Architect/Structural Engineer
Albert C. Martin and Associates, Los Angeles

General Contractor
Robert E. McKee, Inc., Los Angeles

Steel Fabricator/Erector
Central Industrial Engineering Co., Santa Fe Springs, California

Owner
Prudential Insurance Company, Westlake Village, California



THOUSAND OAKS LIBRARY

Thousand Oaks, California

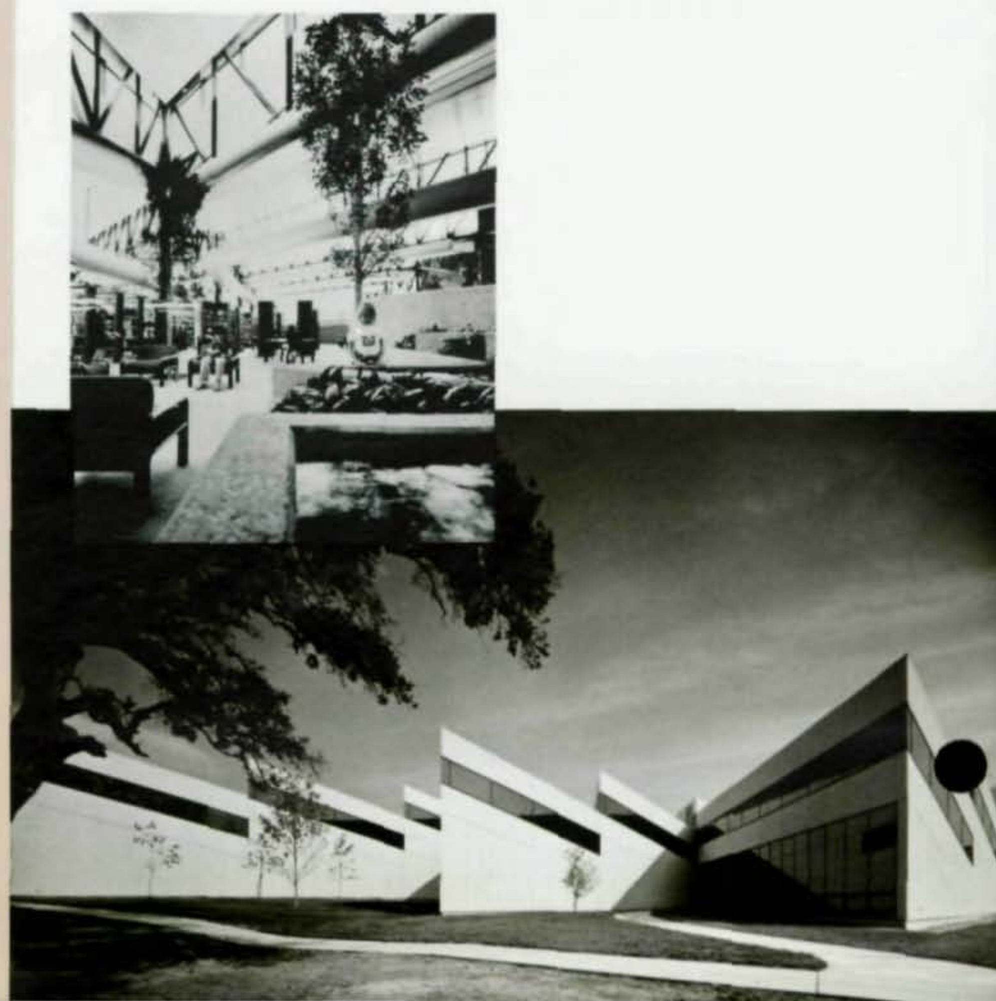
A single story structure to house support library functions and public meeting facilities, with interiors to be flexible and easily expandable. Materials were to be durable and maintenance-free. Design was to be innovative, environmentally sensitive to its 44-acre park site and energy conservation measures were to be a serious consideration. The result: a large (56,000-sq ft) relatively column-free library provides numerous layout options with its non-load bearing walls. Exposed, light structural steel framing proved most appropriate for this Type V construction. The seismic steel structure, of modules that were built off-site, boasts a long-span system for flexibility and ease of expansion.

Jurors' comments: *"Well sited! Very expressive on the exterior, it integrates energy into its structural quality. To a certain extent, the structure is expressed on the outside through its basic materials. An excellent sculptural form. It has a personality."*

Architect/Structural Engineer
Albert C. Martin & Associates, Los Angeles

Construction Manager
Turner Construction Co., Los Angeles

Owner
City of Thousand Oaks, California



ALLIED BANK PLAZA

Houston, Texas

Quality, slenderness, gracefulness, a building of human scale, were some of the requirements for this 71-story Houston building. The owner's program also required a building with operating characteristics and efficiencies that maximize rentability. Soil conditions, wind loads, foundation depth and architectural massing were considerations that led to the structural steel bundled tube concept for Allied Plaza.

Jurors' comments: *"The strength is the shape . . . the appropriateness for a steel building to be a slender structure really expresses the feeling of a tower. Even though of different shape, it is definitely an office tower, something which sometimes gets lost in a variation of a theme."*

Architect/Structural Engineer
Skidmore, Owings & Merrill, Houston

General Contractors
Miner-Turner (joint venture), Houston

Steel Fabricator
Mosher Steel Company, Houston

Steel Erector
American Bridge Division, USS Corp., Houston

Owners
Century Development Corporation, Houston; and Centennial Equities Corporation, New York; and American General Realty Company, Houston

SCHOLL DIVISION

Memphis, Tennessee

Plough Inc. needed 50,000 sq ft for its Scholl Division. An existing warehouse, in the center of the building, was chosen. Its only exterior exposure was the roof. Design called for a mezzanine floor structurally isolated from existing framing. And materials had to be light enough and small enough to be carried through the surrounding interior. Shallow steel beams, bar joists and metal deck were employed to carry the floor and mechanical systems.

Jurors' comments: *"Putting steel in the middle of an old building . . . pushing it up to make cut-throughs and light wells . . . an excellent rehabilitation."*

Architect
Gassner Nathan & Partners, Memphis

Structural Engineer
Pickering Wooten Smith Weiss, Memphis

General Contractor
Rick Brenner Company, San Antonio, Texas

Owner
Schering-Plough Corporation, Memphis

IBM INFORMATION DIVISION

Charlotte, North Carolina

Situated on a rolling, heavily wooded site, this laboratory/manufacturing facility repeats common elements—especially the exposed steel structural frame and exterior wall system—to provide continuity to different buildings. The owners commanded an economical facility with a high degree of flexibility—one that could be built rapidly. The site's natural beauty lends significant amenities. And the building exterior reflects the refined image of the manufacturer and his products. All buildings employ not only structural steel framing for its economy and speed, but also steel wall panels for their precise appearance and low upkeep.

Jurors' comments: *"Very, very fine detail; maintains a good quality representative of that type of building and an appropriate client responsiveness. It feels very corporate in nature. It is that client."*

Architect
Thompson, Ventulett, Stainback, Atlanta

Structural Engineer
Ross H. Bryan Inc., Nashville

Construction Manager
Blount International, Montgomery, Alabama

Steel Fabricator
Owen Steel Company, Gastonia, North Carolina

CHICAGO BOARD OF TRADE

Chicago, Illinois

A new trading floor, support spaces and offices for exchange members and staffs are incorporated in this annex to the existing Art Deco landmark structure. Large column-free spaces on the trading floor required deep two-story steel trusses below the sky lobby. A 12th-floor atrium serves as a transfer point for spaces in both buildings. Glass elevators and the atrium add dynamic elements to open space and express function and technology in the melding of old and new.

Jurors' comments: *"A tribute to Chicago, a sympathetic response to the existing building, one of its strengths from an external standpoint . . . a very quiet building in terms of the urban scale and surrounding structures, yet extremely dramatic in its interior space. Unique, which is refreshing."*

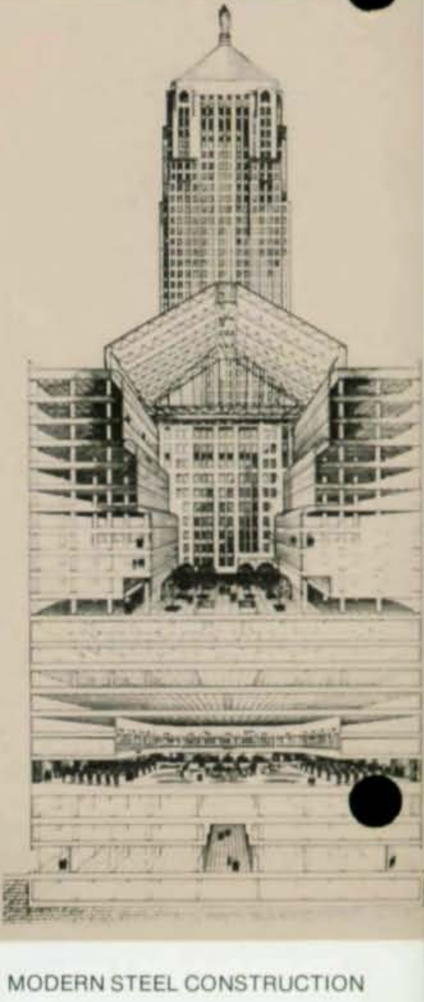
Architects
Murphy/Jahn, Chicago; and
Shaw and Associates, Chicago; and
Swanke Hayden Connell Architects, Chicago

Structural Engineer
Lev Zetlin Associates, Inc., New York

General Contractors
Newberg Construction Company, Chicago;
Pashen Contractors, Inc., Chicago

Steel Fabricator
F. M. Weaver, Inc., Lansdale, Pennsylvania

Steel Erector
Midwest Steel Erection Co., Inc., Chicago



TEKTRONIX, INC.

Vancouver, Washington

Tight, efficient site planning and long-term flexibility, smaller 25,000-sq ft blocks organized into larger units, half the energy usage, 12% less cost and equal employee amenities were design criteria for this manufacturing facility. Smaller blocks are grouped into 200,000-sq ft units joined by skylighted malls which provide utility distribution, material handling and employee amenities. Use of structural steel provided a long-term flexibility to unpredictable future needs, economy and speed of erection under a fast-track schedule.

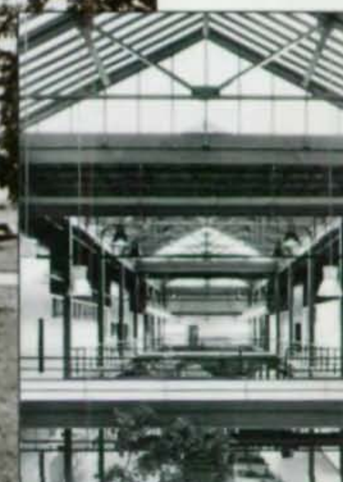
Jurors' comments: *"A very good example of something well done. It has a special quality and identity . . . like it would be a good place to work. Independent buildings were pulled together on an industrial site and made into a mall. They have saved energy, space, and used steel to frame the space. It's very simple."*

Architect
Zimmer Gunsul Frasca Partnership, Portland

Structural Engineer
KPFF Consulting Engineers, Portland

General Contractor
Hoffman Construction Company, Portland

Owner
Tektronix, Inc., Vancouver, Washington



LOUISVILLE GALLERIA

Louisville, Kentucky

The largest mixed-use project ever undertaken in Kentucky includes a seven-story steel-and-glass galleria, two 26-story office towers, a large department store, a renovation of an ornate historic building and a 750-car garage. A steel truss lattice highlights and preserves a historic structure, provides an enclosed urban space as a focal point for year-round enjoyment.

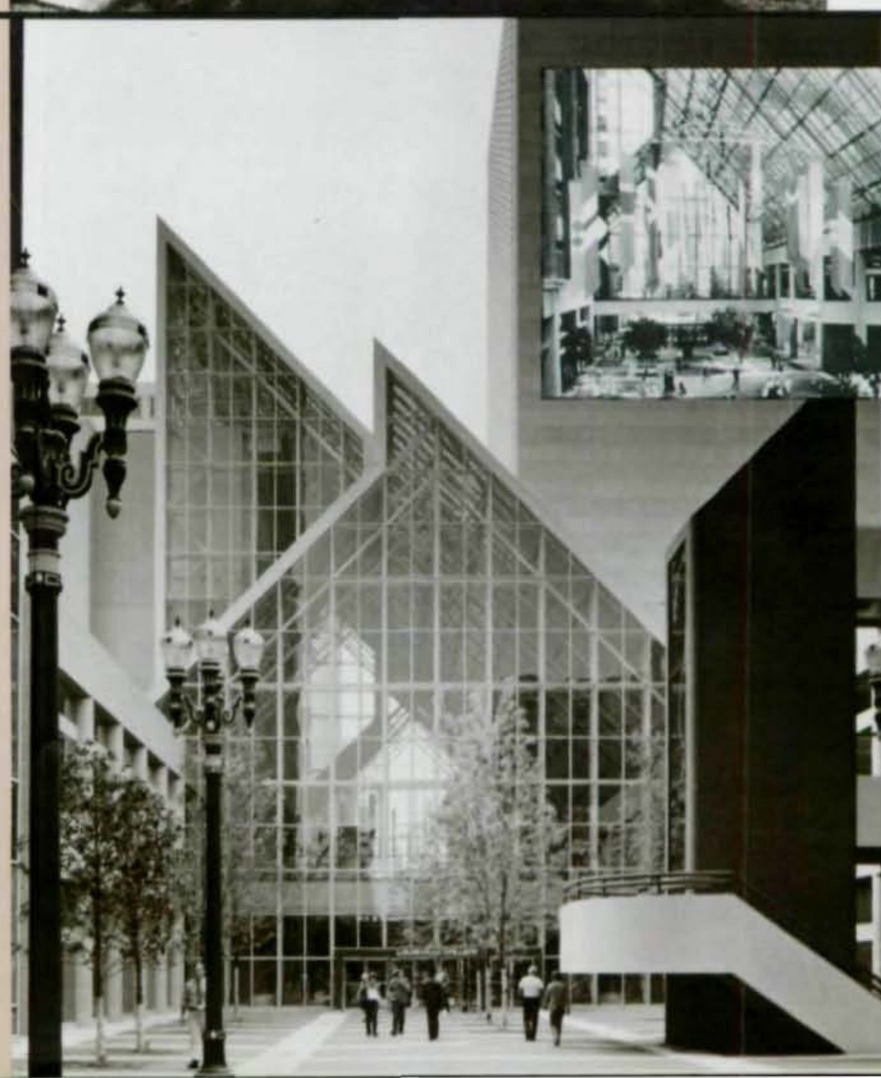
Jurors' comments: *"A very urban design solution, where steel spans and creates space between buildings already there, and becomes the walls of the space—an interesting precedent in being able to re-work an existing inner-city area into a year-round urban space."*

Architect/Structural Engineer
Skidmore, Owings & Merrill, Denver

General Contractor
PCL Construction, Ltd., Louisville

Steel Fabricator
Haven-Busch Company, Grandville, Michigan

Owner
Oxford Properties, Inc., Louisville



THE U.S. PAVILION EXPO '82

Knoxville, Tennessee

This pavilion at the Knoxville World's Fair won the national design competition held by the U.S. Dept. of Commerce. The only customized pavilion, its architecture was to express the theme of energy production and conservation. A pedestrian artery at ground level dictated long spans and 108-ft cantilevers, only possible in structural steel. A tight schedule, budgets, stepped design, long cantilevers and the possibilities for off-site fabrication called for structural steel to save the day for this Fair centerpiece.

Jurors' comments: *"Obviously steel was used for fast-tracking. The speed of pre-fabricated structural steel is a strength. Animation of the steel makes it feel like a fair-type building."*

Architect
FABRAP Architects, Inc., Atlanta

Associate Architects
Turner Associates/Architects & Planners, Atlanta; and
Lindsay and Maples/Architects, Knoxville

Structural Engineer
O'Kon and Company, Atlanta

Construction Manager
Rentenbach Engineering Co., Knoxville

Steel Fabricators
Tallman Iron Works, Inc., Maryville, Tennessee; and
INCA Materials, Inc., Atlanta

MEMPHIS TRANSIT GARAGE

Memphis, Tennessee

Four buildings provide complete maintenance, servicing, refueling and coin removal facilities for the Memphis Transit Area's 350 buses. The site demanded a lightweight building—steel filled the bill. And, in addition to economy, the architect's final choice of steel was for its use in the passive solar design of the structure. Light weight, economy, availability, speed—and solar capacity—they found it all in steel.

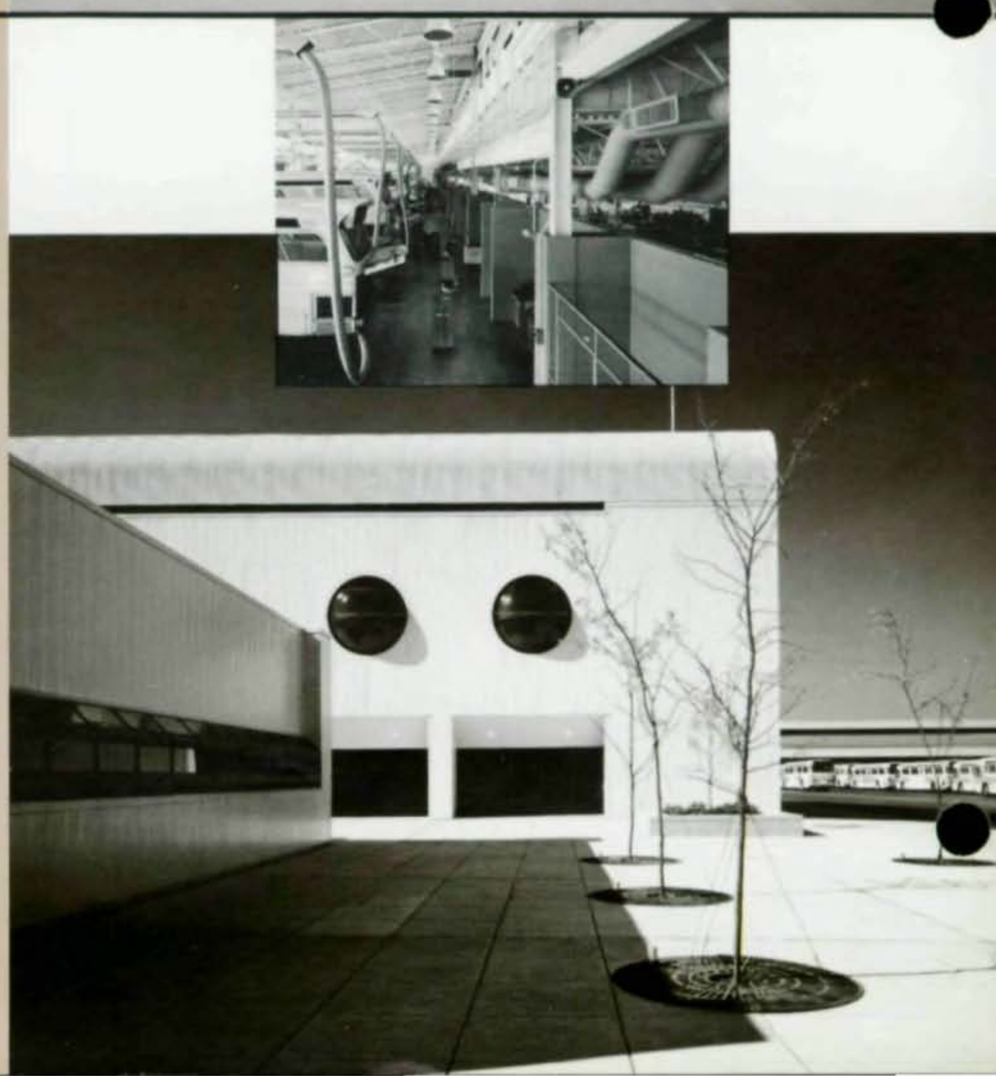
Jurors' comments: *"Even an industrial repair facility can receive design attention. It has a strong exportational form, commendable for an industrial building."*

Architect
Walk Jones & Francis Mah, Memphis

Structural Engineer
Pickering Wooten Smith Weiss, Memphis

General Contractor
Frank J. Rooney, Memphis

Owner
City of Memphis



WHITE MARSH MALL

White Marsh, Maryland

A regional shopping center—main street to a Baltimore County, Md. area—called for a shopping center of 370,000 sq ft, with the mall to serve as town center to its new community. The straight-line mall creates a main street—and a perimeter around which five major department stores revolve, plus a streetscape replete with landscaping, brick paving, park benches and a town clock. Structural steel used in the roof design adds a light, airy feel—and recalls images of Baltimore's ancient wharf buildings of exposed steel trusses and corrugated deck. Truss connections were gusset plates and bolts. Reduced cost, and ease and speed of construction brought steel into the picture.

Jurors' comments: *"One of its virtues is the exposed steel, which animates an otherwise conventional way to treat a shopping center."*

Architect/Structural Engineer
RTKAL Associates, Baltimore

General Contractor
H.C.B. Contractors, Atlanta

Steel Fabricator
Montague-Betts Company, Lynchburg, Virginia

Steel Erector
R. E. Linder Steel Erection Co., Baltimore

Owner
White Marsh, Inc., Columbia, Maryland

GENE COULON MEMORIAL BEACH PARK

Renton, Washington

A mile-long shoreline was dramatically transformed from heavy industrial use into a 57-acre public park. Four (of seven) park structures took the historic nature of the site into consideration, which called for traditional, turn-of-the-century waterfront architecture. The steel structures and finishes permitted the architect to achieve lightness and openness and a free use of color to create a festive nature. Long life against vandalism and ease of maintenance were also strong factors favoring the use of steel.

Jurors' comments: *"Total use of steel . . . just what you want for a pavilion . . . an understated urban design solution. Fits its surroundings and picks up some of the Victorian structures built in the Northwest. Part of it could be Norway."*

Architect
Jones & Jones, Architects, Seattle

Structural Engineer
KPFF Consulting Engineers, Seattle

General Contractor
Frank Coluccio Construction Co., Seattle

Owner
City of Renton, Washington

VILLAGE MARKET
National Tennis Center

Corona, New York

An outdoor restaurant facility used for two weeks during the U.S. Open Tennis Tournament at the National Tennis Center. The Village Market, located where two major pedestrian lanes cross, is a group of 16 steel-and-canvas shelters arranged around trees to cover nine food stands. At night, strings of tiny lights outline the painted steel framework. Steel was the designer's choice to create a light, airy result. Cantilevered corners were easily done, and truss design adds a simple detail compatible with the structural system of the adjacent stadium.

Jurors' comments: *"What was actually a minimal use of steel added to the dimension of spaces . . . really provides a central focus for the entire area. It is nothing more than the simplistic use of steel forms in the simplest of shapes."*

Architects
The Schnadelbach Partnership, New York; and David Kenneth Specter & Associates, New York

Structural Engineer/General Contractor/Steel Fabricator/Erector
Jensen-Lewis Co., New York

Owner
USTA National Tennis Center, New York

AISC Publications

OCTOBER, 1983

ALSO—NOW AVAILABLE FROM AISC!

Books of other publishers on steel design, structural engineering and other related subjects that you may want to add to your steel construction library — see pages 15-22

CONTENTS

The American Institute of Steel Construction is a non-profit trade association representing and serving the fabricated structural steel industry in the United States. Its purpose is to improve the competitive position of steel construction through research and development, education, technical assistance, standardization, and quality control. For over 50 years, AISC has conducted its market-building activities with a scrupulous sense of public responsibility. For this reason, and because of the high caliber of its staff of registered professional engineers, the Institute enjoys a unique relationship with engineers, architects, code officials, and educators, who recognize its professional status in the fields of specification writing, structural research, design development, and performance standards.

It is hoped that the publications listed in this brochure will assist designers, educators, public officials, contractors, and fabricators to increase their knowledge and improve their skills in the design, fabrication, and uses of structural steel construction.

For further information or design assistance, we invite you to contact your local AISC regional representative. A list of regional offices appears on the back cover of this brochure.

Manuals and Textbooks

***M014 Engineering for Steel Construction, 1st Edition (1984)** **$52.00**

Available January 15, 1984

Advanced material from *Structural Steel Detailing* (M008) was combined with new material to create new text for advanced detailers and design engineers. Keyed to 8th Edition *Manual of Steel Construction,* contains suggested design and detailing procedures for more complex structures and connections. M013 and M014 are each self-contained units. (Approx. 320 pp.)

***M013 Detailing for Steel Construction, 1st Edition (1983)** **$32.00**

New textbook directed to beginning detailers, keyed to 8th Edition *Manual of Steel Construction.* Contains instruction, explanations, problem solutions and many typical shop details and drawings. Replaces much of *Structural Steel Detailing* (M008) and reflects the latest in detailing practice. Subjects covered are (1) Drafting Equipment and Procedures, (2) Structural Steel, (3) Detailing and Fabricating Structural Steel, (4) Fundamentals of Structural Engineering, (5) Connections—Bolted, (6) Connections—Welded, (7) Columns and (8) Framing for Industrial Buildings. (288 pp.)

***M012 Manual of Steel Construction, 8th Edition—Lightweight (1982)** [redacted] $48.00

This lightweight, field version of the 8th Edition *Manual* contains the same material as the library volume (see below), but is just ⅞ in. thick and weighs only 1 lb. 5¼ oz. Perfect for traveling, job sites.

***M011 Manual of Steel Construction, 8th Edition (1980)** [redacted] $48.00

An essential reference for engineers, architects, detailers, draftsmen, contractors, building officials and fabricators. The 8th Edition is based on the provisions of the November 1978 AISC *Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.* Data is divided into six basic sections: (1) Dimensions and Properties, (2) Beam and Girder Design, (3) Column Design, (4) Connections, (5) Specifications and Codes and (6) Miscellaneous Data and Mathematical Tables. A comprehensive index is provided and each section is thumb-indexed. (832 pp.)

**** Descriptive brochure available.***

***M008 Structural Steel Detailing, 2nd Edition (1971) — $20.00**

Replaced by *Detailing for Steel Construction* (M013) and *Engineering for Steel Construction* (M014). M008 will remain available until present stock depleted. (406 pp.)

***M007 Problems and Solutions for Structural Steel Detailing (1972) — $8.00**

Problems and solutions keyed to *Structural Steel Detailing* (M008) and to 7th Edition *Manual of Steel Construction*. (Part 1, 44 pp.; Part 2, 108 pp. Supply limited.)

***M005 Design Manual for Orthotropic Steel Plate Deck Bridges (1963) — $18.00**

A comprehensive presentation of the theory and practice of "orthotropic plate" bridge construction. Reviews the historical and theoretical background and gives design criteria and practical design procedures illustrated by numerical examples. Includes charts for design in accordance with AASHTO specifications. (240 pp.)

***M004 Plastic Design of Braced Multistory Steel Frames (1968) — $10.00**

A practical design manual written in clear, simple language, containing enough theory to explain the structural behavior involved. A large portion of the book is devoted to the design of a 24-story, three-bay braced steel apartment house frame, which will serve as a guide to the practicing engineer in his own plastic design work. Design aids are included to reduce design time and simplify calculations. (124 pp.)

***M003 Iron and Steel Beams 1873-1952 (1953) — $10.00**

A tabular compilation of the properties of wrought iron and steel beam and column shapes produced in the United States through the year 1952. Also provided is a summary history of unit stresses recommended by early manufacturers, ASTM tensile and yield strength requirements, and the working stress recommendations of AISC during the period covered. (142 pp.)

** Descriptive brochure available.*

Specifications and Manual Supplements

6 Specification for the Design, Fabrication and Erection of Structural Steel for Buildings (with Commentary) **$ 5.00**

Effective November 1, 1978

The nationally recognized standard for structural steel design in the United States. A Commentary is provided to help the designer make more efficient use of the Specification by explaining the basis for its various provisions, with attention directed primarily to less widely understood provisions and new modifications. (168 pp.)

***S325 Dimensions and Properties New W, HP and WT Shapes (1978)**

ASTM Standard A6-77b ***Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use*** contains revisions to the standard profile series for W and HP shapes. In this booklet, tables of "Properties for Designing" and "Dimensions for Detailing" for W shapes, HP shapes, and structural tees cut from W shapes include data for both the new and previous series profiles, with the previous *series shapes shaded for easy identification* and comparsion. In addition, an "Allowable Stress Design Selection Table" is provided for the new series. (56 pp.)

S324 A Guide to the Shop Painting of Structural Steel (1972) **$ 1.50**

This guide, jointly prepared by AISC and the Steel Structures Painting Council, outlines some of the elements involved in surface preparation and priming in the steel fabricating shop. It also provides a delineation, from the fabricator's point of view, of some of the factors to be considered by the designer, contractor, paint supplier, owner, and others jointly involved with the fabricator in providing a complete and effective paint system. (16 pp.)

** No charge for single copies in U.S.A. Price for foreign and quantity orders supplied on request.*

S323 Quality Criteria and Inspection Standards, 2nd Edition (1980) **$ 5.00**

The commonly accepted standards of workmanship for fabricated structural steel framing assure satisfactory fit and appearance at minimum cost for the vast majority of buildings and bridges. More restrictive tolerances, while sometimes justified by special conditions of usage, are sometimes stipulated only because owners, architects, or engineers are not familiar with standard fabricating practice, nor with the economic effect of special workmanship requirements. This commentary discusses some common problems involving fabricating tolerances and procedures, and provides AISC recommendations for their clarification and solution. (48 pp.)

S314 Specification for Structural Joints Using ASTM A325 or A490 Bolts **$ 1.50**

Approved by the Research Council on Structural Connections of the Engineering Foundation, August 14, 1980.

Covers the design, installation, and inspection of structural joints using ASTM A325 high strength carbon steel bolts or ASTM A490 high strength alloy steel bolts. Endorsed by AISC and the Industrial Fasteners Institute. (24 pp.)

S302 Code of Standard Practice for Buildings and Bridges **$ 1.50**

Adopted Effective September 1, 1976

Fabricators, erectors, owners, architects, engineers, and contractors have developed certain standard practices relating to the design, fabrication, and erection of structural steel. Since 1924, AISC has published these standards, updating them as new standards have been established, to make them available for ready reference by all concerned with the use of structural steel in construction. (36 pp.)

Technical Publications

Technical Reprints

T115 **Stability of Metal Structures—A World View**/SSRC **$12.00**

Run in serial form in four succeeding issues of the *Engineering Journal* in 1981-82, this booklet was compiled by the Structural Stability Research Council. It summarizes state of the art in the field of stability of metal structural members and frames, including design approaches and procedures, as experienced in Japan, North America, West Europe and East Europe. (148 pp.)

T114 **Torsional Analysis of Steel Members (1983)** **$16.00**

The aim of this design aid booklet is to reduce the amount of computation required for a complete analysis of the effects of torsional loading on structural members. Tables and charts are provided for the solution of torsion problems. Restraining effects of contiguous framing conditions in actual structures are investigated and a procedure is provided to calculate the resulting reduced torsion.

T113 **Light and Heavy Industrial Buildings**/Fisher and Buettner **$20.00**

Published in 1979 as a supplementary reference for the AISC lecture series on this subject, this guide is a valuable tool for anyone who designs industrial buildings. Divided into two sections, buildings with cranes and buildings without cranes, the text covers load conditions and combinations, roof systems, framing systems, wall systems, column design, bracing systems, crane girders, and other special features of industrial building design. Numerous details, design examples, and tables supplement the text. (180 pp.)

T112 **Bridge Fatigue Guide/ Design and Details (1977)** **$ 5.00**

A guide to the general problem of bridge fatigue intended to assist the designer with the selection and design of bridge details that offer superior fatigue strength. The booklet is a revised and expanded version of the earlier AISC publication, ***Guide to the 1974 AASHTO Fatigue Specifications.*** (58 pp.)

T111 **Guide for the Analysis of Guy and Stiffleg Derricks (1974)** **$10.00**

Recommendations and procedures for the investigation and evaluation of the structural components of guy and stiffleg derricks, including a suggested specification for the design of such derricks. (52 pp.)

T110 **Simple Span Steel Bridges – Composite Beam Design Charts (1969)** **$12.00**

A design aid that permits the direct selection of the most economical combination of rolled beam and coverplate acting compositely with a concrete slab as a component of a simple span bridge to support HS20 highway loading. Separate sets of design charts are provided for 36 ksi and 50 ksi steels. The charts conform to the provisions of the 1973 AASHTO specifications. (176 pp.)

T106 **Moments, Shears and Reactions for Continuous Highway Bridges (1966)** **$ 4.00**

A design aid that can reduce the time required for the analysis of two, three, and four span continuous highway beam bridges. Tables of maximum moments, shears, and reactions are presented for 456 continuous highway bridge spans, encompassing the full range of beam and usual plate girder bridges. The tabulated values and corresponding impact coefficients, based on one lane of AASHTO HS20-44 live loading, conform to the provisions of the 1973 AASHTO specifications. For problems involving special loading, corresponding tables of influence coefficients presented. (88 pp.)

T105 **Welded Interior Beam-to-Column Connections (1959)** **$ 4.00**

A summary of experimental and analytical investigations into the behavior of two-way and four-way welded beam-to-column connections with and without stiffeners. Design rules stemming from these investigations are presented and illustrated with practical examples. (40 pp.)

TR232 **Effect of Hole-Making on the Strength of Double Lap Joints**/Iwankiw and Schlafly **$1.00**

(AISC Engineering Journal, 3rd Quarter 1982)

Report on series of tests that indicated various hole-forming methods have no significant effect on connection strength and performance under static loads. Prudent use of flame-cutting was found to be an acceptable hole-making method. (12 pp.)

TR231 Design of W-Shapes for Combined Bending and Torsion/Johnston **$1.00**

(AISC Engineering Journal, 2nd Quarter 1982)

Provides graphical charts to permit rapid design checks for a variety of load types and end conditions involving W-shapes in combined bending and torsion. Design examples demonstrate use of charts and ways to reduce torsion. (24 pp.)

TR230 Predesigned Bolted Framing Angle Connections/American Institute of Steel Construction **$ 1.00**

(AISC Engineering Journal, 1st Quarter 1982)

AISC has developed tables of predesigned double-angle framing connections to reduce the time and cost that would be required for design, review and checking if unique designs were prepared for each application. Tabular capacities are given for A325 bolted connections for uncoped and single-coped W beams of 36 ksi and 50 ksi (F_u = 65 ksi) steel. Tables do not apply to friction-type connections, double-coped beams, nor A307 and A490 bolts. (12 pp.)

TR229 Design Aids for Single Plate Framing Connections/Young and Disque **$ 1.00**

(AISC Engineering Journal, 4th Quarter 1981)

Recently completed research at the University of Arizona has demonstrated that a properly designed single plate framing connection fabricated from A36 steel is safe and practical. To assist designers, detailers and estimators, the authors have developed tabular design aids which can significantly reduce the computation time required for the design of such connections. (20 pp.)

TR228 Load and Resistance Factor Design/ Galambos **$ 1.00**

(AISC Engineering Journal, 3rd Quarter 1981)

This paper is an update of an earlier paper by Galambos and Ravindra for which the author was awarded the 1981 T.R. Higgins Lectureship. It briefly summarizes the existing development of an AISC LRFD Specification, with emphasis on the numerous sources on which that document stands. (12 pp.)

***TR227 8th Edition Manual Errata**
(AISC Engineering Journal, 3rd and 4th Quarters 1980, 2nd Quarter 1981)

As errors in the 8th Edition ***Manual of Steel Construction*** have been discovered, they have been corrected in subsequent press runs (impressions), and have been reported in the AISC ***Engineering Journal.*** These errata are brought together in this reprint, so that owners of the 1st, 2nd and 3rd impressions of the Manual can correct their copies. All these errors have been corrected in the 4th impression. (4 pp.)

TR226 Detailing to Achieve Practical Welded Fabrication/Blodgett **$ 1.00**
(AISC Engineering Journal, 4th Quarter 1980)

The author stresses that poor welded details frequently are caused by lack of awareness of improved design principles and advances in the welding arts. He discusses a number of problem details encountered in his consulting work and illustrates both good and bad details. (16 pp.)

TR225 The Analysis and Design of Single Plate Framing Connections/Richard, Gillett, Kriegh and Lewis **$ 1.00**
(AISC Engineering Journal, 2nd Quarter 1980)

The authors present a recommended design procedure for single plate framing connections, based on analytical and experimental research conducted at the University of Arizona. The procedure involves a design curve developed for uniform load, but also applicable to concentrated load conditions by using eccentricity coefficients given in the Appendix. The method is illustrated in a design example. (16 pp.)

TR224 A Specification for the Design of Steel-Concrete Composite Columns/Task Group 20, Structural Stability Research Council **$ 1.00**
(AISC Engineering Journal, 4th Quarter 1979)

Charged with the task of reconciliating existing design concepts for composite steel-concrete columns, the task group has developed a statement of recommended design rules and a discussion of composite column behavior which serves as a commentary for the recommendations. To facilitate and illustrate applications of the rules, design examples and charts are included in the report. (16 pp.)

**No charge.*

TR223 Fracture and Fatigue Control In Steel Structures/Rolfe $ 1.00

(AISC Engineering Journal, 1st Quarter 1977)

Because of recent changes in the design of steel structures, such as the complexity of structures, the increased use of high-strength, thick, welded steel members, new construction practices, types of loading, the need for prevention of brittle fracture is increasingly important. The author reviews recent advances in the fracture mechanics field that permit a more rational approach to fracture as a part of the design process. (16 pp.)

TR222 Human Response to Wind-Induced Motion of Buildings/Hansen, Reed, and Vanmarcke $ 1.00

(AISC Engineering Journal, 3rd Quarter 1979)

Some tall buildings sustain motions and other effects in intense wind storms which cause discomfort to the occupants. The authors describe the results of surveys conducted of occupants of two buildings after several wind storms. A methodology and criterion format for rationally analyzing the wind-motion-discomfort problem for tall buildings is proposed, and tentative motion criterion values are recommended. (12 pp.)

TR221 Behavior of Bearing Critical Double-Angle Beam Connections/Birkemoe and Gilmor $ 1.00

AISC Engineering Journal, 4th Quarter 1978)

The authors present an evaluation of the application of the new bolt shear and bearing stresses on the basis of several tests of bolted double-angle beam connections, with top flanges both coped and uncoped. Several recommendations are made on the basis of these limited tests, and further research to develop design guidelines is recommended. (8 pp.)

TR217 Composite Beams with Formed Steel Deck/Grant, Fischer, and Slutter $ 1.00

(AISC Engineering Journal, 1st Quarter 1977)

A report, based on results of research tests at Lehigh University, evaluating the shear capacity of stud shear connectors 3/4-in. and smaller in diameter embedded in composite beams with formed steel deck, as well as the flexual capacity of the composite beams themselves. Additionally, the behavior of composite beams with or without formed steel deck is evaluated for working loads, and a comparison is made of connector capacity and beam behavior with existing design criteria. (20 pp.)

TR216 Commentary on Highly Restrained Welded Connections/American Institute of Steel Construction — $ 1.00

(AISC Engineering Journal, 3rd Quarter 1973)

A "state of the art" report intended to present information which could be of aid in minimizing the occurrence of conditions that might precipitate a lamellar tear in highly restrained welded connections. The paper notes that for the great majority of welded connections the conditions which provide the potential for lamellar tearing or other distress do not exist. Numerous authoritative research reports and much information on the subject are reviewed and presented concisely. (24 pp.)

TR212 The Effective Length of Columns in Unbraced Frames/Yura — $ 1.00

(AISC Engineering Journal, April 1971)

The commonly used alignment chart for determining column K-factors is described as overly conservative or inapplicable for inelastic columns. Methods are presented for the design of such columns using "inelastic" K-factors. (8 pp.)

TR211 Inelastic K-factor for Column Design/Disque — $ 1.00

(AISC Engineering Journal, 2nd Quarter 1973)

Discusses further some of the questions raised by Yura's paper on K-factors for inelastic columns (see TR212) and shows how Yura's method may be applied without iteration. Tables of stiffness reduction factors are provided to reduce calculations. (4 pp.)

TR207 Ponding of Two-Way Roof Systems — $ 1.00
Marino

(AISC Engineering Journal, July 1966)

An analysis of the behavior of a two-way roof framing system subjected to ponding (i.e., the loading condition created when a flat roof retains water that causes deflection of the roof system and may, under certain conditions, lead to structural failure of the system). The author provides charts to assist the designer in checking for potential ponding hazard, and illustrates the analytical method with design examples. (8 pp.)

General Publications

***G445 Architectural Awards of Excellence – 1981**

Buildings that represent outstanding architectural design in structural steel, selected by a distinguished Jury of Awards in the competition sponsored by AISC. (8pp.)

G444 The First 60 Years, The American Institute of Steel Construction, Inc., 1921-1980/Gillette **$40.00**

A history of AISC from its founding in 1921 to the present. The book, profusely illustrated, reviews the development of the structural steel industry, the formative years of AISC, major activities and issues, and the people who led, worked for, and influenced this organization and the industry it represents. (180 pp.)

***G443 Prize Bridges – 1980**

The most beautiful steel bridges opened to traffic in 1978-79, selected by a distinguished Jury of Awards in AISC's Prize Bridge Competition. (28 pp.)

***G442 This is AISC**

A brief description of the American Institute of Steel Construction, its activities, and its services available to designers, builders, and educators.

***G441 Architectural Awards of Excellence – 1979**

Buildings that represent outstanding architectural design in structural steel, selected by a distinguished Jury of Awards in the competition sponsored by AISC. (36 pp.)

***G439 High-Rise Residential Economy With Steel (1978)**

Steel has gained a new economic advantage in high-rise apartment construction, primarily because of the impact of escalating field labor costs on competitive framing materials and the development of new steel technology and systems. This booklet reviews the background of this change and details these and other advantages of steel in today's high-rise residential market. (28 pp.)

**No charge for single copies in USA. Price list for foreign and quantity orders supplied upon request.*

Fabricator Publications

AISC Engineering Journal

F503 AISC Accounting Manual (1982) $50

New manual of standard practice in cost accounting for structural steel fabricators. This guide provides an accounting system of maximum flexibility that is suitable for companies of all sizes and for actual accounting practices used in the steel fabricating industry. It provides alternate methods of handling controversial items, adequate tie-in from original bidding estimates to final accounting records and sample forms for following costs as contract work progresses. (118 pp.)

F502 Steel Fabrication Safety Manual (1981) $ 4.00

Recommendations for good safety practices in structural steel fabricating shops, developed by AISC to help its members achieve the humanitarian and economic benefits of an effective safety program. An important guide that should be provided to every worker in a steel fabricating shop. (120 pp.)

AISC ENGINEERING JOURNAL

The only technical magazine in the United States devoted exclusively to the design of steel structures, the AISC *Engineering Journal* provides structural engineers architects, and educators with the latest information on steel design, research, and construction. Since its inception in 1964, the Engineering Journal has featured papers of practical design value, rather than highly theoretical and mathematical material. This quarterly magazine is an important technical reference for all engineers, architects, and educators involved in steel construction.

Subscription Rates

	U.S.	Foreign Surface Mail	Foreign Air Mail
1 yr. (4 issues)	$ 8	$11	$30
3 yrs. (12 issues)	$18	$24	—
Single copies	$ 3 ea.	$ 4 ea.	—

Books of Other Publishers

The following books of other publishers may be of special interest to those interested in steel design and construction. They are offered at the publisher's standard list price as a convenience only, and should not be considered endorsed by AISC, nor is AISC responsible for their contents.

P626 Structural Steel Fundamentals—An Engineering and Metallurgical Primer/ M. G. Lay **$20.00**

Intended for structural engineers and metallurgists to aid in the understanding of each other's approaches. Gives basic structural design concepts and discusses mechanical properties, including general stress-strain relations and yield behavior. Presents fracture and fatigue from a fracture-mechanics point of view, introduces metallurgy of steel making and gives basic information on welding. Discusses behavior of structural members, including effects of residual stresses and fire. 1982; 241 pp. (Australian Road Research Board)

P625 Steel Design for Structural Engineers, 2nd Ed./Kuzmanović and Willems **$33.95**

Textbook on the design of steel buildings and bridges based on the AISC, AASHTO and AREA specifications. Also refers to foreign specifications when these reflect significantly different approaches. Includes discussion of types of loadings acting on bridges and buildings. Covers detailed design of connections. In addition to design of individual members, gives practical examples of design of a complete single-story building and a highway-bridge girder superstructure. 1983; 601 pp. (Prentice-Hall)

P624 Safety Requirements for the Construction, Care and Use of Mechanical Power Presses (ANSI B11.1-1982) **$9.00**

A coordinated set of safety recommendations for construction, care and use of mechanical power presses, developed by manufacturers and users of this equipment. The standard establishes guidelines for safeguarding operations. 1982; 47 pp. (American National Standards Institute)

P623 Safety Requirements for the Construction, Care and Use of Hydraulic Power Presses (ANSI B11.2-1982) **$6.00**

A coordinated set of safety recommendations for construction, care and use of hydraulic presses, developed by manufacturers and users of this equipment. The standard establishes guidelines for safeguarding operations. 1982; 32 pp. (American National Standards Institute)

P622 Safety Requirements for the Construction, Care and Use of Power Press Brakes (ANSI B11.3-1982) **$12.00**

A coordinated set of safety recommendations for construction, care and use of power press brakes, developed by manufacturers and users of this equipment. The standard establishes guidelines for safeguarding operations. 1982; 96 pp. (American National Standards Institute)

P621 Basics of Structural Steel Design, 2nd Ed./Samuel Marcus **$24.95**

Comprehensive text in steel design incorporating the new 1980 AISC Specifications. Up-to-date treatment includes bolted and welded connection and composite design with formed metal deck. For two- or four-year engineering, architectural or technology students. 1981; 496 pp. (Prentice-Hall, Inc.)

P620 Safety Requirements for Shops Fabricating Structural Steel and Steel Plate (ANSI Z229.1-1982) **$8.**

Developed as a coordinated set of safety recommendations and requirements for steel fabricating shops, this safety standard may also serve as a guide to federal, state and other authorities in determining compliance of a plant with recognized and accepted safety practice. This standard was developed by AISC and adopted by ANSI. 1982; 48 pp. (American National Standards Institute)

P619 Guide to Stability Design Criteria for Metal Structures, 3rd Ed./ Johnston (Ed.) **$59.50**

This is the 3rd Edition of the widely used reference formerly entitled *Column Research Council Guide to Design Criteria for Metal Compression Members.* More than 110 engineers and researchers collaborated, through the Structural Stability Research Council, to provide this comprehensive summary of research results and the application of these results to design. Research workers, structural engineers, and graduate students should find this a constantly useful reference work. 1976; 616 pp. (John Wiley & Sons)

P618 Guide to Design Criteria for Bolted and Riveted Joints/Fisher and Struick **$51.50**

Based on experimental and theoretical studies on the behavior and strength of riveted and bolted structural joints, this book suggests design criteria for such connections. It provides the basis for many provisions of the AISC Specification. It reviews the historical development of mechanically fastened joints and discusses the various theories of design, strength and performance criteria. Bolt installation is also discussed. 1974; 314 pp. (John Wiley & Sons)

P617 Structural Welding Code—Steel (D1.1-83)/American Welding Society **$45.00**

Prepared by the AWS Structural Welding Committee, the 1983 AWS Structural Welding Code—Steel (D1.1-83) covers the welding requirements and constitutes a body of rules for the regulation of welding in all steel structures, including buildings, bridges and tubular structures.

This Code is not intended to apply to pressure vessels or pressure piping. The 1983 Code and Commentary are together in the same document to provide the user with more rapid clarification or explanation of Code requirements. The 1983 Commentary has been updated to cover the changes that have been made in the 1983 Code. 1983; paperback; 321 pp. (American Welding Society)

P616 Minimum Design Loads for Buildings and Other Structures (ANSI A58.1-1982) **$12.00**

Gives requirements for dead, live, wind, snow and earthquake loads and the combinations that are suitable for inclusion in building codes and other design documents. The basis for the requirements is described in the Appendix, and the structural load requirements described by this standard are intended for use by architects, structural engineers and those engaged in preparing and administrating local building codes. 1982; 100 pp. (American National Standards Institute)

P615 Composite or Mixed Steel-Concrete Construction for Buildings/Iyengar **$11.50**

A state-of-the-art report, written for the ASCE Structural Specification Liaison Committee. Covers existing building codes and standards, evolution of design procedures and current design practice, and advantages and efficiency of mixed steel-concrete systems and methods. Contains sections on composite columns; composite beams, trusses and slabs; mixed steel-concrete systems; connections for mixed systems; summary and research needs. 1977; 154 pp. (American Society of Civil Engineers)

P614 Structural Engineering Handbook, 2nd Ed./Gaylord and Gaylord **$64.50**

This is the second edition of a reference that provides concise, ready-to-use material on the planning, design and construction of engineered structures. To save the user time, derivations of formulas are omitted, yet their limitations are explained and, in most cases, worked-out examples are given. Advantages and disadvantages of alternatives in structure type and methods of analysis and design are discussed. 1979; 1246 pp. (McGraw-Hill Book Co.)

P613 Steel Structures: Design and Behavior, 2nd Ed./Salmon and Johnson **$37.95**

An expanded and updated edition of a successful textbook that offers a logical, easy-to-follow examination of the fundamentals of structural steel design. Incorporates the 19[illegible] AISC Specification provisions. The chapters on tension members, fasteners, and the lateral-torsional buckling of beams have been completely rewritten to reflect the new AISC design procedures. 1980; 1007 pp. (Harper & Row)

P612 Plastic Design In Steel—A Guide and Commentary, 2nd Ed. (ASCE Manual No. 41)/Joint Committee of Welding Research Council and American Society of Civil Engineers **$15.00**

Documents the applicability of plastic analysis to the design of structural steel beams and frames. Theoretical considerations involved in the plastic theory and in certain secondary design problems are presented. Experimental verification is provided, and approximations in the form of design guides are suggested. Contains Appendix sections on nomenclature, glossary of terms, and a comprehensive bibliography for each chapter. 1971; 336 pp. (American Society of Civil Engineers)

P611 Structural Design of Tall Steel Buildings, Vol. SB/Beedle (Ed.) **$75.00**

Part of a five-volume monograph covering virtually all aspects of planning, design, construction and use of tall buildings, the result of a major international cooperative effort by the Council on Tall Buildings and Urban Habitat. Volume SB, developed by a number of the world's leading structural engineers, presents the state-of-the-art and anticipated future trends and developments for tall steel buildings. Compiled in the late 1970's, Volume SB covers elastic and plastic analysis and design, stability, fatigue and fracture, connections, load and resistance factor design, mixed steel-concrete construction, and a 98-page bibliography. 1981; 1057 pp. (American Society of Civil Engineers)

P610 Design of Modern Steel Highway Bridges/Heins and Firmage **$45.95**

Provides integrated coverage of structural analysis and design of conventional and modern bridges, with appropriate specifications and design examples. Demonstrates design procedures and development, organization of design computations, and interpretation of AASHTO design specifications. Includes discussions of substructures, bridge piers, abutments, and bridge rating and repair. 1979; 463 pp. (John Wiley & Sons)

P609 Joints in Structural Steelwork/ **$57.95**
Howlett, Jenkins and Stainby (Eds.)

Subtitled: The Design of Semi-Rigid and Rigid Joints in Steel and Composite Structures and Their Influence on Structural Behavior. Proceedings of the International Conference held at Teesside Polytechnic, U.K., April 6-9th, 1981. Thirty-seven papers examine progress in the research, development, and application of joint design. Includes "desk top" expressions now available for the realistic design of joints with no increase in cost. Incorporates improved knowledge of joint design coupled with new approaches in column and beam design that make possible considerable weight saving. 1981; 680 pp. (John Wiley & Sons)

P608 **Design for Structural Stability/** Kirby and Nethercot **$49.95**

Constrado Monograph (U.K.) A clear transition from theory to practice, providing a basic understanding both of fundamenta principles and the way these are used as the bases for everyday design rules. Methods applicable to design office practice are given for calculating elastic critical loads for columns, beams and complete structures, and the nonlinear effects of instability and their relevance to design are discussed. 1979; 165 pp. (John Wiley & Sons)

P607 **Fracture and Fatigue Control in Structures: Applications of Fracture Mechanics/**Rolfe and Barsom **$39.95**

Introduces engineers to the benefits and uses of fracture mechanics, as well as the research aspects. Emphasizes applications as well as the importance of engineering experience, economics and theory. Provides new information on fatigue crack initiation and propagation behavior. Discusses the many factors involved in developing fracture criteria. Includes case studies and examples from actual failures, as well as data and design information on structural materials. 1977; 562 pp. (Prentice-Hall)

P606 **Construction of Structural Steel *Building Frames, 2nd Ed.*/***Rapp* **$49.95**

Covers the erection of structural steel building frames, including preparation for bidding, planning the erection scheme, selecting proper tools and equipment, setting of ste members, costs and production. Stresses the need for cooperation between the contractor, architect and structural engineer to avoid possible pitfalls. 1980; 400 pp. (John Wiley & Sons)

P605 **Formulas for Stress and Strain, 5th Ed./**Roark and Young **$43.50**

This revised edition of a highly respected reference contains approximately 30% entirely new material. There has been a tremendous increase in the amount of tabulated data included, much of which has been restructured in a style most easily used on a computer. Engineers, designers, architects and others involved in the analysis and understanding of stress and strain should find this revision a valuable aid in their work. 1975; 512 pp. (McGraw-Hill Book Co.)

P604 **Volume 1, Good Painting Practice** **$55.00****

Has, for 30 years, been the "bible" in protective anti-corrosive coatings. Presents new technological update and covers latest practices on: surface preparation, application, inspection, safety, quality control, rigging, costs, design, shop painting. In addition, deals with: corrosion, inhibitive primers, cathodic protection, zinc-rich, all major coating types. Also describes painting practices for: industry and government, user and supplier, fabricating shops, highway bridges, railroads, pipelines, shipbuilding; and the following plants: sewage, chemicals, food, paper, water, power, petroleum. 1982; 512 pp. (Steel Structures Painting Council)

P603 **Volume 2, Systems & Specifications** **$55.00****

In its first major revision in the last 18 years, has been updated to replace the current edition by the leading users, suppliers, specifiers from 33 committees of experts with data verified in long-term SSPC tests. It is performance/composition-oriented and contains new guides and specifications for: surface preparation, application, thickness, safety, maintenance. New paints and painting systems are discussed including zinc-rich, epoxies, water base, vinyls, lead-chromate free, coal tar epoxies, chlorinated rubber, silicone-alkyds, urethanes. 1982; 518 pp. (Steel Structures Painting Council)

***Volumes 1 and 2 combined: $98.00**

2 **Basic Steel Design, 2nd Ed./** **$31.95**
Johnston, Lin and Galambos

Revised edition of a successful textbook. A basic primer, it emphasizes the fundamentals of structural steel design, taking into account the provisions of the 1978 AISC *Specification*, and provides a practical understanding of structural behavior. Minimizes the use of complex theory. Contains detailed example problems and uses flow diagrams to illustrate the logical sequence of decision and design steps. 1980; 368 pp. (Prentice-Hall)

P601 **Guide for the Design and Construction of Mill Buildings (AISE Technical Report No. 13)** **$50.00**

Provides owners, engineers, and contractors with a comprehensive, rational approach to design and construction of mill buildings, and other structures having similar use. Subjects covered include soil investigation; loads and forces; foundations, floors and walls; structural steel; and electrical. Recommendations are made for distribution of transverse shearing forces to the columns. Also gives guidance for combined stress evaluation in crane girders from simultaneous vertical and lateral loadings, and more. 1979; 196 pp. (Association of Iron and Steel Engineers)

INFORMATION FOR ORDERING

Publication Numbers

All publications must be ordered by number (M010, T105, etc.). It is not necessary to indicate titles when ordering.

Minimum Order

A minimum order of $3.00 is required. Orders for lesser amounts will be returned.

Postage

Postage will be prepaid in U.S.A. On shipments outside the United States, add 10% of the total purchase price to cover postage and handling.

Delivery

All shipments will be by least expensive means. Allow 4 weeks for delivery in U.S.A. For UPS delivery (within continental U.S. only), add $3.00 handling charge for orders up to $100.00. If other special routing or mailing is required (express, air mail, etc.), rates will be quoted on request.

Payment

Orders must be accompanied by payment in U.S. dollars, drawn on a U.S. bank. Make checks, money orders, or drafts payable to American Institute of Steel Construction.

Prices

All prices are subject to change without notice.

Order Form

Date ______

Name ______

Company ______

Street or P.O. Box ______

City ______

State ______ Zip ______

Quantity	Publication No.	Unit Price	Total Price

Total price (min. $3.00) (Outside U.S. add 10%)	$
Sales tax (N.Y., Calif. & Ill. residents)	$
UPS delivery within continental U.S. only ($3.00 min., see "Information for Ordering")	$
Amount enclosed	$

MAIL TO:

American Institute of Steel Construction
P.O. Box 4588 Dept. MS
Chicago, Illinois 60680

REGIONAL OFFICES

Atlanta, Georgia
Boston, Massachusetts
Charlotte, N. Carolina
Chicago, Illinois
Dallas, Texas
Denver, Colorado
Detroit, Michigan
Houston, Texas
Los Angeles, California
Minneapolis, Minnesota
New York, New York
Philadelphia, Pennsylvania
Pittsburgh, Pennsylvania
San Francisco, California
Seattle, Washington
St. Louis, Missouri
Tampa, Florida

American Institute of Steel Construction, Inc.
400 North Michigan Avenue
Chicago, Illinois 60611

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
The Wrigley Building, 400 North Michigan Avenue
Chicago, IL 60611

Address Correction Requested