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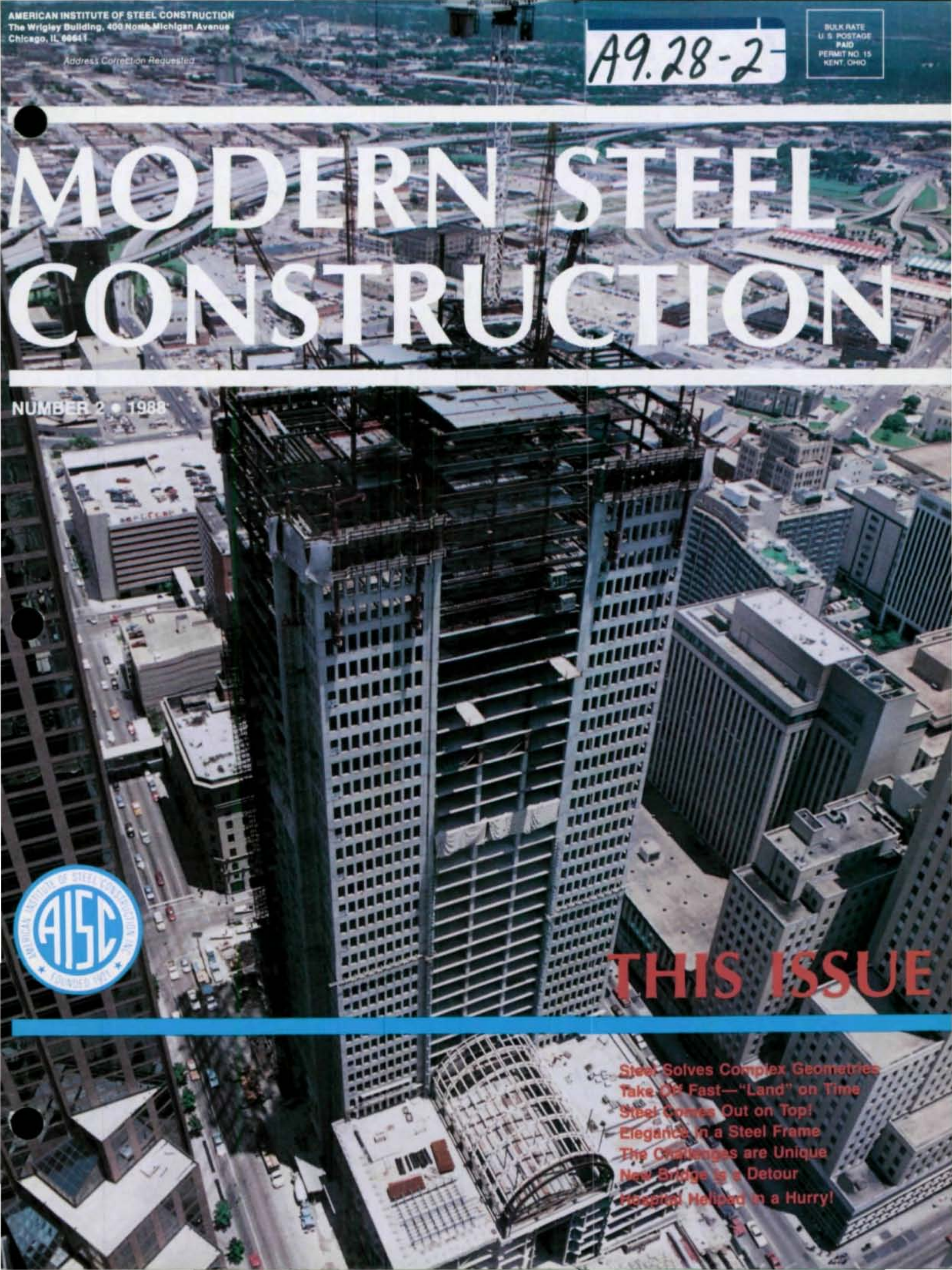
MODERN STEEL CONSTRUCTION

NUMBER 2 • 1988



THIS ISSUE

- Steel Solves Complex Geometries
- Take Off Fast—"Land" on Time
- Steel Comes Out on Top!
- Elegance in a Steel Frame
- The Challenges are Unique
- New Bridge is a Detour
- Hospital Helipad in a Hurry!

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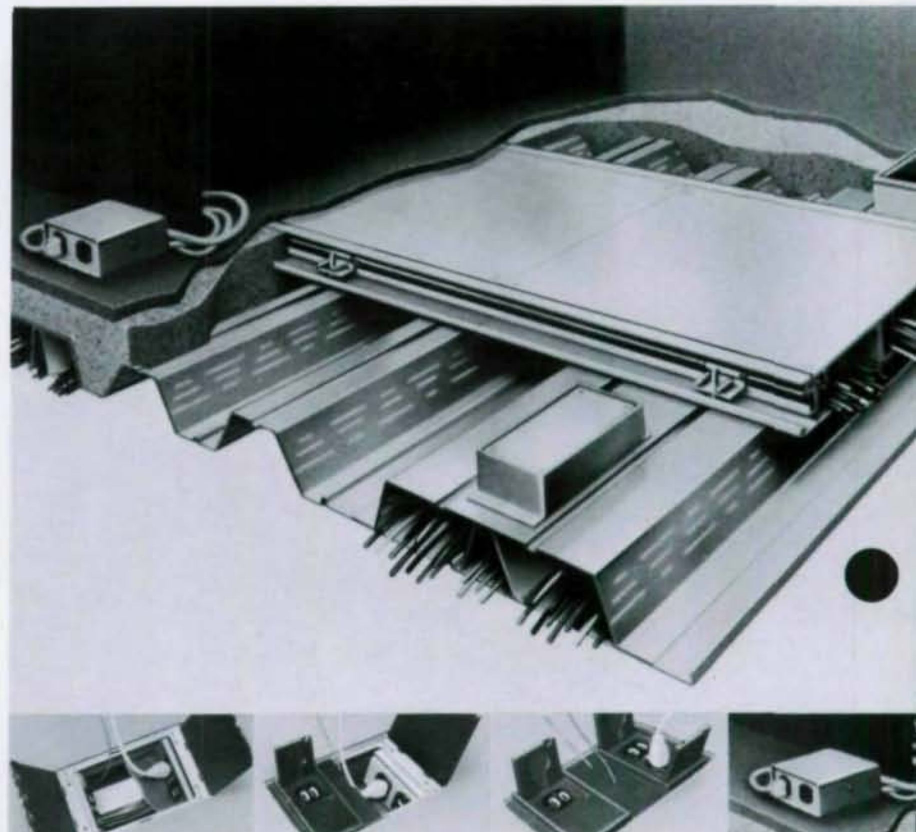

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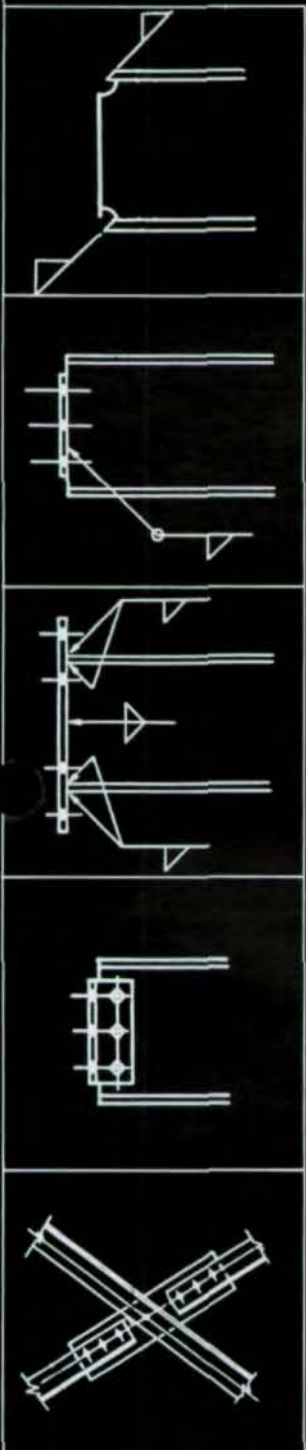

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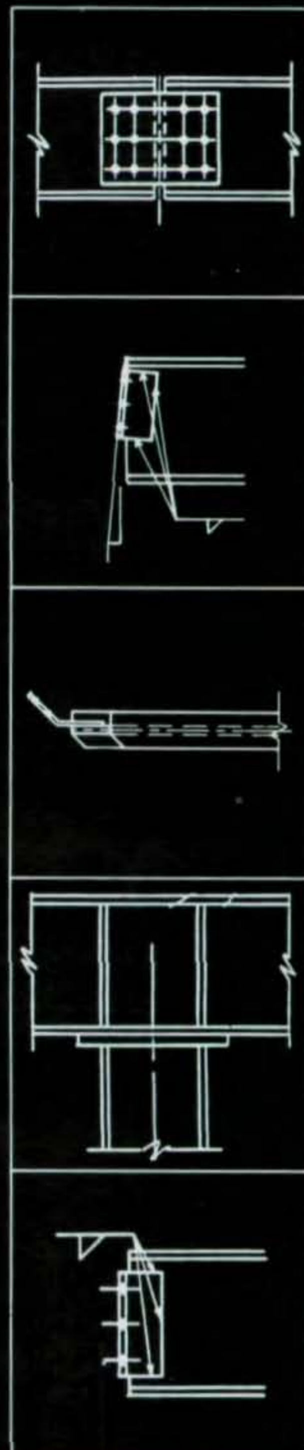

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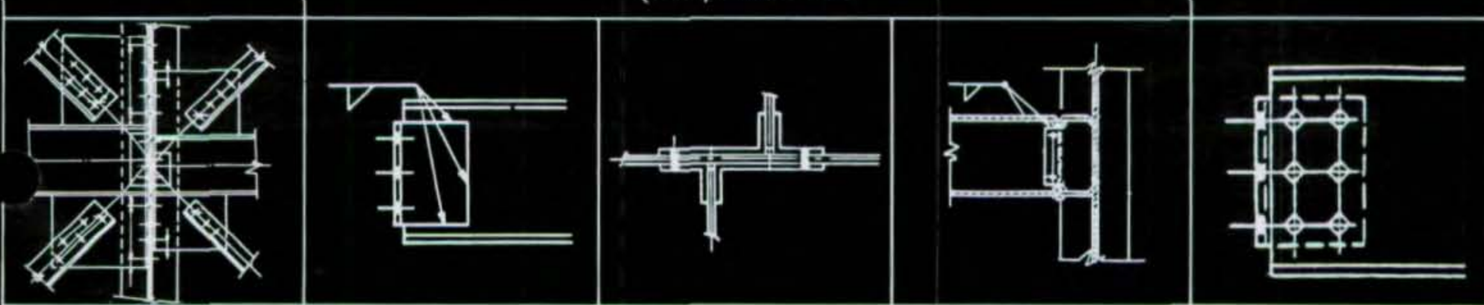

DETAILING INTERFACES: ESTIMATING – AUTO CAD – MILL ORDERS – PRODUCTION CONTROL – C.N.C. EQUIPMENT

MODERN STEEL CONSTRUCTION

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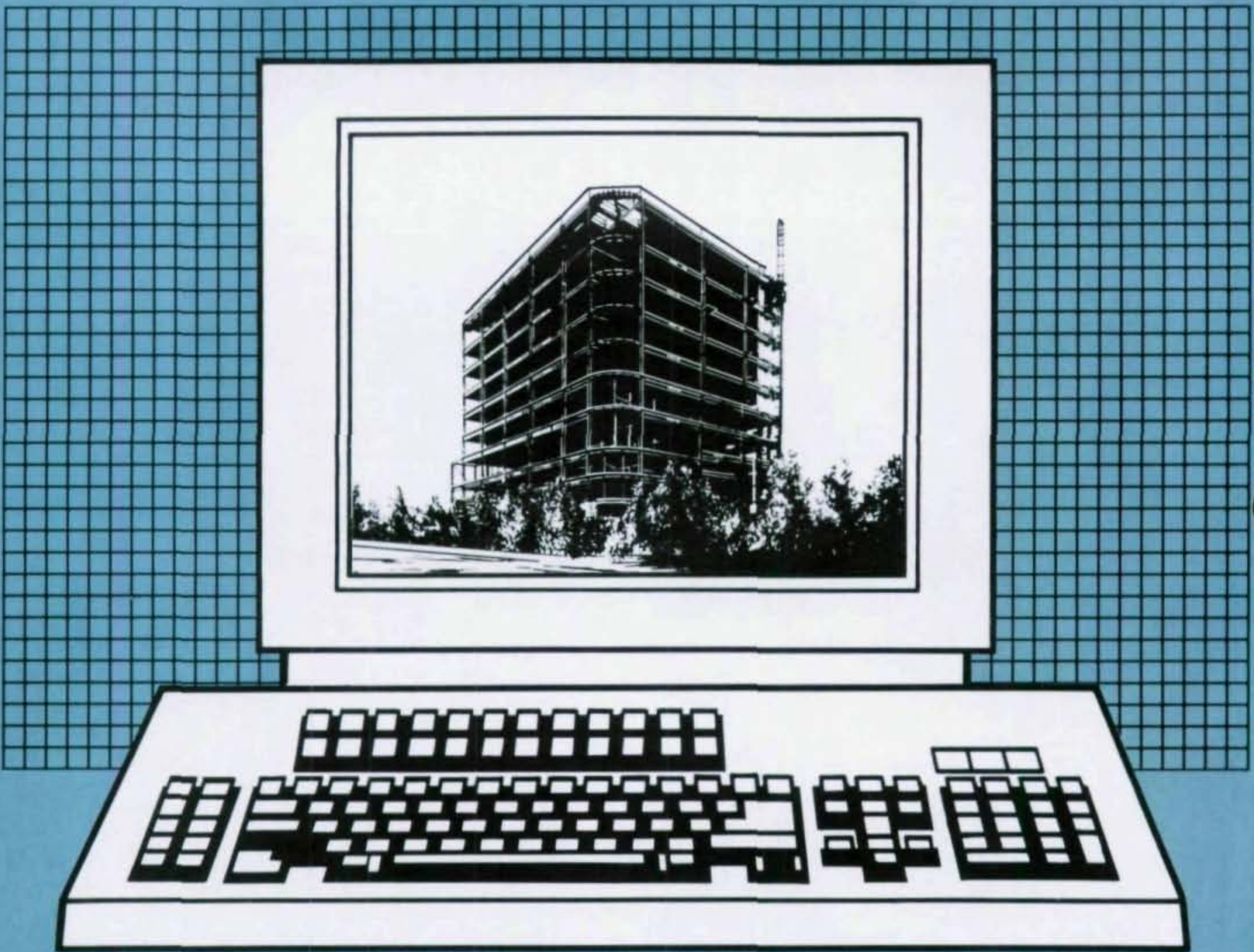
American Institute of Steel Construction, Inc.
The Wrigley Building
400 North Michigan Avenue
Chicago, Illinois 60611-4185
Phone: 312 / 670-2400

ON OUR COVER:
Momentum Place
Dallas, Texas

How can you be sure to select the right system?



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Geometric Data Flow's Detail™ Feature List

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- Produces opposite hand structures with minimal effort.
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- Automatically details all connection material separately.
- Automatically details all members (beams, columns, bracing, etc.) by size and weight, combining all identical members.
- Automatically classifies and composes shop detail drawings for optimum space utilization.
- Automatically plots bills of material showing piece weights, assembly weights, and sheet totals.
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Automatically plots full size templates.

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- Details the building as a unit instead of member-by-member.
- Handles all shapes, wide-flange, tube, channel, pipe, etc.
- Supports over 60 commonly used connection types with maximum flexibility within each type.
- Automatically performs design calculations and reports for all connections (base and cap plates, angles, moments, etc.).
- Flags troublesome connections, allowing the user to make corrections prior to plotting detail drawings.
- Preserves marking and sequencing throughout successive design revisions.
- Maintains a complete file of structural members and connection material for interface for other applications.
- Automatically integrates to ESTIMATE™ for estimating and STEELFLOW™ for production management.
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- Integrates to virtually any shop CNC equipment via direct down-load — no tapes or floppy diskettes required.

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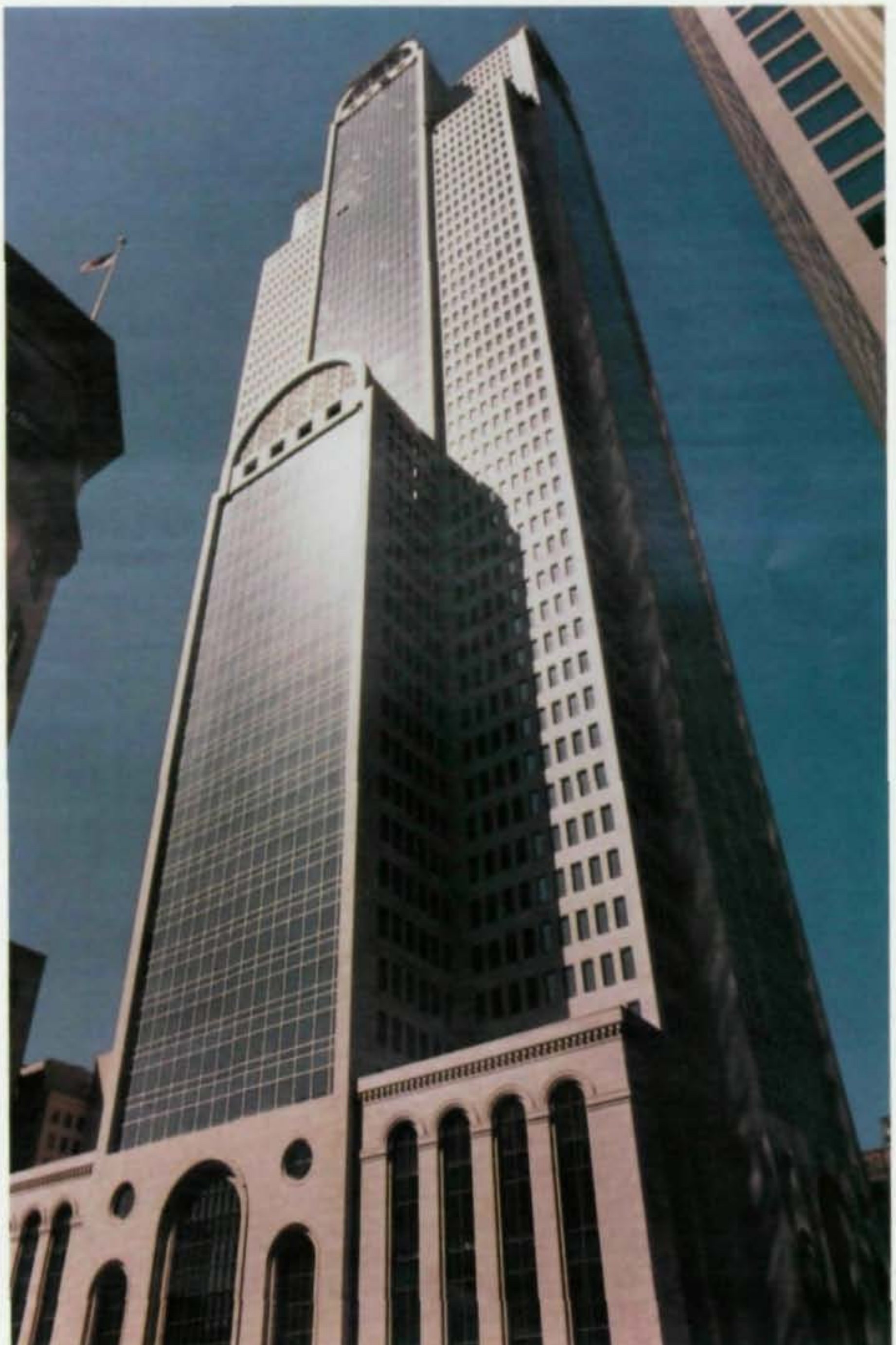
MOMENTUM PLACE
Steel Solves Complex Geometries

by David A. Platten

Momentum Place, in the central business district of Dallas, Tex., is the new headquarters for MBank, Dallas. The complex features a 60-story granite-clad structure with 1.6-million sq. ft of office and banking space. Four additional levels under the tower provide 400,000 sq. ft for parking. Also included in the development of the 200- x 400-ft city block is a network of underground pedestrian tunnels which link Momentum Place to adjacent blocks on all four sides.

A six-level atrium banking hall provides the base for the main office tower. Entrance to the banking hall is from a granite-paved, landscaped plaza through a monumental, 55-ft high carved granite archway. A barrel-vaulted skylight covers the atrium banking hall, 120 ft above the bank trading floor. On the face opposite the banking hall, a 75- x 40-ft appendage, or "bustle," extends from levels 6 to 26. This structure is topped by a vaulted copper roof which extends to level 30. The 135- x 200-ft typical tower plan occurs from levels 30 to 50, where quarter-circle vaulted skylights allow the plan shape to change from a rectangle to a cruciform. The tower rises to a height of 787 ft, where it is crowned with a cross-vaulted barrel roof clad in copper and granite.

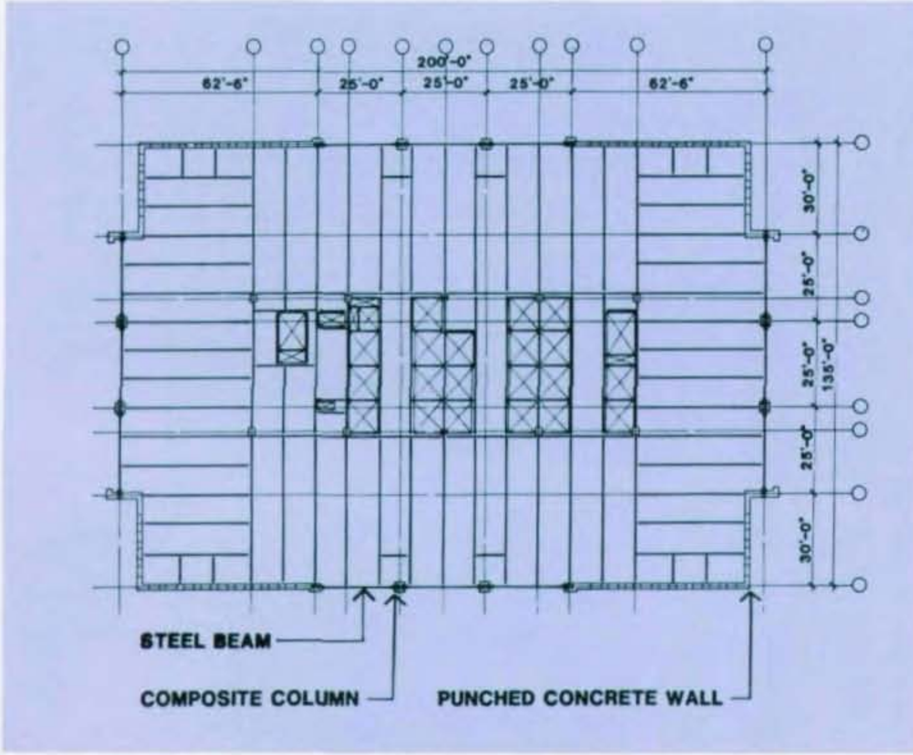


Dallas' spectacular Momentum Place—east building elevation

Framing Systems Studied

Extensive value engineering studies were conducted during design development of the project. Based on previous experience with buildings of similar height and plan dimension, the architects and engineers realized the perimeter of the building would need to participate in resisting wind loads. Once the concept of a perimeter framed-tube system was established, several variations were designed and priced:

1. Structural steel perimeter columns spaced 10 ft o.c. at the building corners (granite-clad areas) and 15 ft o.c. between building corners (curtainwall areas). Spandrel beams consisted of



Typical framing plan. Perimeter-framed tube wind-resisting system shows unique combination of composite columns, punched walls and steel spandrel beams.

W36 steel sections. Shop-fabricated, two-story tree columns were proposed to facilitate erection.

2. Composite perimeter columns spaced as in No. 1, with W36 steel spandrel beams. This system allowed structural steel erection to proceed several levels above column concrete placement by using W14×61 erection columns.
3. Concrete walls with punched window openings at the building corners linked together using infills consisting of composite columns spaced 15 ft o.c. and W36 steel spandrel beams.
4. Concrete walls with punched window openings at the building corners linked together using concrete columns spaced 15 ft o.c. and concrete spandrel beams. Unlike the first three systems, this system required the use of a concrete floor framing system.

In addition to the wind-framing systems described, six floor-framing systems were studied. Concrete floor-framing systems were fairly competitive from a cost standpoint, but they required more time to construct. Steel systems were, therefore, attractive to the owner who faced a very tight construction schedule. Furthermore, with a concrete floor came concrete core columns. Even using high-strength concrete, the resulting large column dimensions prevented the architect from obtaining an optimum core layout. Concrete floor-framing systems were therefore eliminated, also eliminating wind framing system No. 4.

With strong preference shown for a steel floor framing system with steel core columns, further study was undertaken to determine which of the remaining three perimeter wind-framing systems would be most cost effective. System No. 1 required two basic modifications to meet developing needs of the owner and architect, which resulted in lost economies. First, the owner's leasing personnel recommended column spacing be increased in the curtain-wall areas from 15 ft to 25 ft. Secondly, offsets in the building perimeter required by developing architecture resulted in the addition of non-typical column spacings and complex built-up corner column sections. System No. 3 was ultimately selected over system No. 2 for two primary reasons. First, forming of concrete walls with punched window openings at the building corners could be done as quickly and more economically than constructing a series of composite columns 10 ft o.c.. Secondly, walls at the building corners provided a direct means of supporting granite cladding, eliminating the need for a secondary stone support system.

The resulting perimeter framed-tube wind resisting system consisted of a unique mix of concrete and steel elements, providing some new challenges for the contractor. Erection sequence had to be carefully studied to achieve a two and one-half floor per week construction schedule. To support the main tower crane, one bay of core framing was erected two to four floors ahead of the main floor framing. Floor framing in turn lead corner wall construction by another two to four floors. Floor framing in the building corners which used the concrete walls for support was erected two to four floors behind corner wall construction. At this point, metal decking was in place over the entire floor plate, with slab casting occurring another two to four floors below. Composite columns were cast two to four floors below the finished slabs. Between levels 30 and 50, where the floor plate was rectangular, rate of construction occasionally reached three floors per week.

Interior Gravity Framing

Typical floor construction consisted of a 5½-in. thick composite metal deck slab, including 3½-in. lightweight concrete on 2-in. metal deck. Floor beams spanned from building core to perimeter on 8 ft-4 in. to 9 ft-4 in. centers. W18 rolled sections were used at 45-ft spans, while W16 sections spanned 38-ft conditions. All gravity floor framing was specified as A572 Gr. 50 and was designed to act compositely with the slab using field-installed shear connectors. Shop camber was specified to allow beams to deflect to a horizontal position under the wet weight of the concrete slab. Core girders were offset from column center lines adjacent to elevator shafts to provide the most efficient integration of core and lease areas.

Core columns typically consisted of W14, A572 Gr. 50 sections. Where design loads exceeded the capacity of a W14×730 section, a transition to box sections was made. To optimize core layout architecturally, box column size was limited to 2 ft×2 ft-4 in. Plate thicknesses ranged from 2¾ in. to 6 in., resulting in column weights of 870 to 1,630 plf. Plate material was specified as A572 Gr. 42. Core column base plates ranged in thickness from 8 in. to 10 in. and were specified as A36 material.

Perimeter Wind Frame/Transfer Conditions

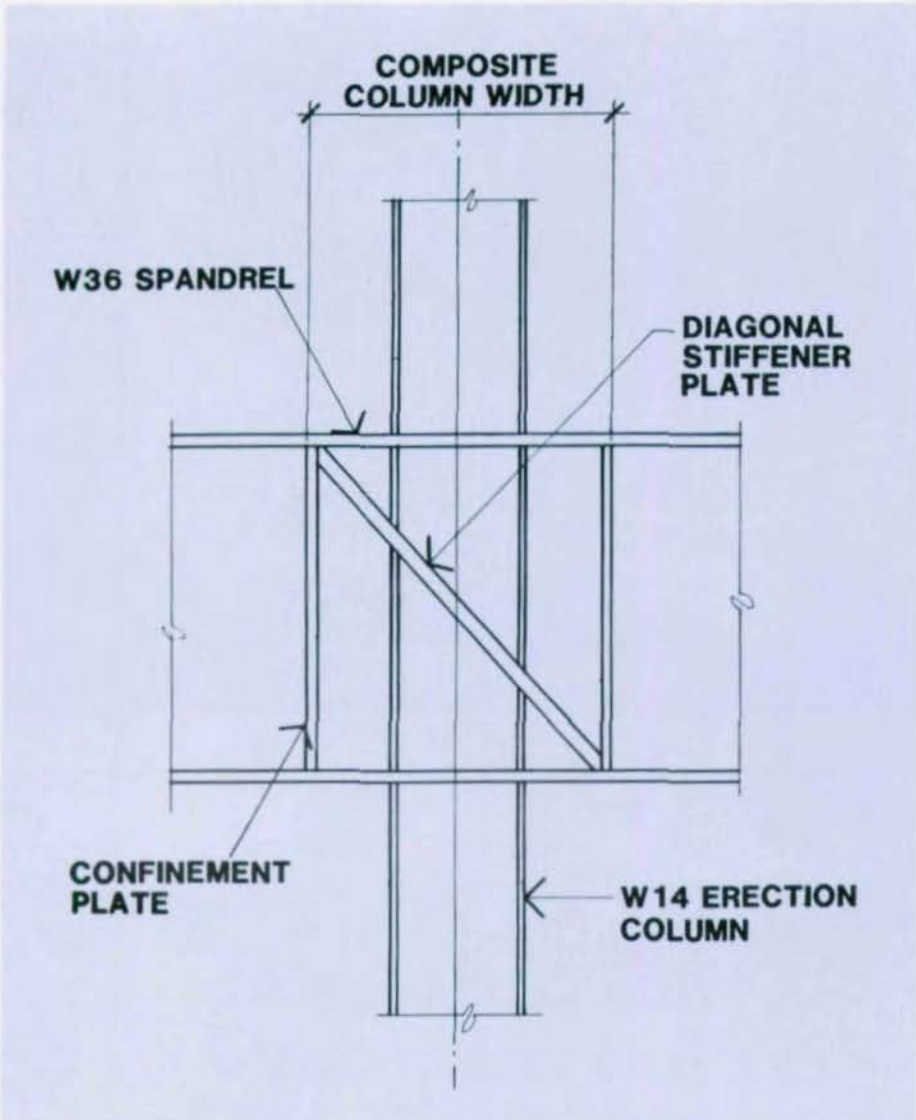
The basic perimeter wind framing system was applied to the building between levels 6 and 50. Spandrel beams spanning the concrete corner walls ranged in size from W36×245 to W36×135. Since the primary function of the spandrels was to provide necessary stiffness, A36 material was specified. To facilitate erection, spandrel beams were fabricated in one-piece lengths of 75 ft. As a result, at the composite column intersections, W14 erection columns occurred between the spandrel beams. Erection columns were also employed at each end of the building corner walls, facilitating steel erection and providing lateral stability for corner wall formwork. Computer analysis indicated spandrel beam/composite column joint stiffness significantly affected overall building drift and top floor acceleration. Consistent with analytical assumptions, joints were stiffened using diagonal web plates. Vertical confinement plates were used at the face of concrete encasement, while additional vertical plates provided for continuity of the erection column section through the spandrel beam.

Above level 50 and below level 6, the typical wind framing system had to be interrupted to accommodate building architecture. The resulting transfer conditions put structural steel to the test in a variety of ways:

1. Above level 50, the floor plate changed from a rectangular to a cruciform shape. Two major structural problems were created. First, the perimeter framed-tube was broken, leaving only two-dimensional rigid frames on each building face. To control frame distortions under wind loading, two-story x-braced frames were added to the core. Bracing members were A36 wide-flange sections, ranged in size from W14×211 to W14×74, and extended from level 44 to the top of the building. This modification required strengthened floor diaphragms to provide for transfer of wind shear forces from the x-braced frames to the perimeter framed-tube below. Second, gravity columns at the re-entrant corners of the cruciform had to be transferred to provide column-free lease space below level 50. Story-deep Vierendeel trusses spanning 45 ft move these gravity column loads to the perimeter wind frame and to the core. Truss chords consisted of continuous W14×455 or W14×500 A572 Gr. 50 sections, while truss verticals used W36 sections. Because of the "out-of-phase" relationship of the core and perimeter columns, the trusses had to be supported at the core by two-story Vierendeel trusses spanning 28 ft to the building core columns. Chords and verticals of the two-story truss were made up of W14 A572 Gr. 50 members.
2. Transfer conditions of major significance became necessary at level 6 to allow for open public areas in the podium levels below.

   a. On the west face, punched concrete walls with columns at 5 ft o.c. were transferred to columns at 25 ft o.c. Even with a full 16-ft story height available for the transfer, concrete sections

Construction photo shows level 6 transfer girders.



Steel spandrel/composite column joint stiffening detail

could not provide adequate shear strength. To accomplish the transfer, 18-ft deep steel plate girders were utilized. Flange plates were 2-in. thick, while the web was 1⅞-in. thick. All plate material was A572 Gr. 50. The plate girders were subsequently encased in concrete to facilitate concrete wall construction above and were supported by wide-flange and box-column sections below. Box columns were 2 ft-4 in. × 2 ft-4 in., with plate thicknesses ranging from 2¾ in. to 5¼ in., resulting in column weights of 940 to 1,630 plf. Plate material was A572 Gr. 42.

b. On the east face, transfer conditions occurred similar to those described above at the west face. However, due to truck loading dock and ramping requirements below grade, concrete walls had to be transferred to columns 45 ft o.c. instead of 25 ft o.c.

c. The north and south punched concrete walls of the "bustle" located on the east side of the building also had to be transferred, this time to columns 38 ft o.c.. Similar details at, above and below these transfer conditions were employed. The bustle transfer girders intersected with the east face transfer girders, resulting in extremely high column loads at the intersection points. Photo shows the north "bustle" transfer girder on the left in its final position, while one of the east transfer girders is lowered into final position at the right.

d. On the north and south faces of the building, column transfers were also necessary due to a change in column locations between the office floors above, and the podium facade below. Again, steel plate girders were required to provide for adequate transfer of shear forces. Girders were 5-ft deep and were made up of 2 in. × 22 in. A572 Gr. 50 flange plates and 3⅝-in. thick A572 Gr. 42 web plates. These plate girders were also encased in concrete to provide the transition from composite columns above to concrete columns below.

Roof Framing Conditions

Structural steel also provided solutions to the framing of four arched roof conditions which occur on Momentum Place. Each of these conditions presented a unique challenge, collectively requiring the use of a variety of structural steel shapes:

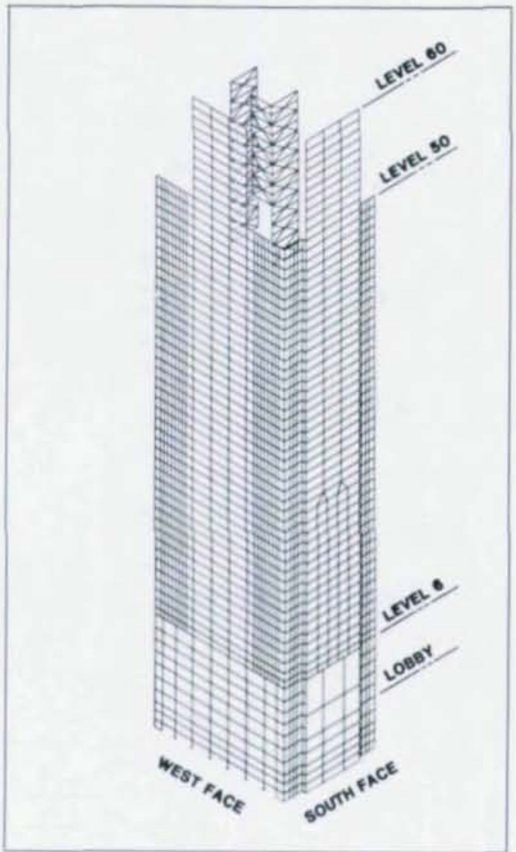
1. The first barrel-vaulted roof framing condition occurs at level 6, providing support for the skylight covering the atrium banking hall. This structure was of monumental importance to the architect, since it was to be exposed to view from each of six levels below. Arched, castellated plate girders 13 ft o.c. with a radius of 34 ft provided primary support for the vaulted skylight. Perpendicular 8-in. dia. standard pipe sections completed the desired architectural appearance and also served as bracing elements for the main arched girders. Arched plate girder sections were 30-in. deep, with 1¾-in. thick flange plates and ¾-in. thick web plates, all A572 Gr. 50.

   Because of the open nature of the banking hall space below, support for the arched roof system had to clear-span 102 ft. A story deep truss could be integrated into the building architecture to support the arches on each side, but a series of mechanical exhaust fans also had to be incorporated. In response to these constraints, Vierendeel trusses using W36 chord and vertical members were selected, one shown in position supporting the arched plate girders. Fabrication of the trusses was complicated by the need to continue the arched plate girder sections through the vertical truss members. This allowed for thrusts imposed by the arches to be carried to the bottom of the trusses where transfer to the floor diaphragm could be accomplished.

2. The bustle structure extends to level 26, where it is topped by a vaulted copper roof. In addition to wind loads, design of the roof had to provide for a large window washing machine which moves along the top of the arch. Arched W27 and W36 sections 10 ft o.c. with a radius of 34 ft were employed as the primary framing system. Primary framing was braced back to the main tower by a series of perpendicular W12 sections. Three-in. deep metal deck spanned between arch members, providing support for the copper roofing system.
3. At level 50, quarter vault conditions occur at each corner of the building. Similar to the banking hall roof, these roof conditions provide support for skylight framing, thus exposing the structure to view from below. The architect preferred the use of pipe sections to frame the atria, but wanted to limit their size to an 8-in. dia. Wind tunnel tests revealed negative pressures of up to 115 psf at the quarter vault areas. In response to the architectural and wind loading criteria, 8-in. dia. double extra strong pipe sections spaced 5 ft o.c. were used.


Construction photo shows banking hall roof framing.

Computer model of perimeter wind frame illustrates differing structural conditions.



These sections were rolled to a radius of 21 ft to provide support for the vaulted skylights. Four-in. dia. standard pipe sections perpendicular to the arched sections provide lateral bracing back to the main tower.

4. Finally, the structure is topped with a cross-vaulted barrel roof clad in copper and granite. Arched members with a radius of 34 ft, spaced 10 ft o.c., served as the primary supporting structure. Member sizes ranged from W10 to W36 and were rolled to the required radius where possible. For the deeper sections, the fabricator had to use built-up sections in lieu of rolled sections. Web plates were cut to the proper radius, while flange plates were rolled and subsequently welded to the web plates. The primary arched framing was braced by a secondary x-bracing system made up of angles ranging in size from 5 × 5 to 8 × 8. A band of x-bracing 10 ft wide ran along the top of the arches, and around the radius of the arches at each end. Similar to the bustle roof condition, 3-in. deep metal deck spanned between arch members, providing support for the copper roofing system. □

(continued)

West building elevation

Architect
John Burgee Architects with Philip Johnson
New York, New York

Associate Architect
Harwood K. Smith and Partners
Dallas, Texas

Structural Engineer
The Datum/Moore Partnership
Irving, Texas

General Contractor
HCB Contractors
Dallas, Texas

Steel Fabricator
Mosher Steel Company
Houston, Texas

Steel Erector
John F. Beasley Construction Company
Dallas, Texas

Owner/Developer
The Elm Block Limited Partnership,
a joint venture of Cadillac Fairview,
Urban Development and MBank Dallas
Dallas, Texas

David A. Platten, P.E., is vice president of the Datum-Moore Partnership, Irving, Texas.

You can't get heat treated plate any longer.

DELTA MARKETING BUILDING

Takes Off Fast, "Lands" on Time

by Michael Cannon

Exterior highlights layered brick coursing and triple-pane window treatments. Entry canopy and vestibules in background.

Construction of a $6-million Delta Airlines Marketing Services Building immediately north of the Salt Lake International Airport went fast, smooth and on time.

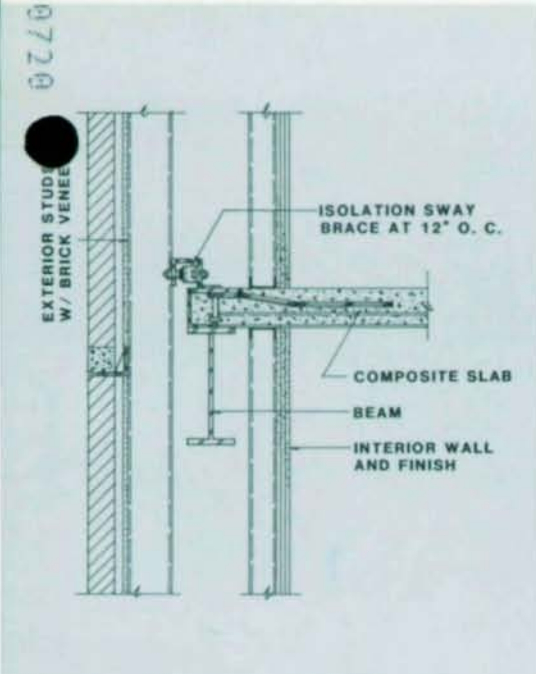
Work on the 88,000-sq. ft, two-story facility took off in April and "landed" in mid-September. That's flying, by anyone's definition!

According to Ronald Reaveley, project structural engineer and president of Reaveley Engineers in Salt Lake City, the use of a steel structure was a major factor in meeting the tight time schedule. And it also allowed an important design change early in the project.

"The design phase started March 9, and the first bid package—structural steel, footings and foundation—went out March 16," explains Reaveley. "The structural system is a high-strength, composite steel frame, laterally braced around the perimeter with diagonal steel tubes. Columns are 46-ksi tubular steel. Steel was selected because of its availability, speed of construction and design flexibility. The braced-frame structure was economical, yet lightning-fast to erect."

Reaveley's engineering firm used a computerized composite steel design program developed in-house to maximize the cost effectiveness of the structure. Beams and purlins were fabricated from A-572 Gr. 50 steel. Each element was designed fully

Michael Cannon is editor of Intermountain Contractor *magazine, Salt Lake City, Utah.*



Connection detail on second floor shows how exterior wall was isolated from structure.

or partially composite as economics dictated.

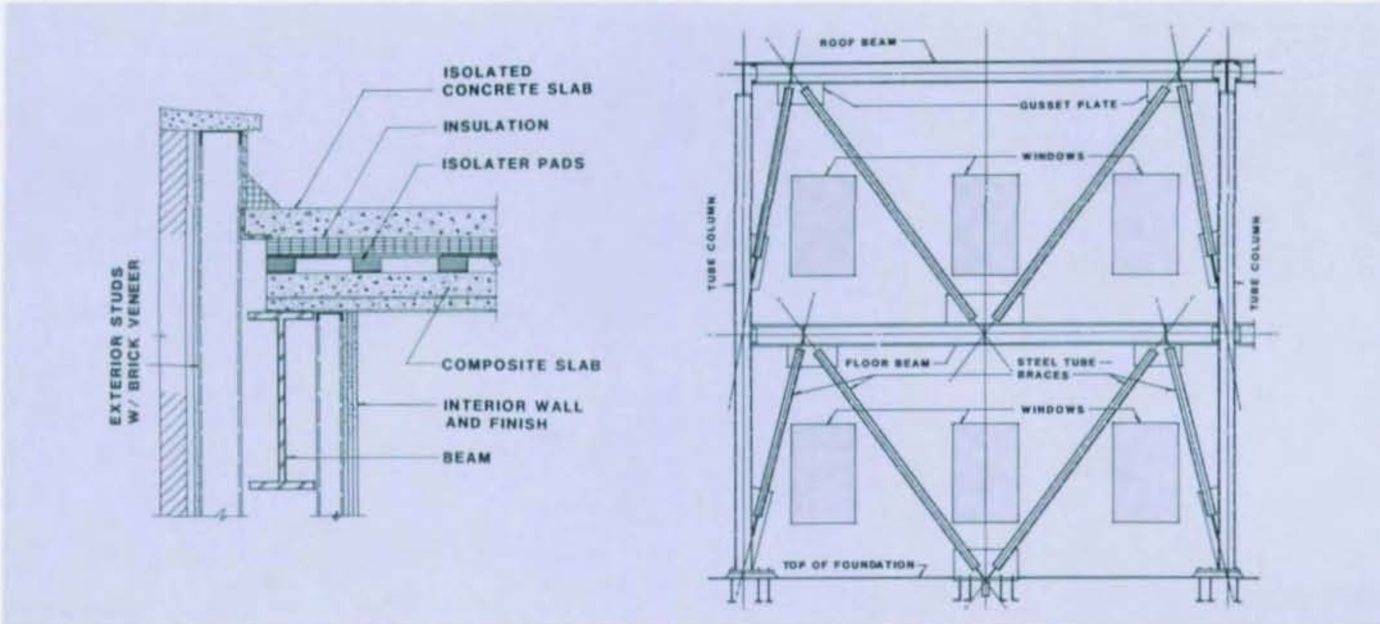
"Structural costs were kept to an absolute minimum," he emphasizes.

The fabricator had started fabricating steel for the facility when Delta decided to add another bay and relocate the interior lateral bracing, designed to resist UBC Seismic Zone 3 earthquake forces. "Using steel allowed building modifications to occur without putting the project behind schedule. The building was erected in an incredibly short period. We had an unbelievable deadline. Meeting it required cooperation and commitment from everybody on the design and construction team," Reaveley adds.

A Fast Takeoff

After work on the first phase got rolling, the second bid package—masonry work, roof, stairways, mechanical and electrical—went out April 20. The final package for interior finishes was let May 18. The push to complete the building in September was mandated by Delta so employees moving into the area could get settled and their kids into school.

The owner did pay extra to build it quickly even though the employees did not demand it. But the company did it because everyone recognized the importance of both the schedule and of quality work. In addition to the early design change, a slight delay was caused because the build-



Connection detail at roof (above) shows how exterior wall and second roof slab were isolated from structure. Elevation of vertical seismic bracing (r.) at perimeter shows how bracing geometry was arranged to permit regular spacing of windows, as requested by owner.

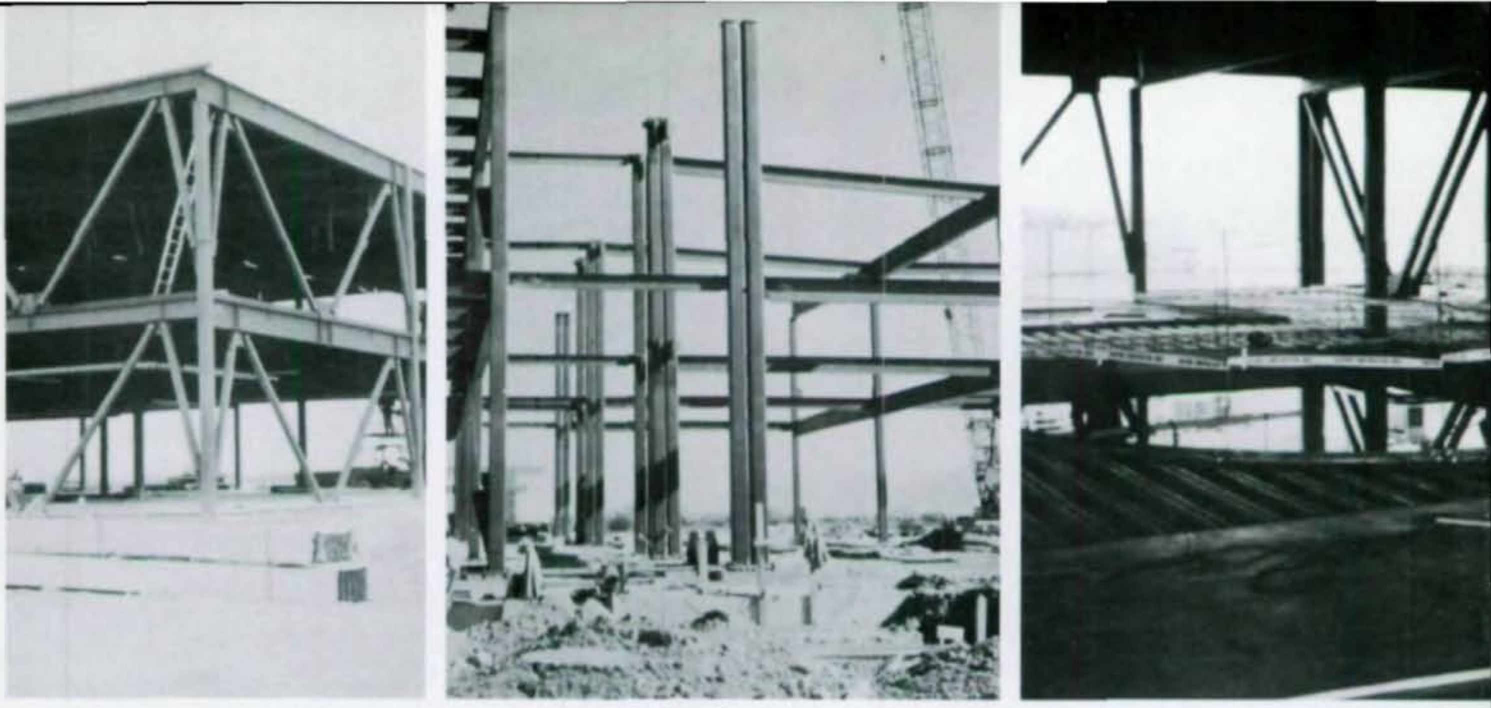
ing rests on a site designated as wetland. The Airport Authority was ready to start placing structural fill on the site when work was delayed until necessary permits were secured from the Corps of Engineers. The general contractor made up for the lost time in several weeks by using double shifts.

Tight Schedule Impressive

Meeting the tight schedule was impressive because the building is good sized and relatively complex. The second floor houses 450 reservations personnel who operate computer terminals around-the-clock, seven days a week. Level 2 also houses a large recessed computer room with removable, raised-access flooring and conference and training rooms.

Marketing, pilot and attendant training are conducted on the ground level, which includes dressing rooms, marketing offices, meeting rooms, a fuselage mockup where pilots and attendants are trained in emergency procedures and a fire extinguisher practice room. The practice room, with a two-hr. fire rating, has ventilation hood, a gas line that fuels fires and a back-up sprinkler system to bail out any failing firefighters. The exterior, a veneer of brick and precast concrete bands, had nine colors of brick (browns and tans) to mirror the desert terrain west of Salt Lake City and add interest to the long, horizontal walls.

In the future, a Delta maintenance and repair hangar will be built adjacent to the building. Jet engines will be run wide open for up to 15 minutes after maintenance adjustments. The future engine testing and proximity of passing aircraft made sound control a major design consideration in the marketing structure.



(L. to r.): Diagonal steel tube braces permit regular spacing of windows. Double columns along exterior create center expansion joint. Circular cutout for main lobby.

Noise Elimination Important

To eliminate noise, the veneer is acoustically isolated and set apart from the structure, creating a 10-in. airspace between interior and exterior walls. The shell-within-a-shell system is interesting and extremely effective in isolating outside noise. Inside the building, the noise from commercial jets taking off and landing on the adjacent runway is barely noticeable. Six-inch studs run from the foundation up two floors and attach to the roof deck. Exterior walls are connected to the second-floor deck with seismic isolation braces and then to the top roof slab, which is isolated from the structure.

The roof has an isolation mat of concrete and steel, topped with a concrete deck, rigid insulation and another 4-in. reinforced slab. The top slab is tied to the exterior walls, creating an exterior shell around the interior and preventing outside noise or vibrations from penetrating the building.

Windows have double-pane units in the exterior walls and single-pane units in the interior, so sound is absorbed between them. Between the window units are perforated aluminum panels with fiberglass insulation. Also for sound purposes, boilers and chillers were placed in a separate mechanical building, and cooling towers, gas meters, the electrical transformer and television antennae are hidden apart from the building behind a circular masonry screen wall.

There is nothing on the roof except four flashed-ventilation and exhaust shafts, so the building looks good from the air—especially important to the people at Delta Airlines. □

Architects

Lord and Sargent (project)
Atlanta, Georgia

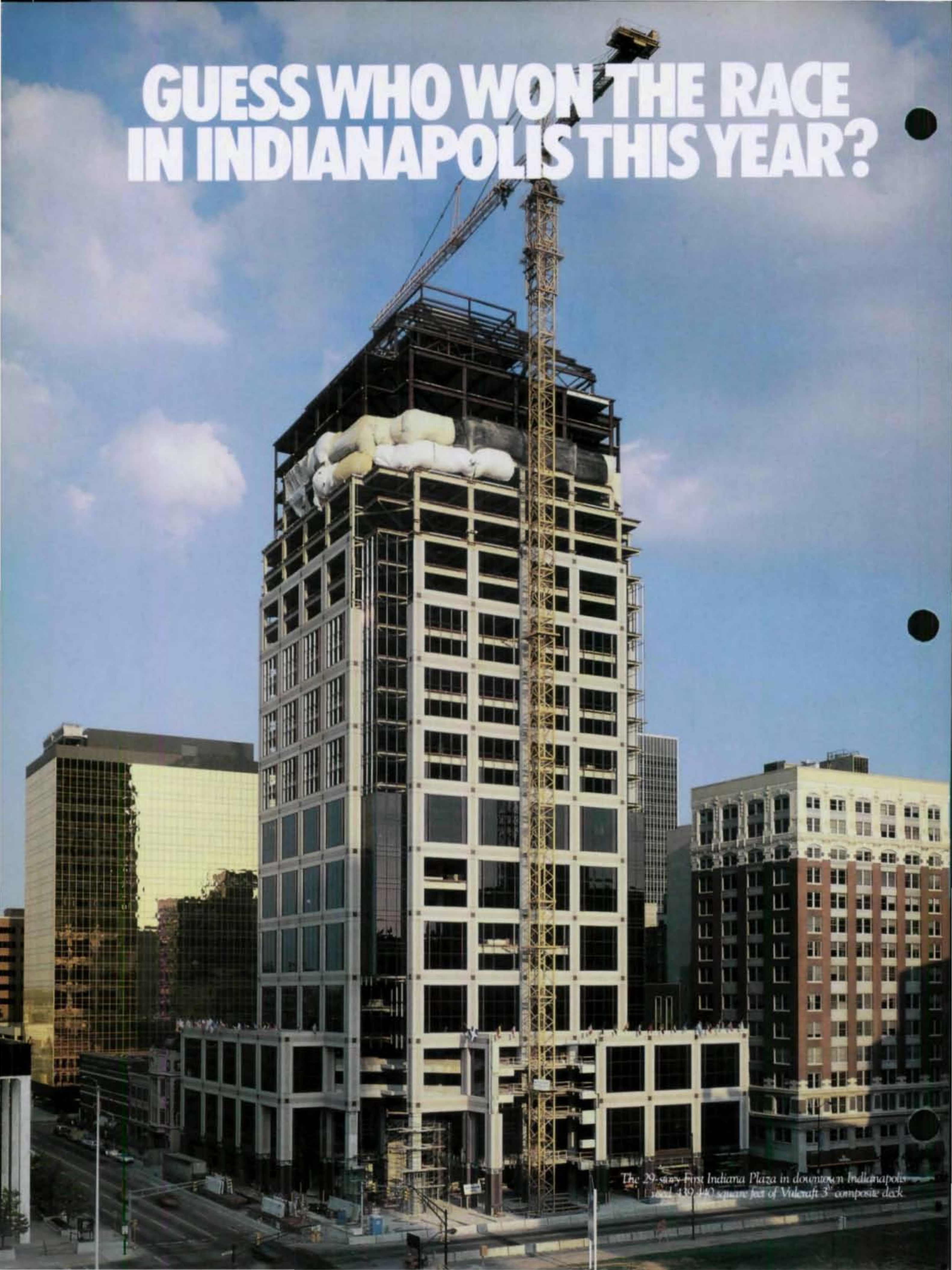
MHT Architects, Inc. (associate)
Salt Lake City, Utah

Structural Engineer

Reaveley Engineers and Associates
Salt Lake City, Utah

General Contractor

Okland Construction Co.
Salt Lake City, Utah



The 29-story First Indiana Plaza in downtown Indianapolis used 139,140 square feet of Vulcraft 3" composite deck

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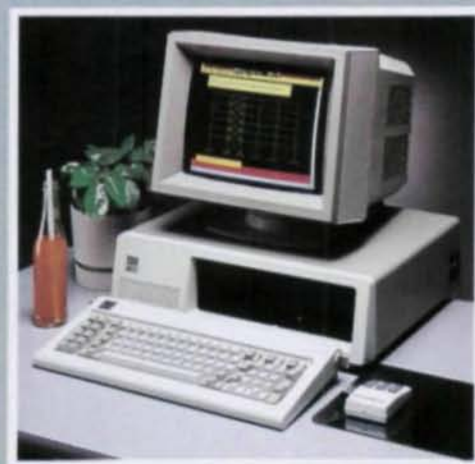

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- Comprehensive yet concise user's manual
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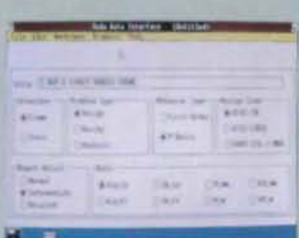

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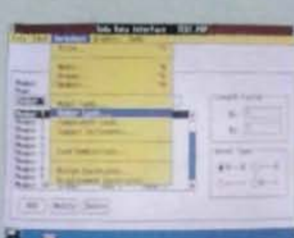
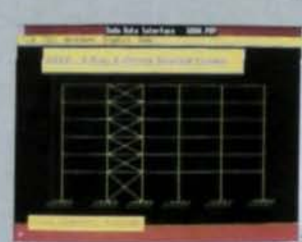


User interface is accomplished with mouse and drop down menus.



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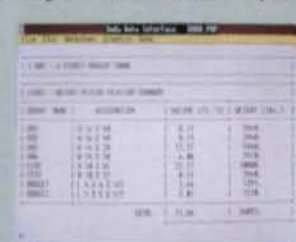

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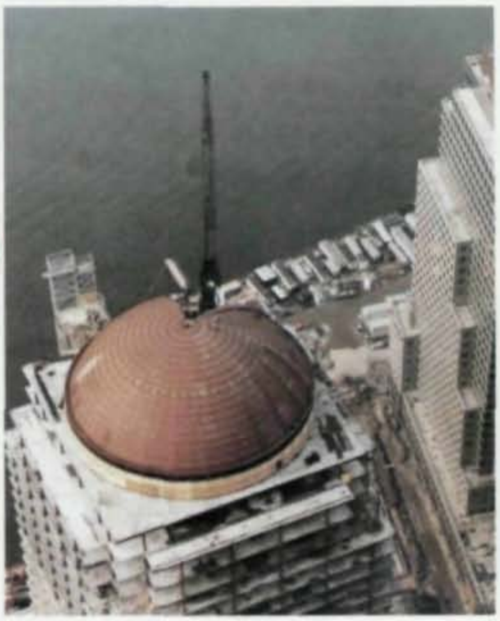
STRUCTURAL OPTIMIZATION DESIGN AND ANALYSIS

WORLD FINANCIAL CENTER

Steel Comes Out on Top!

by Abraham Gutman, Leonid Zbrovosky and Lee Petrella



Steel-framed dome tops World Financial Center. Entire "slice" (r.) was lifted into place and connected to tension ring and compression hub. Process was repeated—650 ft up—until dome was completed.

The World Financial Center, a four-tower complex containing about 7 million sq. ft of office space, nears completion on the west side of lower Manhattan. The complex has a common architectural vocabulary, but each tower has its own distinct top. Building A, 37 stories high, has a truncated pyramid; Building B, 45 stories high, has a dome; Building C, 51 stories high, has a pyramid and Building D, 35 stories high, has a stepped, flat-topped pyramid. A major challenge was design of the dome for Building B. It had to be economical to fabricate and practical to erect 650 ft up. Arc welding helped to make this possible.

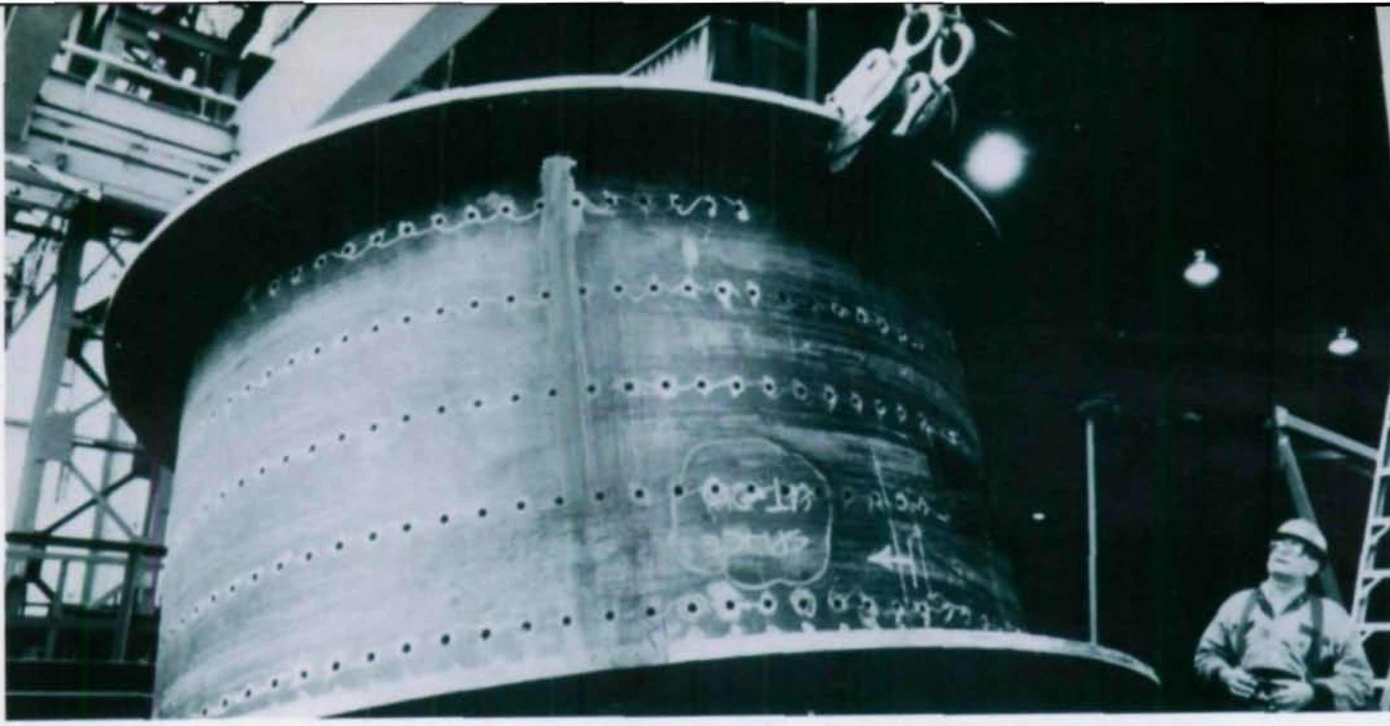
Several Design Concepts Considered

The architectural design called for a 150-ft dia., 45-ft high dome resting on a 20-ft high cylinder. The dome, to be clad with a standing seam copper roof system, serves as an enclosure of a multi-level, 20,000-sq. ft mechanical room. The contractor/owner was using an innovative concept of erecting the mechanical and electrical equipment simultaneously with the steel framing, so quick erection of the dome was essential to protect this equipment from the elements.

Several concepts were considered in the initial stages of design. A cast-in-place concrete shell concept was rejected because of the difficulty in placing concrete 650 ft above street level, at an exposed, windy site.

Another concept considered was curved metal deck spanning between concentric arch-trusses. This system was rejected because of the difficulty in welding metal deck to curved surfaces. In addition, the metal deck did not provide sufficient bracing and stiffening to the top chord of the arch-trusses. Also, installation of the copper cladding would require a complete subframing system.

A concept consisting of precast concrete



Compression hub weldment swings into place.

elements spanning between arch-trusses was also investigated, but rejected because of cost and difficulties with erection. A system had to be created which met these requirements:

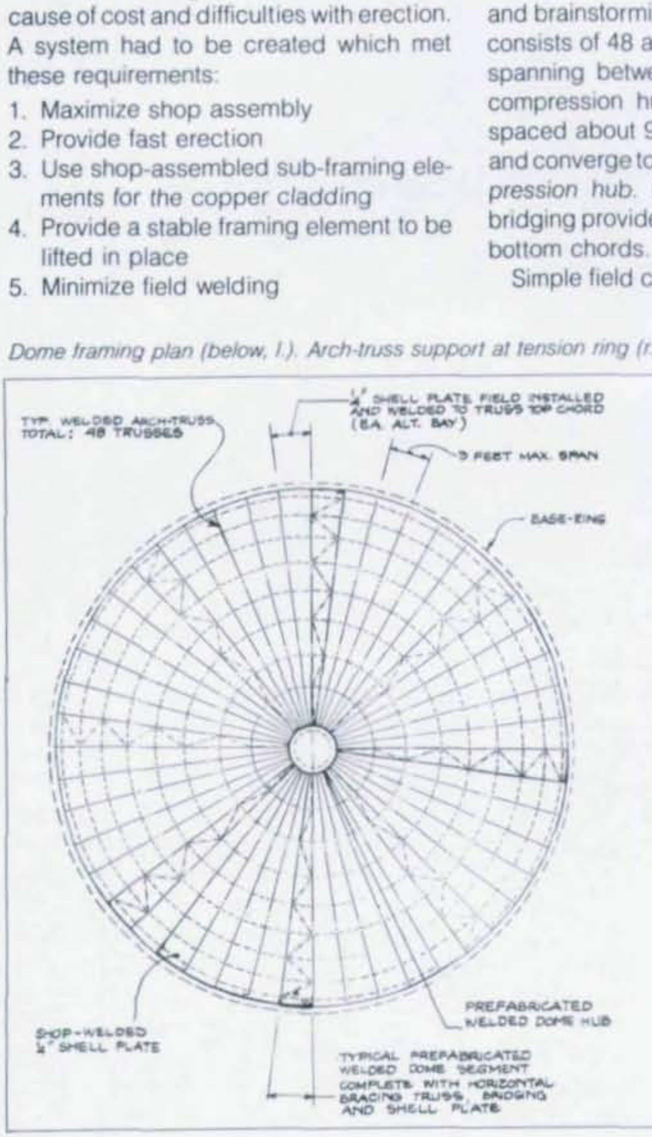
1. Maximize shop assembly
2. Provide fast erection
3. Use shop-assembled sub-framing elements for the copper cladding
4. Provide a stable framing element to be lifted in place
5. Minimize field welding

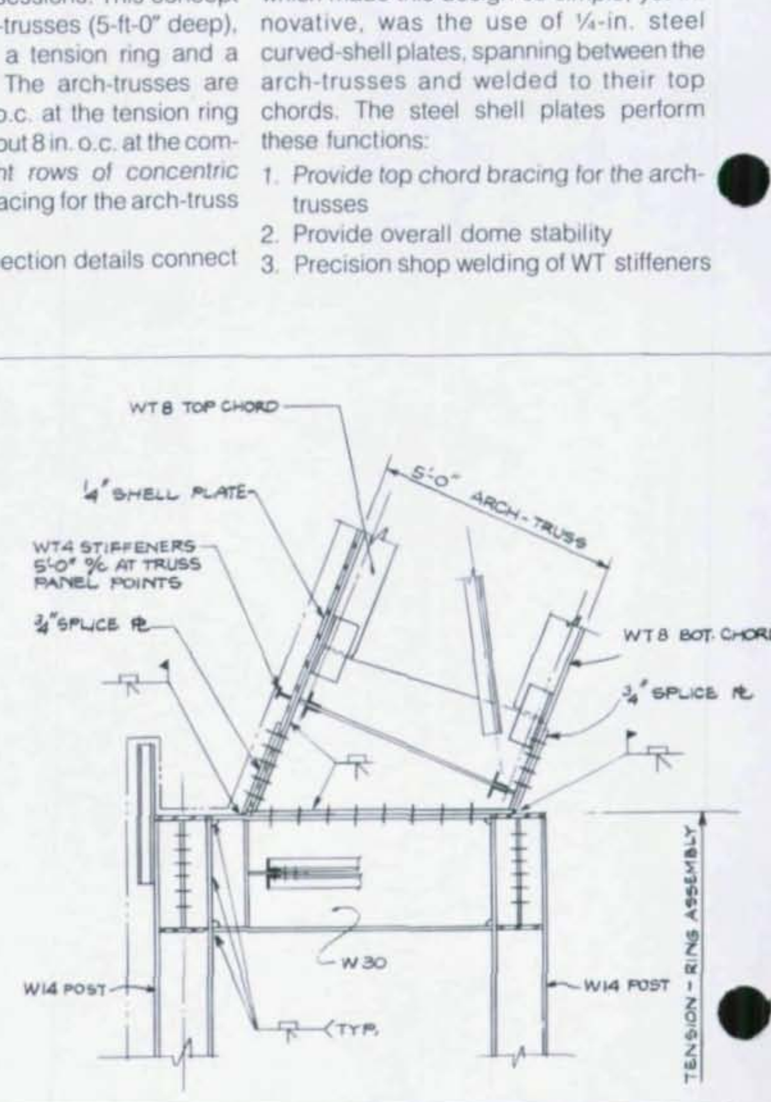
The final concept was developed through value engineering methodology and brainstorming sessions. This concept consists of 48 arch-trusses (5-ft-0" deep), spanning between a tension ring and a compression hub. The arch-trusses are spaced about 9 ft o.c. at the tension ring and converge to about 8 in. o.c. at the compression hub. Eight rows of concentric bridging provide bracing for the arch-truss bottom chords.

Simple field connection details connect the arch-trusses, to the tension ring and the compression hub. Finally, the idea which made this design so simple, yet innovative, was the use of ¼-in. steel curved-shell plates, spanning between the arch-trusses and welded to their top chords. The steel shell plates perform these functions:

1. Provide top chord bracing for the arch-trusses
2. Provide overall dome stability
3. Precision shop welding of WT stiffeners

Dome framing plan (below, l.). Arch-truss support at tension ring (r.).





Gaps between arch-truss assemblies were filled in with curved plate segments welded in field.

4. Provide an instant sealed steel dome roof
5. Place 90% of the welding in the shop

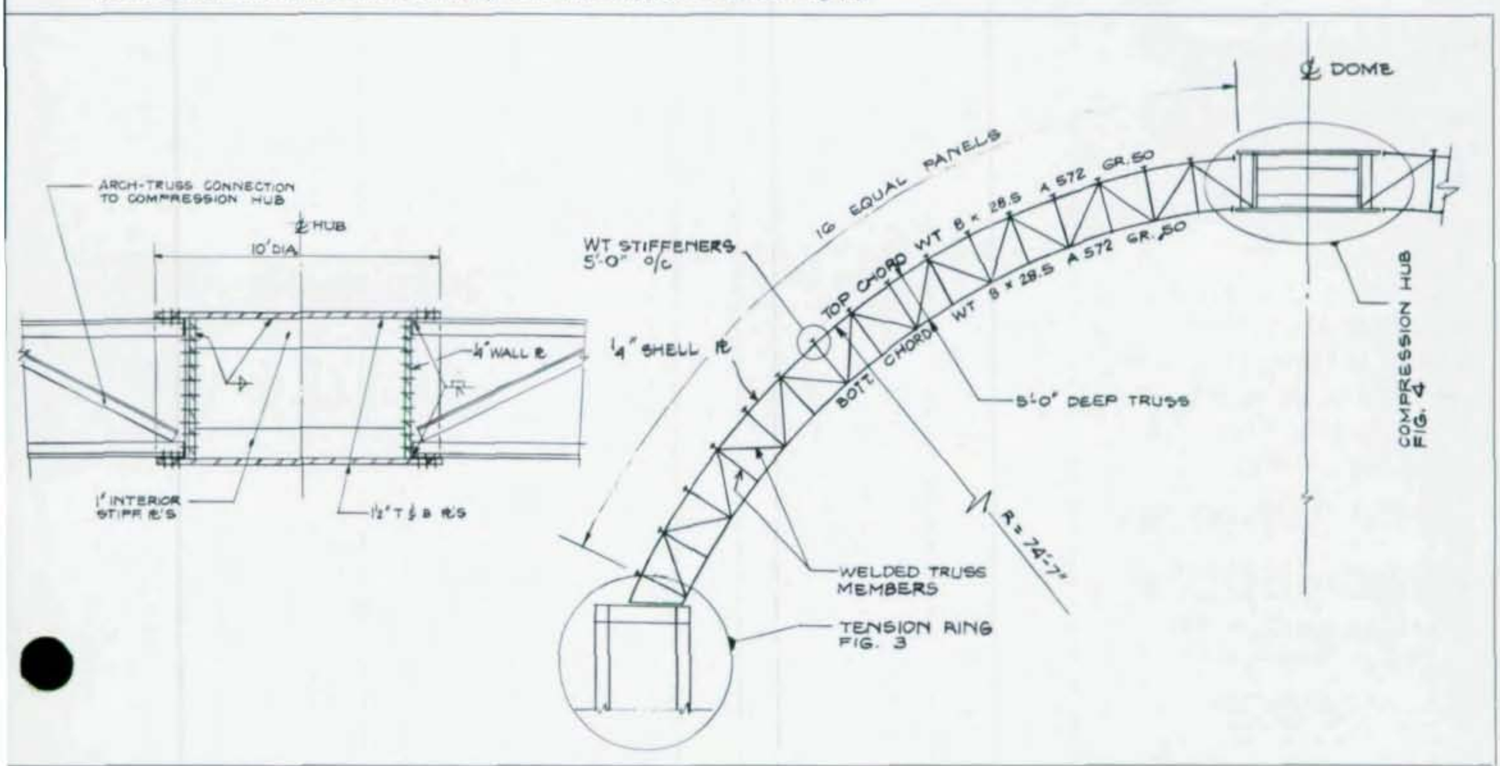
The ¼-in. steel plate is stiffened by WT4 stiffeners running concentric to the dome and spaced 5 ft o.c. The WT4 stiffeners, shop welded to the ¼-in. plate, also serve as mounting clips for nailers which support the copper cladding. The timber nailers were installed 2 ft o.c. by sliding their ends under the WT flanges. Insulation was placed between the timber nailers and plywood sheathing applied to the entire dome. The copper cladding is then attached to the plywood.

Fabrication

The arch-truss segments are WT8 top and bottom chords and double-angle diagonals and verticals, welded in the shop. The ¼-in. curved, trapezoidal plate sections (three pieces per pair of arch-trusses) were shop-welded to two arch-trusses to form a stable assembly.

The compression hub weldment assembly is a 1¼-in. cylinder plate and 1½-in. top and bottom plates, assembled using full-penetration welding. The welding of 1-in. interior stiffener plates was accomplished through access holes in the top and bottom

Welded compression hub detail (below, l.). Arch-truss support at tension ring (r.)



Dramatic lift of entire "slice" for connection with tension ring/compression hub

plates. The entire arch-truss assembly element, consisting of two half arch-truss sections (+38 ft long) with a ¼-in. plate welded to the top chords, was shipped to the job site as a unit. Prior to shipping, complete truss-arches were assembled end-to-end in the shop to assure precision fitting.

Erection Intricate

The compression hub was erected first and supported on a temporary shoring tower. Arch-truss assemblies (+38 ft long) were lifted to the 10th floor (local roof). On the 10th floor the two arch-truss sections were joined end-to-end, forming a wedge-shaped slice of dome. The entire slice was lifted into place and connected to the tension ring and compression hub, a process repeated section by section until the entire dome was erected. Finally, the gaps between the arch-truss assemblies were filled in with curved plate segments (three trapezoidal pieces per gap) which were welded in the field to the top chords of the arch-trusses. The erection of the steel dome was completed in one month and it was ready to receive the copper cladding.

Arc welding was essential to the successful completion of the Building B dome top. The light, yet stiff, arch-trusses, the compact, heavily loaded compression hub, the WT plate stiffeners and the ¼-in. shell plate itself all required extensive use of this versatile connection method. □

Architect
Cesar Peli & Associates
New Haven, Connecticut

Structural Engineer
Lev Zetlin Associates
New York, New York

General Contractor/Owner
Olympia & York
New York, New York

Abraham Gutman, P.E. is vice president; Leonid Zbrovosky is an associate and Lee Petrella, P.E., a project engineer for Thornton-Tomasetti, Engineers and Designers, New York, New York.

TACO BELL

Elegance in a Steel Frame

by Jon Patrick Allen

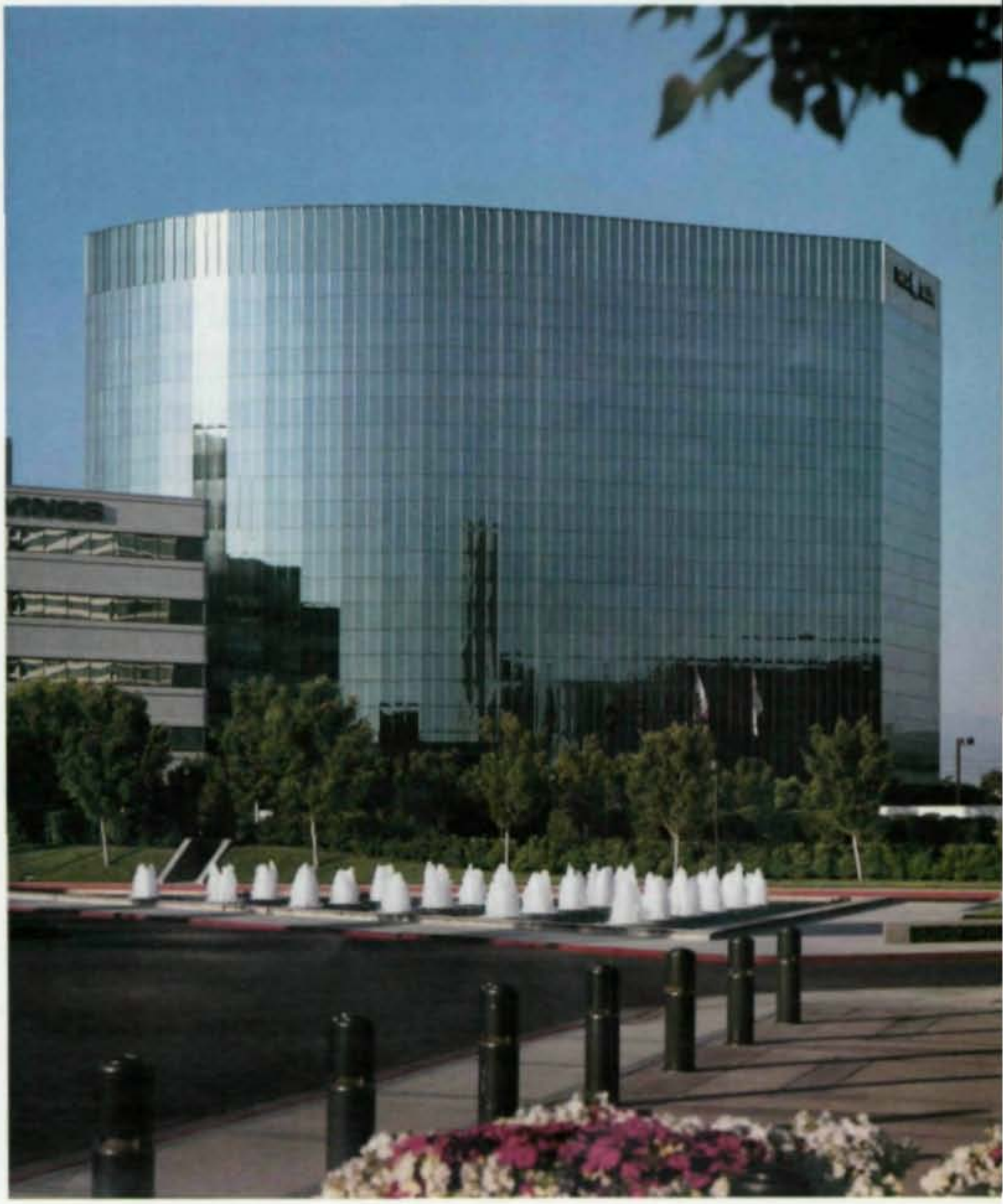
The $50-million Taco Bell building in Irvine, Cal., boasts not only the largest lease in Orange County history, but also one of the county's most elegant skylines. And, it represents a successful, cost-effective response to challenging site conditions. Selected as the gateway to the 47-acre northern parcel of the $1-billion Koll Center Irvine project, one of the largest mixed-use developments in Orange County, the building was designed by Langdon Wilson Mumper Architects.

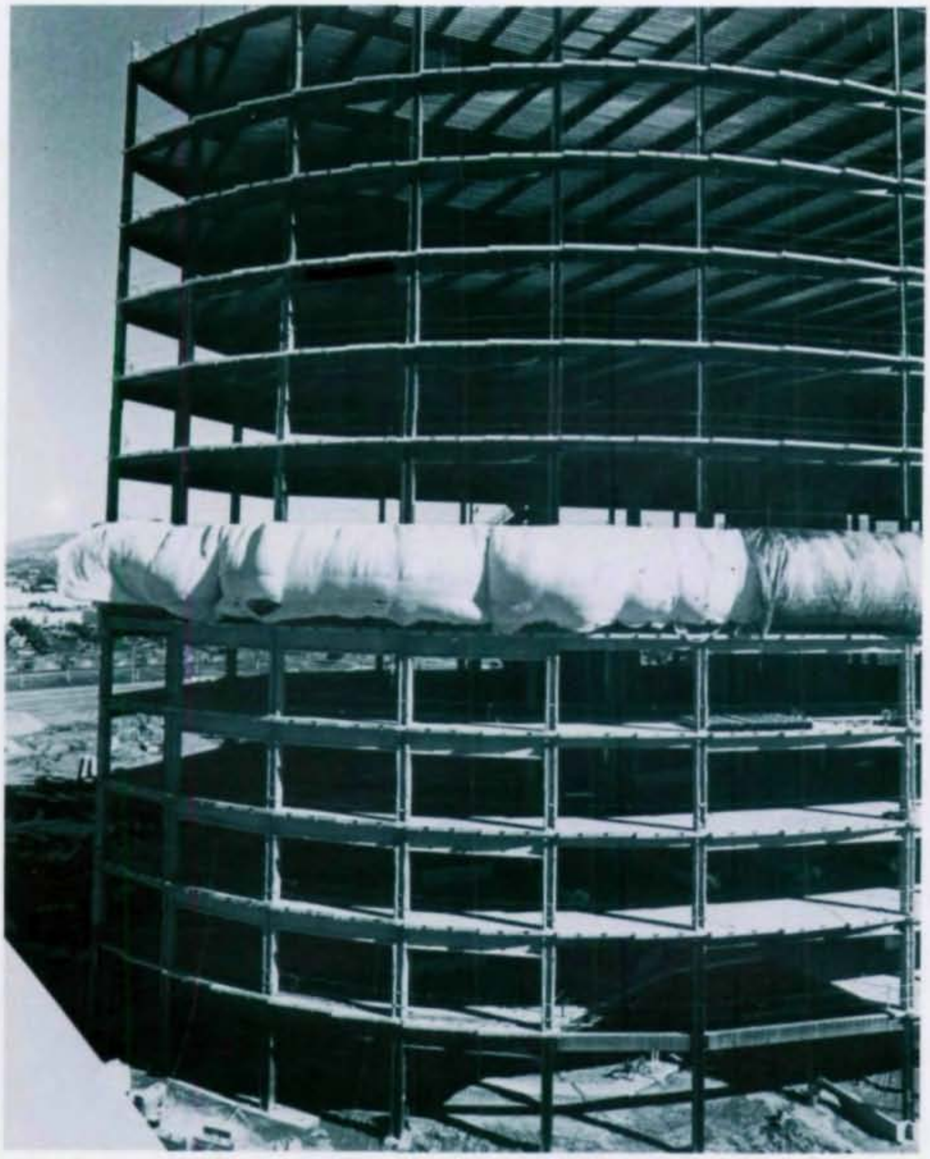
The design program called for a 12-story office structure to harmonize with an existing building on a site restricted in size. It was the first of nine scheduled high-rise office structures on the site. Responding to design requirements, the architect created a composition of dissimilar yet harmoniously integrated forms. The contrasting shapes of the 275,000-sq. ft Taco Bell building—with its triangular fountain and curvilinear tower—complement the soft form of the existing five-story Columbia Savings and Loan building—essentially a square with rounded corners.

The fact that the site was so restricted—67,200 sq. ft—precluded exterior plaza space between the buildings, so the tower was undercut and integrated with the water feature, increasing the apparent space between the buildings at the ground plane.

To further enhance the restricted site, the area between the Taco Bell building, Columbia Savings and Loan building and Embassy Suites hotel was improved as a plaza with alternating colored bands of brick and groves of trees. This dual-purpose plaza also serves as the entrance and exit to the 1,450-car parking structure.

A strong visual element, the building's closely set stainless steel mullions portray





Asymmetrical shape of Taco Bell building demanded flexibility of steel.

shiny vertical pinstripes in strong contrast to the thick horizontal bands of the existing low-rise edifice. The structure's sheath of green reflective glass accentuates the polished mullions.

To create a striking outline of the building from a distance, the architect specified inset glass panels at the top of the building so the setting sun would crown it in silver. The shining top draws the vertical sight lines to the base of the granite, water and land features, where design elements are reduced in size to cater to a human scale.

Shape Demands Steel

The asymmetrical curvilinear shape of the building demanded the strength and flexibility of steel, a material which would also easily accommodate the various mechanical and electrical systems.

The structural steel moment frame, designed to meet wind and seismic standards recommended by the Structural Engineers Association of Southern California, was chosen primarily because it can be erected quickly and economically. Steel used for typical framing members was ASTM-A36, Gr. 36, while the lateral resisting welded frame columns were ASTM-A572 Gr. 50 ksi steel.

The steel frame also permitted flexibility to accommodate future tenant alterations. This was illustrated when Taco Bell leased the entire building, shortly after its completion in 1985, and initiated several tailor-made changes. One of the first changes easily accommodated by steel framing was the installation of a full-service employee health club on the first and second floors. The steel frame also proved the only effective building support system for elevator machinery dropped into a mezzanine level on the 12th floor.

Holes which penetrated webs in major girders easily facilitated air conditioning ducts and plumbing lines. Similarly, floor penetration of electrical and telephone lines was facilitated by the 6¼-in. composite concrete/metal deck floor system. The flooring, chosen for its lightweight and structurally efficient properties, consisted of a lightweight structural concrete fill over 3-in. metal deck.

Where concrete framing would have required heavier foundations, the lightweight steel frame resulted in savings on the concrete pile foundations. Floor beams span 40 to 44 ft for a building designed to support a live load of 100 psf.

A fast-tracked building system, responsible for maintaining the construction schedule, permitted the steel frame and floors to be erected while the architect finalized design decisions. In addition, steel was pre-bid so as to maintain the construction schedule. Contractors who erected the steel raced ahead of schedule, with 2,015 tons erected in seven weeks.

While the erector's equipment and capabilities resulted in welds completed in record time, high-strength bolts facilitated faster steel connections. Rates of rejection for welds inspected by the ultrasonic method were negligible.

The steel frame supports a unitized curtainwall system of solarban aquamarine vision glass. Exterior columns are exposed at the lower two levels on the west side of the building and are faced with polished fontein-green granite, with several of the columns rising from a dramatic, 200-ft long water element along the west side of the building. The waterscape, designed by landscape architects POD, Inc., features waterfalls, fountains and tiled steps down to the reflecting pool, with stepping stones across the pool.

Entry to the building is marked with a sculptured, white marble canopy, with the marble continuing on the walls of the elevator lobby. Floors of the elevator lobbies on the first two levels continue the polished green granite of the exposed exterior columns, and ceilings and elevator doors are stainless steel. □

Architect
Langdon Wilson Mumper Architects,
Newport Beach, California

Structural Engineer
Brandow & Johnston Associates
Newport Beach, California

General Contractor
Koll Construction Company
Newport Beach, California

Owner
Shuwa Corporation

Jon Patrick Allen, AIA, is with the firm of Langdon Wilson Mumper Architects, Newport Beach, California.

Remodeling–with Steel

ARMCO STEEL

The Challenges are Unique

by Donald G. McLaughlin

View of inspection station

Payoff reel and entry looper car

Recognizing the future demand for electrogalvanized steel in the automotive industry, Armco, Inc. decided in September 1984 to build an electrogalvanizing line at their Middletown, O. works. Burns & McDonnell/ENCORP undertook the tasks of final design and construction management of the $50-million facility which was to be on line by Jan. 1, 1986. Using the design-build approach and a fast-track schedule, the contractor delivered the project on schedule, and with a cost savings of $2.9 million.

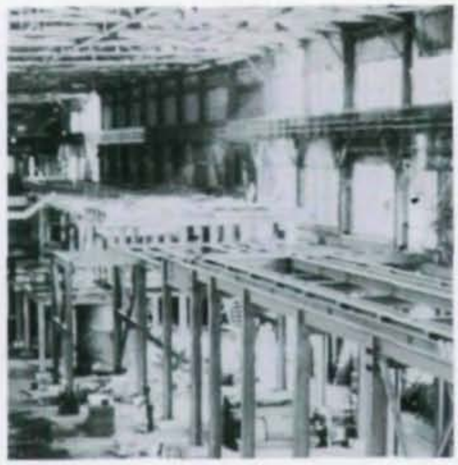
The challenge by the owner was to construct a state-of-the-art electrogalvanizing line inside a turn-of-the-century steel mill building in less than one year. The existing 68 × 864-ft building contained no less than five different exterior wall coverings, from corrugated metal to the original brick. The interior of the building with its two 40-ton cranes had been used for four different steel processes during its long life. In fact, initial rework of brick facade at the steel building columns revealed that rainwater had gotten behind the brick on all 40 of the columns. The 40-ton cranes were immediately parked pending further investigation. Removal of the brick revealed a partial, and often complete, disintegration of the steel column flanges due to corrosion. A column repair program was undertaken and completed without affecting the project schedule.

Structural Challenge

The heart of the electrogalvanizing line is the elevated, 160-ft long process section, or specifically the 16 Gravitel cells and their associated anodes. The distance from the oval flat plate anodes to the moving strip has to be held constant to ensure high quality coating. This criteria resulted in construction tolerances more appropriate to a machine base than to a steel-framed structure. Structural steel live-load and dead-load deflections were limited to less than $1/10$-in. movement or 0.1-degree rotation of the equipment. The process section included 16 rigid frames which contained five conductor/sink roll mounting plates, each of which needed to be milled level with each other. Furthermore, each set of plates had to be erected within $\pm 1/8$-in. in any direction from any adjacent set of plates. By equipment layout tolerances, the maximum sweep and camber of main frame beams was limited to $1/8$ in.

These restrictions were placed on the structural design by Andritz-Ruthner, the Austrian electrogalvanizing equipment supplier, to accommodate machine components and dynamic loadings:

- All columns and beams had to fit into a 12 × 12-in. envelope.
- No X-bracing was allowed perpendicular to the process line.

Existing process control building framing (l.). Electrogalvanizing line frame before equipment installation

- Certain major beams were required to have top flanges coped to accommodate electrolyte tanks.
- Lateral design loads would be equal to 5% of equipment dead load plus live load plus 2½ times the strip tension.
- The maximum allowable stress would be 12,000 psi (A36 steel) or ¾ths of the calculated allowable, whichever is smaller.

Structural Steel Solutions

From the outset, it was obvious that only structural steel framing could meet the fast-track schedule and the stringent design criteria proposed. However, the method used to meet the criteria was not so obvious. Choices ranged from one extreme of using standard steel framing and erecting to strict tolerances to the opposite extreme of shop fabricating to strict tolerances and possibly eliminating erection problems. Another important factor to consider was the fact the structural steel fabricator may not be awarded the erection contract (in retrospect this did occur).

The schedule answered the question of which framing option to use. The engineers used microcomputer scheduling techniques to verify that process equipment and steel erection were critical-path items which must be completed in a short duration. However, the steel fabrication duration was more forgiving, considering the time required to bid, award and construct the process foundations. From this analysis, fabricating to strict tolerances and eliminating as many erection difficulties as possible was the chosen solution.

Structural tolerances were met by breaking the plating section into components as large as practical. These were still small enough to be handled by the fabricator and shipper, but large enough to include one set of conductor roll mounting plates. Each individual component was fabricated with end plates where they connect and stress-relieved to eliminate internal fabricating stresses. The three conductor roll mounting plates were milled in a single pass to ensure levelness. Connection plates opposite the conductor roll mounting plates were milled with respect to this horizontal plane to ensure proper elevation of conductor roll plates. All end plates were then milled simultaneously with respect to the theoretical process centerline and a set length apart to ensure proper fit and horizontal location of the conductor roll and sink roll mounting plates.

Design Considerations

Lateral stability of the electrogalvanizing line was accomplished without using X-bracing by employing multiple rigid frames.

To meet deflection requirements, these rigid frames were computer-designed, using fixed-base columns. Multiple grades of steel and cover plates were employed at critical areas to meet stress and maximum member size requirements.

Longitudinal stability of the electrogalvanizing line was accomplished by the use of X-bracing. However, this bracing could not be added indiscriminately considering the temperature effects invovled in a 450-ft long rigid structure. Because of temperature stresses, the structure was broken into three distinct sections, the entry section, process section and exit section. Each is stabilized with bracing located near its center to allow ends to deflect in response to temperature changes. Deflections between the sections were kept to a minimum so as not to upset the critical strip tension as the strip flows from one section to the next.

Process Control Enclosure

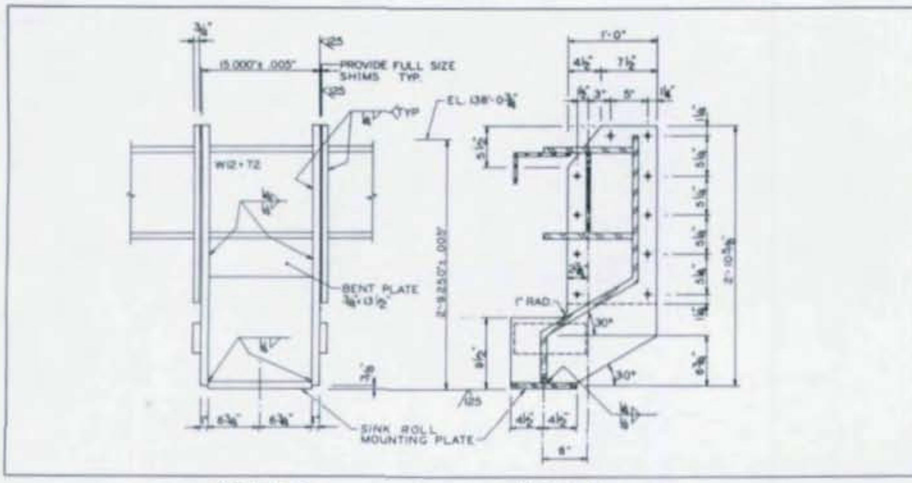
Commensurate with construction of the electrogalvanizing line inside the mill building was the construction of a three-level (35,000-sq. ft) process control enclosure outside. This structure used rigid frames in the east-west direction to accommodate future expansion. Rigid-frame moment connections were constructed inexpensively using shop joint preparation and field welding. Design floor live loads for elevated slabs were 250 psf. This enclosure contained the 32, 23,000-amp, 30-volt dc rectifiers (total 736,000-amp capacity) which powered the 16 Gravitel cells of the process section. The rectifiers and enclosure are cooled by five fans with a total capacity of 750,000 cfm.

Process Control

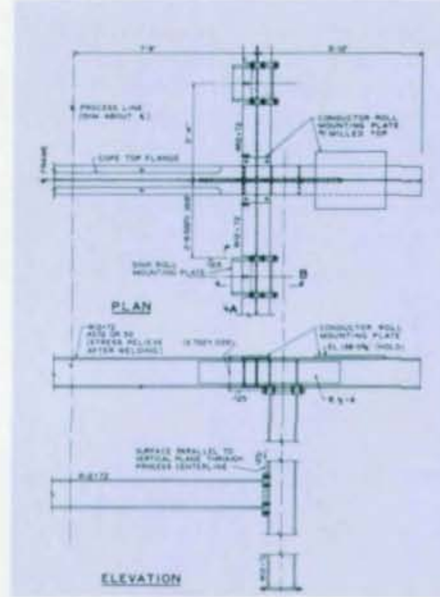
The entire electrogalvanizing line is monitored and controlled by the most modern distributed real time digital technology available today—programmable controllers (PCs). The PCs monitor over 3,000 control points every ½ second. They have the capability of providing both alarms and corrective action if a variable approaches a preprogrammed upper or lower limit. Examples of variables monitored include electrolyte temperature, strip tension, cell amperage, electrolyte composition, etc. If critical variables (such as cell amperage) cannot be corrected, the PCs will automatically shut down the line. Constant feedback and instantaneous adjustments will ensure product quality.

Conclusion

The need for quality electrogalvanized steel strip is constantly increasing. All of the major domestic manufacturers are se-



Section A *Section B*



Typical process section frame.

riously pursuing the use of electrogalvanized products to meet their corrosion warranty goals. The increased use of an electrogalvanized steel is quite evident in the material specification for the 1988 model year and beyond. Armco Steel can now meet the demands of the future with 250,000 tons per year of Armco Zincgrip Electrasmooth Steel. □

Architect, Structural, Electrical, Mechanical and Civil Engineer
Burns & McDonnell Engineers-Architects/Consultants
Kansas City, Missouri

General Contractor
Burns & McDonnell/ENCORP

Steel Fabricator
Southern Ohio Fabricators, Inc.
Cincinnati, Ohio

Owner
Armco
Middletown, Ohio

Donald G. McLaughlin, M.S.C.E., P.E., is an associate and senior structural engineer, Burns & McDonnell Engineers-Architects/Consultants, Kansas City, Missouri.

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1988 NATIONAL STEEL CONSTRUCTION CONFERENCE
HILTON FONTAINEBLEAU HOTEL
MIAMI BEACH, FLORIDA

OFFICIAL PROGRAM & REGISTRATION FORM

JUNE 8-11, 1988

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The 1988 National Steel Construction Conference, combining the AISC National Engineering Conference and AISC Conference of Operating Personnel, is the only "all-steel" conference in the U.S.

While special sessions are scheduled focusing on the specific interests of consulting engineers, educators, and fabricators, the "heart" of the meeting is in each of the many workshop sessions devoted to topics of interest to every industry discipline. See Pages 4-6 for detail on papers to be presented, and names of this year's speakers.

CONVENTION HEADQUARTERS

The Fontainebleau Hilton Hotel and Spa has been selected as the site of the 1988 National Steel Construction Conference.

All general sessions will be held in the Fontainebleau Ballroom, accommodating up to 2,000; the 100,000 sq. ft. Grand Ballroom will be dedicated to Exhibit Space, with more than 100 exhibit booths staffed by representatives of firms who provide services and products to the fabricated structural steel industry.

Workshop sessions and satellite meetings will be held in meeting rooms above and below the two ballrooms.

SPECIAL SECTION

In planning your itinerary, check the 8-page, 4-color Special Section from the January-February issue of *Modern Steel Construction* featuring the Fontainebleau and things-to-do, places-to-go in the Greater Miami area.

HOTEL RESERVATIONS

To obtain reduced room rates at the Fontainebleau, AISC must receive your room request, accompanied by one night's room deposit (credit cards accepted) before May 6.

HOTEL CANCELLATIONS

Deposits for cancelled reservations will be returned in full by the Hotel if cancellation is received at least 72 hours prior to scheduled arrival time.

REGISTRATION

See inside back cover of this Program for combined Registration and Room Reservation Form. Registration fees include all Special and Plenary Sessions, all workshops, coffee breaks, Continental breakfast and luncheons both Thursday and Friday, Cocktail Reception Wednesday evening, and a copy of the Proceedings.

EARLY REGISTRATION DEADLINE

To take advantage of reduced fees for early registration, forms and fees must be received before April 11.

ONE-DAY & HALF-DAY REGISTRATIONS

To register for only one day, a half-day, or even a single session, call AISC headquarters (312-670-2400) and request a "Partial Registration" form. You may use the same form to obtain a Visitor's Pass to the Exhibits, available at no charge.

REGISTRATION CANCELLATIONS

If cancellations are received before May 25, 100% of pre-paid registration fees will be refunded; after May 25, 50% will be refunded.

AIRLINE DISCOUNTS

Continental Airlines and Eastern Airlines have been designated as Official Carriers for the Conference.

Continental will offer 5% off the lowest applicable fare at time of booking or at least 30% off first class and off (Y9) coach fares.

Eastern will offer 5% off the lowest applicable fare at the time of booking or at least 30% off first class, and 50% off coach fares.

Discounts are applicable only within the continental U.S.; reservations must be booked through the Airlines Convention Desk using the Easy Access Number below. After reserving the flight, you may purchase your tickets from your local Travel Agency, any Continental Eastern ticket office or airport ticket counter—or the airlines will mail them directly to you with an invoice for payment.

Call: **1-800-468-7022** (in Continental U.S.)
Easy Access Number: **EZ 6AP79**

Program Summary

Wednesday, June 8 — Pre-Conference Events

1:30– 3:00	*Plenary Session: Purchasing New Equipment*			
1:30– 5:00	*Educator Session*			
1:30– 5:00	*AISC Professional Member Forum*			
3:30– 5:00	*Workshop Sessions*	*1*	*2*	*3*
6:30– 7:30	*AISC Cocktail Party*			

Thursday, June 9

8:30–10:00	*Opening Plenary Session* *KEYNOTER: Walter P. Moore, Jr.*							
10:30–Noon	*Workshop Sessions*	*4*	*5*	*6*	*7*	*10*	*11*	*12*
1:30– 3:30	*Exhibit Session* *Poster Session*							
3:30– 5:00	*Workshop Sessions*	*5R*	*6R*	*9*	*17*	*19*	*21*	*22*
EVENING	*Optional Events*							

Friday, June 10

8:30– 9:30	*Plenary Session* *"Jumbo Shapes" Position Paper: Reidar Bjorhovde*						
10:00–11:30	*Workshop Sessions*	*1R*	*2R*	*8*	*10R*	*13*	*16*
1:15– 2:45	*Workshop Sessions*	*4R*	*7R*	*14*	*15*	*18*	*20*
3:30– 5:00	*Workshop Sessions*	*8R*	*9R*	*13R*	*14R*	*21R*	*22R*
EVENING	*Optional Events*						

Saturday, June 11

8:30– 9:00	*Plenary Session* *Presentation of Awards*
9:00–10:00	*The 1988 T. R. Higgins Lecture:* *"Serviceability Guidelines": Bruce Ellingwood*
10:30–Noon	*"More Steel for the Buck": Panel*
12:00 Noon	*Drawing for Attendance Prizes*
12:15 PM	*The 1988 National Steel Conference Adjourns*
2:00– 4:00	*Optional Events*

(NOTE: "R" indicates Repeat Session)

PLUS:

Spouses' Program

Optional Tours

Pre- and Post-Conference Events

1988 WORKSHOP SESSIONS

(See Next Three Pages for details.)

1. *Heat Straightening*
2. *Heat Curving*
3. *Purchasing New Equipment*
4. *Bolt Follow-Up*
5. *Shop Planning*
6. *Steel Decks/Design & Construction*
7. *Economical Steel Design & Stability Provisions*
8. *United Airlines Terminal: A Case History*
9. *New Quality Criteria & Inspection Standards*
10. *Weld Design-Weld Metal*
11. *Angle Compression Members*
12. *Short Span Bridges*
13. *Jumbo Shapes: Workshop*
14. *Waste Disposal*
15. *Tubular Structures & Connections*
16. *Innovative Bridges*
17. *Connections-Mixed Construction*
18. *Controlling Wind Response*
19. *LRFD Seismic Design*
20. *Fire Protection*
21. *Computerized LRFD Specification*
22. *Steel-Framed High-Rise Residential Buildings*

SESSION TOPICS

1. HEAT STRAIGHTENING

Moderator: Robert B. Nelson, Vice President-Engineering
AFCO Steel—Little Rock, AR

"Heat Straightening of Steel—from Art to Science"
R. Richard Avent—Professor of Civil Engineering
Louisiana State University—Baton Rouge, LA
and
Daniel J. Holt, President
International Straightening, Inc.—Bismarck, ND

The presentation will outline procedures for straightening material damaged in shipment or erection in order to make the material acceptable for the purpose originally intended. Techniques will also be described for rehabilitating existing structures which have been damaged, utilizing flame straightening and without dismantling the structure.

Wednesday, 3:30–5:00 PM
Friday, 10:00–11:30 AM

2. HEAT CURVING

Moderator: George D. Mandis, General Manager
PDM Structural Group-Melrose Park, IL

"Heat Curving of Structural Steel"
Charles W. Roeder, Professor of Civil Engineering
University of Washington—Seattle, WA
and
G. J. Hill, Principal
G. J. Hill Associates, Inc.—Williamson, MI

Shop procedures for the application of heat to material to provide the required curvature in members in accordance with contract drawings.

Wednesday, 3:30–5:00 PM
Friday, 10:00–11:30 AM

3. PURCHASING NEW EQUIPMENT—WORKSHOP/PANEL

Moderator: Frank A. Becher, Vice President-Manufacturing
Vincennes Steel Corporation—Vincennes, IN

Robert Kaplan, Professor
Harvard University—Boston, MA

Kenneth McLennan, President
Machinery & Allied Products Institute—Washington, DC

Eli Luftgarten, Machine Tool Analyst
Paine-Webber Machine Tools—New York City, NY

Particular emphasis on considerations in planning for the purchase of new automated equipment for the small and medium shop, with the specific intent of reducing man hours per ton of production, a discussion of the planning process and the factors which should take precedence in decision-making.

Wednesday, 3:30–5:00 PM

4. BOLT FOLLOW-UP

Moderator: V. H. Thompson, Jr., Sr. V.P., Technical Services
Trinity Industries, Inc.—Houston, TX

Speakers:
Karl Frank, Professor
University of Texas—Austin, TX
and
Peter Kasper
Nucor Fasteners—St. Joe, IN

This session is a follow-up to last year's workshops on high tensile bolts. New developments will be presented, together with a detailed report on the influx of counterfeit bolts and their impact on the industry.

Thursday, 10:30 AM–Noon
Friday, 1:15–2:45 PM

5. SHOP PLANNING—WORKSHOP/PANEL

Moderator: Sidney W. Blaauw, Vice President-Operations
Paxton & Vierling Steel Company—Omaha, NE

Albert Gebauer, Manager-Project Control
Havens Steel Company—Kansas City, MO

Daniel Worth, Manager-Projects/Chief Draftsman
Missouri Valley Steel Company—Sioux City, IA

Presented by fabricators for fabricators, the session will present an overview of methods and procedures for planning and scheduling work, particularly in the small and medium-sized fabricating shop, and will emphasize how to achieve adjustments to the schedule necessitated by design revisions.

Thursday, 10:30 AM–Noon
Thursday, 3:30–5:00 PM

6. STEEL DECKS/DESIGN AND CONSTRUCTION

Moderator: Philip Levine

"Introduction to Steel Decks"
Philip Levine—Vice President
Roll Form Products, Division of RFP, Inc.—Boston, MA
"Basic Diaphragm Design"
Richard B. Heagler—Director of Engineering
Nicholas J. Bouras, Inc.—Summit, NJ
"1987 Diaphragm Design Manual"
Larry D. Luttrell—Professor of Civil Engineering
West Virginia University—Morgantown, WV

The presentations will review fabrication of steel deck basic floor/roof diaphragm design, and the design methods which have led to the *1987 Steel Deck Institute Diaphragm Design Manual.*

Thursday, 10:30 AM–Noon
Thursday, 3:30–5:00 PM

7. ECONOMICAL STEEL DESIGN & STABILITY PROVISIONS

Moderator: Robert O. Disque, Director-Building Design Technology
AISC—Chicago, IL

"Simple Solutions to Stability Problems in the Design Office"
R. Shankar Nair, Principal
Nair/KKBNA, Inc.—Chicago, IL
"Economical Steel Design"
David T. Ricker, Vice President/Engineering
The Berlin Steel Construction Company—Berlin, CT

Practical solutions to stability and bracing problems will be presented, as well as means of reducing steel fabrication and erection costs.

Thursday, 10:30 AM–Noon
Friday, 1:15–2:45 PM

8. UNITED AIRLINES TERMINAL

Moderator: V. H. Thompson, Jr., Sr. V.P., Technical Services
Trinity Industries, Inc.—Houston, TX

"Design of United Airlines Terminal"
Charles H. Thornton, Principal
Lev Zetlin Associates, Inc.—New York, NY
"Fabrication & Erection of United Airlines Terminal"
Eugene W. Miller, Sr. Vice President
Trinity Industries, Inc.—Houston, TX

This "Terminal for Tomorrow" at Chicago's O'Hare Field features an exposed steel structural system supporting the roof of a 1,730-ft. long vaulted gate area and exposed steel folded plate roof trusses over the 120-ft. x 810-ft. column-free ticketing pavilion area.

Friday, 10:00–11:30 AM
Friday, 3:30–5:00 PM

9. QUALITY CRITERIA & INSPECTION STANDARDS—WORKSHOP/DISCUSSION

Moderator: W. H. Reeves, Jr., Operations Manager
Carolina Steel Corporation—Greensboro, NC

"Q & A on the 3rd Edition, Quality Criteria & Inspection Standards"
Robert Shaw, Asst. Director of Continuing Education
AISC—Southfield, MI
and
Robert B. Nelson, Vice President-Engineering
AFCO Steel—Little Rock, AR

AISC has just published the Third Edition of this document, and this presentation will discuss problems and conflicts of interpretation involving fabricated tolerances and procedures. Those revisions which supercede the Second Edition will be highlighted.

Thursday, 3:30–5:00 PM
Friday, 3:30–5:00 PM

10. WELD DESIGN

Moderator: Frederick R. Beckmann, Director-Bridges
AISC—Chicago, IL

"Designing Longitudinal Welds for Bridge Members"
Warren Alexander, Consulting Metals Engineer
East Greenbush, NY

"What Structural Engineers and Fabricators Need to Know about Weld Metal"
Duane K. Miller, Welding Engineer
The Lincoln Electric Company Welding Technology Center—Cleveland, OH

Important considerations in welding from both a design and fabrication point of view will be discussed. Emphasis will be on weld quality and "fitness for purpose" inspection.

Thursday, 10:30 AM–Noon
Friday, 10:00–11:30 AM

11. ANGLE COMPRESSION MEMBERS

Moderator: Nestor Iwankiw, Director-Research and Codes
AISC—Chicago, IL

"Behavior and Design of Angle Compression Members"
Dr. LeRoy A. Lutz, Principal
Computerized Structural Design, Inc.—Milwaukee, WI
"Double Angle Compression Members"
Dr. Murray C. Temple, Associate Dean of Engineering
University of Windsor—Windsor, Ontario, CANADA

Latest research and design information will be presented on behavior of single angles with combined axial load and moments and, also, double angle struts. Dr. Lutz will cover single angle struts as beam-columns within the context of the proposed AISC design Appendix. Dr. Temple's presentation will cover double angles, related experimental data, and its implication for design, including the related new LRFD criteria.

Thursday, 10:30 AM–Noon

12. SHORT SPAN BRIDGES

Moderator: Geerhard Haaijer, V.P.-Technology/Research
AISC—Chicago, IL

"Short Span Prestressed Steel Bridges"
Dr. Thomas M. Murray, Professor
Virginia Polytechnic Institute and State University—Blacksburg, VA
"Autostress Design Using Compact Welded Beams"
Michael A. Grubb, Assistant Manager-Bridge Engineering
AISC Marketing, Inc.—Pittsburgh, PA

Steel is successfully competing with concrete in short span bridges. Precast composite units are being used in Oklahoma and neighboring states. The Autostress Design method was first used for rolled beams. Trial designs of welded compact beams show even greater economy.

Thursday, 10:30 AM–Noon

13. JUMBO SHAPES—PANEL AND WORKSHOP

Moderator: Reidar Bjorhovde, Chairman-Civil Engineering Dept.
University of Pittsburgh—Pittsburgh, PA

"ARBED's New Generation of Highly Weldable Jumbo Shapes for Tension Applications"
Roger Schlim, Research Associate-Product Development Dept.
ARBED Research Center—New York, NY
"Prevention of Weld Cracking in Heavy Wide Flange Shapes"
Nobutaka Yurioka, Senior Researcher
Nippon Steel Corporation Welding Research Center—Tokyo, JAPAN
and
Takeshi Fujimoto, Senior Researcher
Nippon Steel Corporation, Sakai Works—Tokyo, JAPAN
"Metallurgical Characterization of Jumbo Shapes"
Dean C. Krouse, Sr. Metallurgical Applications Engineer
Bethlehem Steel Corporation—Bethlehem, PA
and
Steven S. Hansen, Supervisor-Steel Product Development Group
Bethlehem Steel Corporation—Bethlehem, PA
and
Gregory J. Buragino, Sr. Development Engineer-QA & Metallurgy
Bethlehem Steel Corporation—Bethlehem, PA
"Noncolumn Application of Wide Flange Shapes"
John M. Barsom, Sr. Metallurgical & Product Consultant
USS Div. of USX Corp.—Pittsburrgh, PA

There are presently conflicting views on the use of jumbo shapes in tension. AISC, together with producing mills, is attempting to arrive at a unified approach to the problem. In this workshop session, representatives of domestic and foreign mills will provide their proposed solutions.

Friday, 10:00–11:30 AM
Friday, 3:30–5:00 PM

14. WASTE DISPOSAL

Moderator: Philip Levine, Vice President
Roll Form Products, Division of RFP, Inc.—Boston, MA

William W. Lanigan, Principal
Law Offices of William W. Lanigan—Morristown, NJ
and
AISC General Counsel

Current Environmental Protection Agency regulations have presented problems for fabricators who must dispose of waste products from painting and abrasive processes. The session will review the requirements as they apply to various quantities of waste materials, and will discuss the methods for containment and disposition of such materials in order to fully comply with the EPA regulations.

Friday, 1:15–2:45 PM
Friday, 3:30–5:00 PM

15. TUBULAR STRUCTURES AND CONNECTIONS

Moderator: Sidney W. Blaauw, Vice President-Operations
Paxton & Vierling Steel Company—Omaha, NE

"Connections to Tubular Members"
Donald R. Sherman, Professor
University of Wisconsin—Milwaukee, WI
"Fabrication of Tubular Sections in the Hawkeye Arena"
Larry A. Kloiber, President
L. L. LeJeune Company—Minneapolis, MN

Increased use of tubular sections in structures has presented the fabricator and detailer with new fabrication and connection problems. Economical connection details and fabrication techniques which are—sometimes uniquely—applicable to tubular sections will be outlined.

Friday, 1:15–2:45 PM

16. INNOVATIVE BRIDGES

Moderator: Geerhard Haaijer, V.P.-Technology & Research
AISC—Chicago, IL

"The Maupre Viaduct Near Charolles, France"
Jacques Combault, Chief Engineer

SESSION TOPICS

Campenon Bernard BTP—Clichy, FRANCE
"Truss Bridges for the 21st Century"
Gerard F. Fox, Partner
and
Raymond J. McCabe, Principal Structural Engineer
Howard Needles Tammen & Bergendoff—New York, NY

Steel is demonstrating itself to be an effective material for innovative bridge applications. A novel bridge structure with a triangular cross-section has been built in France and will be described by the designer. In the U.S., truss bridges have been given a modern look which proved competitive with concrete. A case study is offered.

Friday, 10:00–11:30 AM

17. CONNECTIONS—MIXED CONSTRUCTION

Moderator: Heinz J. Pak, Manager-Building Engineering
AISC Marketing, Inc.—Pittsburgh, PA

"Design of Composite Connections Between Steel Beams and Reinforced Concrete Columns"
Gregory G. Deierlein, Research Assistant
University of Texas at Austin—Austin, TX

"Design of Encased W-Shape Composite Columns"
Lawrence G. Griffis, Head of Structural Division
Walter P. Moore & Associates—Houston, TX

A fast-growing structural system includes structural steel beam framing into composite columns. A researcher and designer will discuss possible ways of making the connection.

Thursday, 3:30–5:00 PM

18. CONTROLLING WIND RESPONSE

Moderator: William D. Liddy, Regional Engineer-Buildings
AISC Marketing, Inc.—Columbus, OH

"Controlling Wind-Induced Response of Buildings"
Ahsan Kareem, Professor
University of Houston—Houston, TX
"Design of Viscoelastic Dampers to Control Wind-induced Vibrations"
Carla J. Keel, Associate Structural Engineer
Skilling Ward Magnusson Barkshire Inc.—Seattle, WA

Tall buildings are often subjected to wind-induced vibrations which can cause human discomfort and other serviceability problems. Research which has been done regarding human sensitivity and procedures to predict motion will be reported. Also, a design engineer will discuss the successful use of visco-elastic damping devices.

Friday, 1:15–2:45 PM

19. LRFD SEISMIC DESIGN—CASE STUDIES

Moderator: Hank Martin, Regional Director-
Construction Codes & Standards
American Iron & Steel Institute—Newcastle, CA

"Design of a Steel Office Building in Mexico City Using Composite Columns"
Enrique Martinez-Romero, General Director
Enrique Martinez-Romero, S.A. Cons. Engineers—Mexico D.F., MEXICO
"Case Study of a 40-Story Building"
Nabih F. G. Youssof, Director of Structural Engineering
Albert C. Martin and Associates—Los Angeles, CA

Two design engineers will discuss how LRFD was used in the seismic design of a 40-story building in Los Angeles, and an office building in Mexico City featuring composite columns.

Thursday, 3:30–5:00 PM

20. FIRE PROTECTION

Moderator: Kathleen Almand, Program Manager-Construction Codes & Standards
American Iron & Steel Institute—Washington, DC

"Fire Protection of Steelwork in Parking Garages"
Ian R. Thomas, Manager of Engineering Research and Development
BHP Melbourne Research Laboratories—Clayton, AUSTRALIA
and
Arthur Firkins, Director of Technical Services
Australian Institute of Steel Construction—Melbourne, AUSTRALIA
"The Effect of Local Fires on Overall Structural Behavior"
J. B. Schleich, Department Manager
ARBED Research—Esch-sur-Alzette, LUXEMBOURG

Fire protection research is being conducted on an international scale. European research will be described that is able to predict the effect of local fires on overall structural behavior. Analytical methods are being used to replace testing in many instances. Australian research provides new data on the effect of fires in open and closed automobile parking garages.

Friday, 1:15–2:45 PM

21. COMPUTERIZED LRFD SPECIFICATION

Moderator: Geerhard Haaijer, V.P.-Technology & Research
AISC—Chicago, IL

"Electronic Version of the LRFD"
Michael H. Ackroyd, Vice President/Applications Development
Visual Edge Software, Ltd.—Montreal, Quebec, CANADA
and
Steven J. Fenves, Professor
Carnegie-Mellon University—Pittsburgh, PA
and
William McGuire, Professor
Cornell University—Ithaca, NY

The developers of the AISC Computerized LRFD Specification will describe and demonstrate this new tool that enables automated and semi-automated interpretation of the LRFD Specification and evaluation of structural components for conformance with the LRFD provisions.

Thursday, 3:30–5:00 PM
Friday, 3:30-5:00 PM

22. STEEL-FRAMED HIGH-RISE RESIDENTIAL BUILDINGS

Moderator: Robert O. Disque, Director-Building Design Technology
AISC—Chicago, IL

"Economical Steel-framed Residential Buildings"
Robert K. Huzzard, Sales Engineer
and
Jay W. Larson, Structural Consultant
Bethlehem Steel Corporation—Pittsburgh, PA
"Influencing the Decision for Steel Framing in High-Rise Residential Construction"
Myron C. Wander, Executive Director
Steel Institute of New York—New York City, NY

Thursday, 3:30–5:00 PM
Friday, 3:30–5:00 PM

SPECIAL EDUCATOR FEE–$150.00

(Educators employed full-time at an accredited architectural or engineering college or university may be eligible for sponsorship by the AISC Education Foundation. The Foundation will pay registration fees for the first 100 educators registering for the Conference. Simply return your registration form along with a letter on your college or university letterhead. Those registering after Foundation sponsorship is filled will be notified and, if they wish to attend at their own expense, will be billed for the $150 Educator Registration Fee.)

NOTE: Special Educator Fee, and Foundation Sponsorship, include all Plenary Sessions, workshop sessions and coffee breaks, Continental Breakfasts and luncheons both Thursday and Friday, and the Get-Acquainted Cocktail Party Reception Wednesday evening, as well as a printed and bound copy of the Proceedings.

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PROGRAM OF PRE-CONFERENCE ACTIVITIES

MONDAY — JUNE 6

8:00 AM - 5:00 PM	**Exhibitor Move-In** — Grand Ballroom

TUESDAY — JUNE 7

8:00 AM	**Exhibitor Move-In Continues** — Grand Ballroom
11:00 AM - 5:00 PM	**Registration Desk Open** — Lobby, Grand Ballroom

WEDNESDAY — JUNE 8

8:00 AM	**Registration Desk Open** — Lobby, Grand Ballroom
11:00 AM	**Partner in Education Advisors' Meeting** — PIE Advisors Only
12:00 Noon	**Exhibits Open** — Grand Ballroom
1:30 PM	**PLENARY SESSION — "Justification for Purchasing New Equipment"** — Fontainebleau Ballroom This special plenary session devoted entirely to planning for the purchase of new automated equipment will be of special interest to fabricators. Workshop #3, held from 3:30–5:00 PM, will continue discussion of the subject. *(See Program Detail, next column)* —
1:30 PM	**EDUCATOR SESSION — "Current Challenges in Steel Education"** *(See Program Detail, next column)* —
1:30 PM	**AISC PROFESSIONAL MEMBER FORUM** Inaugurated last year, AISC will again extend an invitation to AISC Professional Members to attend this special Forum to elicit opinions and technical contributions on structural steel design. *(See Program Detail, next column)* —
3:00 PM	**Coffee Break** — Grand Ballroom (Exhibits Open)
3:30 PM	**WORKSHOP SESSIONS** *(See Workshop Schedule for Details on Individual Topics)* 1 Heat Straightening 2 Heat Curving 3 Purchasing New Equipment — Workshop Session
5:00 PM	**Adjourn**

OPTIONAL EVENTS

6:30 PM - 7:30 PM	**Get-Acquainted Cocktail Party** (Event #1) — Grand Ballroom Exhibit Area

PRE-CONFERENCE EVENTS

Register for any of these Pre-Conference Events by checking the appropriate box on your Registration and Room Reservation Form.

PURCHASING NEW EQUIPMENT
Fabricator-Exhibitor Special Session

Moderator: Frank A. Becher, Vice President-Manufacturing
Vincennes Steel Corporation—Vincennes, IN

Robert Kaplan, Professor
Harvard University—Boston, MA

Kenneth McLennan, President
Machinery & Allied Products Institute—Washington, DC

Eli Luftgarten, Machine Tool Analyst
Caine-Weber Machine Tools—St. Joe, IN

Particular emphasis on considerations in planning for the purchase of new automated equipment for the small and medium shop, with the specific intent of reducing man hours per ton of production, a discussion of the planning process and the factors which should take precedence in decision-making.

CURRENT CHALLENGES IN STEEL EDUCATION
Educator Special Session

1:30 PM	**Welcome** Robert P. Stupp, President Stupp Bros. Bridge & Iron Co.—St. Louis, MO and Chairman, AISC Committee on Education
1:40 PM	**"Capstone Projects in Steel Design Teaching"** Joe Abrams, Professor University of Pittsburgh—Pittsburgh, PA
2:20 PM	**"Classroom Software Exchange"** Curt C. Young, Professor University of North Carolina—Charlotte, NC A "swap shop" for the interchange of software in the public domain used in steel design courses.
3:00 PM	**Coffee Break**
3:30 PM	**"Elements for Teaching LRFD"** Joseph A. Yura, Professor University of Texas—Austin, TX An opportunity to enrich and enhance the understanding of LRFD from the teacher's point of view.
4:45 PM	Wrap-up
5:00 PM	**Adjourn**

AISC PROFESSIONAL MEMBER FORUM
Agenda

- Overview of Proposed Changes in AISC Specifications
- Preparation of New AISC Design Guides
- Professional Member Assistance in ß-Testing of Electronic LRFD
- AISC Codes and Standards for Fabricated Steel:
  - a) Quality Criteria and Inspection Standards
  - b) Code of Standard Practice
  - c) Quality Certification

OFFICIAL PROGRAM OF EVENTS

THURSDAY — JUNE 9 (Opening Session)

7:00 AM **Registration Desk Open** — Lobby, Grand Ballroom

7:30 AM **Continental Breakfast** — Grand Ballroom (Exhibits Open)

8:30 AM **THE 1988 NATIONAL STEEL CONSTRUCTION CONFERENCE**
Opening Plenary Session — Fontainebleau Ballroom

Welcome:

Samuel Y. Golding, President
The Standard Structural Steel Company—Newington, CT
and Chairman, AISC

Victor H. Thompson, Jr., Vice President
Mosher Steel Company—Houston, TX
and Chairman, Conference of Operating Personnel Committee

L. A. Kloiber, President
L. L. LeJeune Company—Minneapolis, MN
and Chairman, National Engineering Conference Committee

8:45 AM **Keynote Address:**

"The Future of Tall Steel Buildings"
Walter P. Moore, Jr.
President and Chairman
Walter P. Moore Associates
Houston, TX

Moore

9:30 AM **"AISC Third Edition, Quality Criteria & Inspection Standards"**
A presentation by AISC Staff on the new Third Edition of this industry standard. A workshop discussion on this new publication will also be conducted; See Workshop #9.

10:00 AM **Coffee Break** — Grand Ballroom (Exhibits Open)

10:30 AM **WORKSHOP SESSIONS**
- 4 Bolt Follow-up
- 5 Shop Planning
- 6 Steel Decks/Design and Construction
- 7 Economical Steel Design & Stability Provisions
- 10 Weld Design
- 11 Angle Compression Members
- 12 Short Span Bridges

12:00 NOON **LUNCH** — Grand Ballroom (Exhibits Open)

1:30 PM **EXHIBIT SESSION** — Grand Ballroom
No Workshops are Scheduled;
All Registrants are encouraged to visit exhibits.

Representatives of firms supplying products and services to the fabricated structural steel industry will exhibit in the Fontainebleau's Grand Ballroom. Contact AISC (312-670-5432) for Exhibit Information.

1:30 PM **POSTER SESSION** — Jade Promenade

A Poster Session is being presented for the first time at an AISC Conference. Selected papers will be presented in Poster Form, by authors, in informal discussions. For information on submitting papers for the Poster Session, call AISC Headquarters
(312-670-5432).

Soft drinks and cofee will be available in the Exhibit Hall until 3:30 PM when the next Workshop Sessions begin.

3:30 PM **WORKSHOP SESSIONS**
- 5R Shop Planning (REPEAT)
- 6R Steel Decks/Design & Construction (REPEAT)
- 9 Quality Criteria—Workshop
- 17 Connections—Mixed Construction
- 19 LRFD Seismic Design
- 21 Computerized LRFD Specification
- 22 Steel Framed High Rise Residential Buildings

5:00 PM **Adjourn**

Optional Tours

7–10:00 PM **Miami at Night** (Event #2, advance tickets required, see Registration Form.)

7–10:00 PM **"The Spirit" Dinner Cruise** (Event #3, advance tickets required, see Registration Form.)

FRIDAY — JUNE 10

7:00 AM **Registration Desk Open**

7:30 AM **Continental Breakfast** — Grand Ballroom (Exhibits Open)

8:30 AM **PLENARY SESSION — "Solutions for the Use of Jumbo Shapes"**
Fontainebleau Ballroom

Bjorhovde

Reidar Bjorhovde, Chairman, Civil Engineering Dept.
University of Pittsburgh—Pittsburgh, PA

The plenary session of Jumbo Shapes will feature a general position paper. A workshop immediately following (10:00–11:30 AM) will include representatives from domestic and foreign mills and an open discussion on the subject. The workshop will be repeated from 3:30-5:00 PM. (See Workshop #13 for details.)

9:30 AM **Coffee Break** — Grand Ballroom (Exhibits Open)

10:00 AM **WORKSHOP SESSIONS**
- 1R Heat Straightening (REPEAT)
- 2R Heat Curving (REPEAT)
- 8 United Airlines Terminal
- 10R Weld Design (REPEAT)
- 13 Jumbo Shapes—Workshop
- 16 Innovative Bridges

11:30 AM **LUNCH** — Grand Ballroom (Exhibits Open)

1:15 PM **WORKSHOP SESSIONS**
- 4R Bolt Follow-up (REPEAT)
- 7R Economical Steel Design and Stability Provisions (REPEAT)
- 14 Waste Disposal
- 15 Tubular Structures and Connections
- 18 Controlling Wind Response
- 20 Fire Protection

2:45 PM **Coffee Break** — Grand Ballroom (Exhibits Open)

3:30 PM **EXHIBITOR MOVE-OUT**

3:30 PM **WORKSHOP SESSIONS**
- 8R United Airlines Terminal (REPEAT)
- 9R Quality Criteria (REPEAT)
- 13R Jumbo Shapes (REPEAT)
- 14R Waste Disposal (REPEAT)
- 21R Computerized LRFD Specification (REPEAT)
- 22R Steel Framed High Rise Residential Buildings (REPEAT)

5:00 PM **Adjourn**

OPTIONAL EVENTS

7:00 PM **THE 1988 NATIONAL STEEL CONSTRUCTION CONFERENCE**
Cocktail Party, Dinner & Entertainment
(Event #4, advance tickets required—See Registration Form)

SATURDAY — JUNE 11

8:30 AM **Plenary Session** — Fontainbleau Ballroom

Ellingwood

Presentation of AISC Fellowship Awards

A Tribute to Memory of T. R. Higgins
Dr. Lynn S. Beedle, Professor
Lehigh University—Bethlehem, PA

Presentation of Higgins Lectureship Award

The 1988 T. R. HIGGINS LECTURE
"Serviceability Guidelines for Steel Structures"
Bruce Ellingwood, Professor
The Johns Hopkins University—Baltimore, MD

10:00 AM **Coffee Break** — Jade Promenade

10:30 AM **MORE STEEL FOR THE BUCK — Plenary Session**

The panel, including a consulting engineer, the chief engineer for a steel fabricator, a steel erector, and a structural steel detailer, will illustrate how the various disciplines work together to make the structural steel an efficient and economical part of the building process. Actual examples of cost savings techniques will be offered, as well as suggestions for improving interaction between the various parties.

Moderator: Robert H. Woolf, President
Cives Steel Company—Roswell, GA

Engineer: James M. Fisher, President
Computerized Structural Design—Milwaukee, WI

Erector: John L. Brown, President
Ben Hur Construction Co.—St. Louis, MO

Detailer: James E. Jackson, President
Compudron, Inc.—Roswell, GA

Fabricator: E. W. Miller, Sr. Vice President
Trinity Industries, Inc.—Houston, TX

12:00 NOON **Drawing for Attendance Prizes**

12:15 PM **THE NATIONAL STEEL CONSTRUCTION CONFERENCE Adjourns**

OPTIONAL EVENTS

1:30-5:00 PM **Seaquarium** (Event #5, advance tickets required)

1:30-5:00 PM **Parrot Jungle** (Event #6, advance tickets required)

SPOUSES' PROGRAM

The greater Miami area offers so many things to do, so many places to see, that we found it difficult to narrow the choices down to those that we felt spouses — or other traveling companions — of conference registrants would most enjoy.

SPECIAL NOTE: This year, for the first time, we are also offering each of the events on the spouses' program as a separately priced event. All those registering for the COMPLETE Spouses' Program will receive tickets for each event listed below. Anyone wishing to register for any one or more of these events INDIVIDUALLY may do so by selecting the events of their choice on the Conference Registration Form (see opposite page).

WEDNESDAY, JUNE 8

6:30 — 7:30 PM
Get Acquainted Cocktail Party **(Event #1)** in the Exhibit Hall (Grand Ballroom). You'll have a chance to visit the Conference Exhibits, greet old friends and meet new ones. Drinks are "on the house", and there'll be plenty of hors 'douevres. We're also planning some special entertainment this year, taking advantage of the Ballroom stage and the multitude of great talent available in Southern Florida. You might like to sleep in tomorrow morning, so we'll delay our next event until

THURSDAY, JUNE 9

11:00 AM
Brunch in the Fontainebleau's Versailles Gallerie, **(Spouses' Event #A)** where a breathtaking view of the ocean will almost lure you away from the hotel's famous Surfsider Buffet. But we've found an even better lure . . . buses will load in front of the hotel at

12:30 PM
for a trip to Vizcaya **(Spouses' Event #B)** . . . the Italian Renaissance-style Villa on Biscayne Bay where John Deering, co-founder of International Harvester, assembled treasures from all over Europe in a magnificent collection: 34 rooms of 15th through 19th century furnishings and decorative arts. Under construction from 1914 through 1916, it is estimated that 1,000 of Miami's residents were employed in construction of the (then) 70-room house, its buildings and gardens. You'll have refreshments in the formal gardens, surrounded by the natural subtropical forest.

FRIDAY, JUNE 10

9:00 AM
We'll whisk you back to the present, with a far more down-to-earth (and water) tour of the Everglades. **(Spouses' Event #C)** Among the high points will be a visit to the Miccosukee Indian Village, an airboat ride deep into the Everglades, craft exhibits and a stop at the Village gift shop. For those not too faint of heart, there'll be a bit of alligator wrestling — no audience participation, of course. Lunch is included at the Village restaurant. (NO alligator steaks on the menu.) Back to the Hotel by 5 PM.

SPOUSES' PROGRAM REGISTRATION FEE: $100.00

(Includes Event #1, Spouses Events #A, B & C)

OPTIONAL TOURS AND EVENTS

EVENT #1 Wednesday, June 8, 6:30 – 7:30 PM

Get-Acquainted Cocktail Party
This annual get-acquainted party, held in the Exhibit Hall, will include complimentary cocktails, hors d'oeuvres and entertainment.

Price: Included in Registration Fee for Conference Registrants, Spouses registered for COMPLETE Spouses' Program and Registered Exhibitors

Individual Ticket Price: $25.00

EVENT #2 Thursday, June 9, 7 – 10:00 PM

Miami at Night
Enjoy one of Miami's world renowned supper clubs. Tour includes dinner, floor show, taxes, tips & transportation. (Gentlemen are required to wear jackets.)

Price: $32.00

EVENT #3 Thursday, June 9, 7 – 10:00 PM

"The Spirit" Dinner Cruise
All the elements of an ocean-going cruise on an affordable intercoastal adventure. Live entertainment, dinner and dancing while cruising one of the most beautiful waterways in the country. Price includes motor coach to and from ship, cruise, dinner, entertainment, dancing, taxes and gratuities.

Price: $32.00

EVENT #4 Friday, June 9, 7 – 10:00 PM

The National Steel Construction Conference Dinner: "Moon over Miami"
We'll bring some of Miami's finest entertainment to you at The National Steel Construction Conference "Moon over Miami" dinner, held beside the Fontainebleau's ½-acre pool-lagoon. Join new and old friends under the stars for a sumptuous poolside buffet and star-studded entertainment.

Price: $45.00

EVENT #5 Saturday, June 11, 1:30 – 5:00 PM

Seaquarium
A half-day treat you'll never forget. Meet the sea's super star, Flipper, and his co-stars: killer whales, but gentle as lambs. Tour price includes all admissions to attractions in this world famous sea-sized aquarium.

Price: $21.00

EVENT #6 Saturday, June 11, 1:30 – 5:00 PM

Parrot Jungle
Unique, dazzling . . . beautiful. Parrots, macaws and exotic tropical birds fly free — a talented few perform on roller skates, solve math problems and even ride bicycles. Bring your camera. Tour price includes all admissions.

Price: $21.00

REGISTRATION AND ROOM RESERVATION FORM

AISC MEMBER FEE: Early Registration (before April 11): $250
Late Registration (after April 11): $300
(Includes AISC Active, Associate and Professional Members)

NON-MEMBER FEE: Early Registration (before April 11): $300
Late Registration (after April 11): $350

EXHIBITOR FEE: (for additional Exhibit Personnel only): $100
(Exhibitors are entitled to one registration for each booth reserved. Above fee is payable ONLY if in excess of one person per booth, and does not include attendance at Workshop Sessions or copy of Proceedings.)

SPECIAL EDUCATOR FEE: $150

REGISTRATION FEES INCLUDE all Special and Plenary Sessions, workshops, coffee breaks, Continental breakfast Thursday and Friday, luncheons Thursday and Friday, the Get-Acquainted Cocktail Reception Wednesday evening, and a printed and bound copy of the Proceedings. (The special Exhibitor Fee for additional Exhibit Personnel includes all of above except workshops and Proceedings.)

EDUCATION FOUNDATION SPONSORSHIP OF REGISTRATION FEE: Available to first 100 educators registering for the Conference. See instructions elsewhere in this Program for applying — and check appropriate box below.

REGISTRATION CANCELLATION POLICY: Cancellations received before May 25, 100% will be refunded; after May 25, 50% will be refunded. (Those cancelling after May 25 will receive a printed and bound copy of the 1988 NEC/COP Proceedings.)

PLEASE REGISTER: (Type or Print)

Name ______________________ Nickname (for badge) ______________________

Company ______________________ Title ______________________

Mailing Address ______________________

City and State/Zip ______________________ Bus. Telephone (   ) - ______ Home Telephone (   ) - ______

If Spouse or other guest wishes to register for Complete Spouses' Program, or individual Spouses' Events, complete next line:

Name of Individual Registering for Spouses' Program ______________________ Nickname (for badge) ______________________

REGISTRATION FEES ENCLOSED:

AISC Member Fee $ ______

Non-Member Fee $ ______

Exhibitor, as indicated below:
Fee Included in Booth Price (1 per booth) ☐
Not Included in Booth Price:
Fee $100.00 $ ______

Educator, as indicated below:
Foundation Sponsorship Requested, Letter attached ☐
(Educators registering after Foundation sponsorship is filled will be billed $150)

Spouse's Fee/Complete Program ($100.00)
Includes Event #1, #A, #B and #C) $ ______

Fees for Optional Events (from Col. 2) $ ______

TOTAL FEES ENCLOSED $ ______

*Included with registration and spouses fee

REGISTRATION FOR SPECIAL SESSIONS

PIE Advisors Meeting (11:00 AM Wednesday, PIE Advisors Only) ☐

Educator Session (1:30 PM Wednesday — No Additional Fee) ☐

AISC Professional Member Forum (1:30 PM Wednesday — No Additional Fee) ☐

Wednesday Plenary Session: Purchasing New Equipment (1:30 PM Wednesday — No Additional Fee) ☐

REGISTRATION FOR OPTIONAL EVENTS

Event	No. Tickets	Total Price
#1–Cocktail Party (Wed., 6:30 PM)	______ @ $25.00	$______*
#2–Miami at Night (Thurs., 7:00 PM)	______ @ $32.00	$______
#3–Dinner Cruise (Thurs., 7:00 PM)	______ @ $32.00	$______
#4–"Moon over Miami" Party (Friday)	______ @ $45.00	$______
#5–Seaquarium (Sat., 1:30-5 PM)	______ @ $21.00	$______
#6–Parrot Jungle (Sat., 1:30-5 PM)	______ @ $21.00	$______
#A–Surfsider Brunch (Thurs., 11 AM)	______ @ $25.00	$______
#B–Vizcaya Trip (Thurs., 12:30 PM)	______ @ $30.00	$______
#C–The Everglades (Fri., 9 AM-5 PM)	______ @ $35.00	$______
TOTAL OPTIONAL EVENT FEES		$______

Make checks payable to AISC. If you wish to pay for the Optional and/or Spouses' Events selected with a separate check, you may do so. Tickets for all events are reserved on a first-come, first-served basis, and will be delivered to you on your arrival at the Registration Desk. AISC reserves the right to limit number reserved by any individual.

REGISTRATION FORM—FONTAINEBLEAU HOTEL

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Departure Date ______
(Hotel Check-in Time is 3 PM, Check-out 11 AM)

NOTE: Rates are subject to 10% local & state tax; children any age free in parents' room. Rooms must be guaranteed by a separate check, payable to the Fontainebleau Hilton, in the amount of one night's stay, or by credit card (See space below). The hotel will honor and guarantee reservations received by May 6, 1988, so return this form promptly.

____ I enclose check for $85, payable to the Fontainebleau Hilton.

____ Please charge my Credit Card # ______
Expiration Date ______
Circle Card Used: American Express VISA MasterCard Diners Carte Blanche Discover

Signature (if Credit Card Charge): ______

MAIL COMPLETED FORMS, REGISTRATION FEES AND HOTEL GUARANTEES TO:

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1988 National Steel Construction Conference
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Steel Notes

NEW LRFD LECTURES PLANNED

A new lecture program, "The Economies of LRFD," is being readied for Fall 1988. The individual lectures will compare design effectiveness of current Allowable Stress Design (ASD) rules vs. Load and Resistance Factor Design (LRFD). Emphasis will be given to design procedures as well as economical aspects. The program is expected to be presented in over 60 cities in late 1988 through 1989.

AISC SEEKS 1988 PRIZE BRIDGE ENTRIES

The 1988 Prize Bridge Competition will honor the most outstanding steel bridge designs using structural steel aesthetically, imaginatively and effectively. To enter, bridges must have been opened to traffic from July 1, 1986 through June 30, 1988. For rules and entry forms contact William Noble, director of marketing and statistics, AISC, 400 N. Michigan Ave., Chicago, Ill. 60611-4185; 312/670-5422. Entry deadline is July 26, 1988.

AISC MARKETING, INC. HANDBOOK CHAPTERS AVAILABLE

AISC Marketing, Inc. now has individual chapters of the *Highway Structures Design Handbook* for sale. The handbook, a two-volume guide to bridge consultants on the design of steel-framed bridge superstructures, is $48 to AISC members, $60 to non-members (plus $5 handling).

Holders of the handbook with missing chapters may wish to bring them up-to-date by purchasing those chapters, available for various prices, from free to $8. For further information, or to purchase the entire set, contact direct: AISC Marketing, Inc., Highway Structures Design Handbook, 437 Grant Street, Suite 1615, Pittsburgh, Pa. 15219-6101.

SECOND STEEL BRIDGE SYMPOSIUM NEXT FALL

The 2nd National Symposium on Steel Bridge Construction will be held in Washington, D.C. Oct. 19 & 20, 1989. The day-and-a-half program features qualified speakers presenting current practices and subjects for future advances in steel bridge construction and the co-relation of design techniques with fabrication, detailing and erection principles. Last year's symposium attracted over 240 fabricators, erectors, designers, owners, bridge contractors, bridge consultants, educators and highway officials.

FELLOWSHIP APPLICATIONS STILL BEING ACCEPTED

AISC's Education Foundation is still accepting applications from engineering students for $8,000 scholarships until April 1, 1988. A maximum of five fellowships will be awarded to senior or graduate civil or architectural engineering students majoring in structural engineering who propose a one-year project dealing with some aspect of steel construction. For information, contact Robert Lorenz, AISC Education Foundation, 400 N. Michigan Ave., Chicago, Ill. 60611-4185; 312/670-5406.

BETHLEHEM STEEL SPENDS $50 MILLION TO MODERNIZE

A $50 million project designed to give Bethlehem Steel Corporation the most modern and cost-efficient structural steel manufacturing facility in the domestic steel industry is nearing completion at the company's Shape & Rail Products Division in Bethlehem, Pa. Modernization work is being done on Bethlehem's 48-in. structural mill and includes installation of a new 59-in. roughing mill.

In addition to the new roughing mill, the company has recently installed a new ingot stripping facility, automatic screwdown on the 48-in. mill, computer controls for the ingot soaking pits and an ingot tracking system. Current plans call for the installation of a new hot saw on the 48-in. mill and other significant equipment replacements in the future, according to Robert N. Gurnitz, Shape & Rail Products Division president. Robert E. Roll, sales and marketing manager of Bethlehem plant products, explained the benefits of the structural operation improvements. ". . . modern fabricating shops require a higher quality and more consistent and dimensionally correct section, as well as better flow of information from their suppliers, and that's our intent," said Roll.

Bethlehem has a comprehensive plan for training employees while maintaining operations with the least amount of interruption to customer service.

LIMITED NUMBERS OF OUT-OF-PRINT BOOKS AVAILABLE

Limited amounts of AISC publications no longer listed in the AISC Publications List are now available while the supply lasts.

Structural Steel Detailing (M008), 2nd Edition (1971) is a comprehensive guide to detailing practices for all types of steel buildings, keyed to the *Manual of Steel Construction*, 7th Edition. The 406-pg. book contains instruction, explanation, problem solutions and more than 400 shop details and drawings. Prepared primarily as a guide for school or on-the-job training of structural draftsmen, this textbook is also an important reference to designers and others interested in structural steel detailing practice. The book is $20 (no discount).

To order any of the books listed, send check, money order or Visa/MasterCard information (state type of card, number and expiration date) to AISC Publications Dept., P.O. Box 4588, Chicago, Ill. 60680-4588.

BEAVER CREEK BRIDGE

New Bridge is a Detour

by Norman H. Rognlie

Steel set on temporary substructure

Steel set on temporary structure

Air winches pull superstructure over

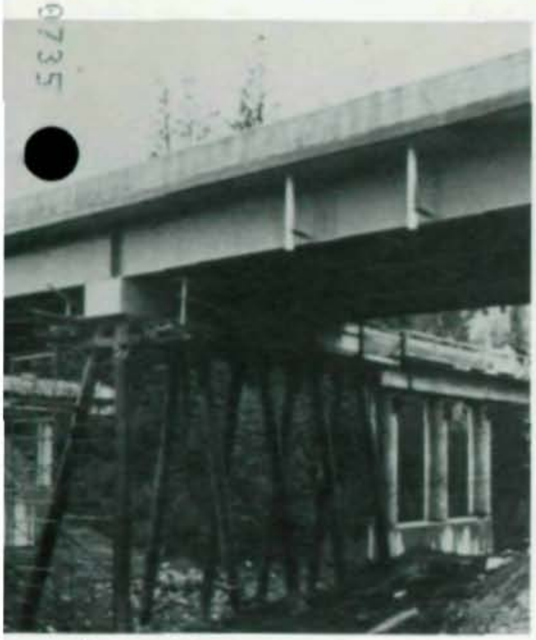
Maintaining traffic on this bridge replacement project, known as Beaver Creek Bridge, was going to be a problem—and expensive. An innovative approach to solving the site condition problems was to move the finished superstructure of this 250-ft long by 40-ft wide, three-span—a continuous steel, multi-beam with poured-in-place deck bridge–laterally about 50 ft. Traffic could not be interrupted for more than two hours. The sequence of events for this project, let to contract in January 1985 and completed in November 1985 went something like this.

The project is 15 miles west of Thompson Falls, Mont. on busy primary Hwy. 200. The existing concrete bridge over the environmentally sensitive Beaver Creek had deteriorated beyond any possibility of salvage, and it was not practical to move it. Since no detour routes were available, the heavy logging and other traffic had to be maintained at the site. The usual procedure would have been to provide a temporary detour road and bridge while the old bridge was removed and a new one constructed. Site conditions dictated that existing alignment and grades had to be used.

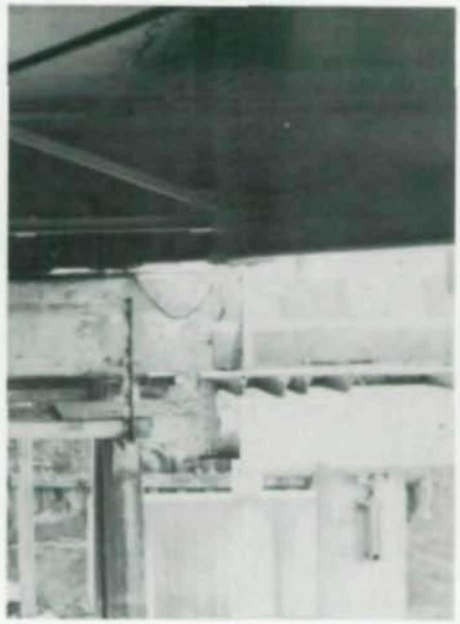
Since a temporary detour bridge would have to be about as long as the new bridge to satisfy environmental concerns, we concluded it would be less expensive to waste a wider temporary substructure under a new bridge than a complete detour bridge. Our estimates indicated about one half the price of a detour bridge could be saved–and bid prices confirmed this.

The construction sequence began with the temporary substructure being built alongside the existing bridge which still carried traffic. Next, the new superstructure was completed on the temporary substructure with the two new intermediate piers built at the same time under the existing bridge. Traffic was then diverted to the new superstructure while the old bridge was removed and the permanent substructure finished. Last came the moving of the 1.7-million lb. superstructure to its permanent location and the installation of the compression seals in the expansion joints at each end abutment.

Although the contractor had the option to propose an alternate method of moving the superstructure, he chose to go with the contract plans prepared by the Bridge Bureau. The move was made on Hilman rollers placed under the diaphragms at each abutment and pier. Air winches at each intermediate pier pulled, with assists at the ends by cranes to keep the bridge going straight for its 50 ft of travel. Traffic was



New superstructure ready for permanent piers



Hilman rollers under girder

Move complete, ready for superstructure removal

New girders in place, ready for decking

stopped and the move began. But movement stopped after about 6 ft, when one or two roller assemblies failed. Traffic was permitted back on the bridge while new, larger assemblies were flown in the next day. The rest of the move was made without incident when properly sized units were in place. Traffic was interrupted for much less than the maximum two hours allowed in the contract.

The steel superstructure was selected because of its light weight and the convenient diaphragms needed to attach roller assemblies. And the move was made without any cracking of the concrete in the deck or barriers. Even the pipe piles for the temporary piers were removed for reuse.

The project was considered such a success that another project may use the same technique. □

Designer/Owner
Dept. of Highways
State of Montana (Helena)

General Contractor/Erector
Cop Construction
Billings, Montana

Steel Fabricator
Roscoe Steel & Culvert Company
Billings, Montana

Norman H. Rognlie, P.E., is chief of the Bridge Bureau, Montana Department of Highways, Helena, Montana.

PARKLAND HOSPITAL

Helipad in a Hurry!

by K. S. Rajagopalan, W. J. Demuth, Jr., and W. H. Walther

New construction around Parkland Memorial Hospital in Dallas affects the use of existing facilities. The construction of a new high-rise teaching hospital required a tower crane. But this crane would obstruct the flight path of medivac helicopters currently using an existing on-grade helipad. So the helipad had to be relocated before the construction crane could be mounted.

A recently completed clinic wing of the hospital, seven stories high, is designed for three additional floors. Access to its roof is through a door in the abutting 10-story building. Elevators in this building are very near the roof access door. It was decided the new helipad should be atop the 7-story wing, thus providing easy access through the door directly into the elevator corridor. Adequate column capacities were available to support the helipad loads because of the design loads for the future addition. Clear flight paths were also available.

Factors Affecting Choice of Framing

The chosen structural scheme was to be economical, quick to construct and composed of elements handled easily by a free-standing crane that could reach to this roof level to erect the helipad. Structural

Medical helicopter zeroes in on big "H" on Parkland Memorial's new helipad.

members were also chosen to permit reuse in event of future relocation.

Three possible structural schemes were studied:

1. An aluminum helipad
2. A helipad built of precast concrete double tees supported on steel beams and columns
3. A structural steel framework supporting a cast-in-place concrete slab

The aluminum helipad proved expensive. The concrete double-tee version proved too heavy to handle with available cranes. The structural steel proved both economical and easy to erect. Speed of construction was assured in this system.

Initially, a helipad to support a helicopter with a gross weight of 20,000 lbs. was considered. However, the final design was based on a 47,000 lbs. gross weight requirement. This high load-bearing capacity can accommodate even the fully armed National Guard Chinook helicopter included in the FAA's county-wide disaster plan.

The existing concrete building had col-

Steel framework erected and large pre-welded panels support safety net. Ramp (bott.) leads directly from helipad to hospital.

umns spaced at 20 ft o.c. east to west and 27 ft o.c. north to south. The helipad structure was a 56-ft square concrete slab and a safety screen 5 ft-4 in. past the slab edge. The slab and the screen were supported by composite steel stringers spanning north to south (27-ft span) supported by beams in the east-west direction. These three lines of beams were supported by steel stub columns atop the existing concrete columns. There is a 127-ft long ramp connecting the helipad to the door leading to the elevators. This 5-ft wide ramp facilitates hospital employees rolling gurneys from the helipad into the hospital. The ramp structure and handrails are supported on posts carried on existing concrete columns or beams.

It was critical that the single-ply roofing membrane not be damaged or burned during construction of the helipad. Therefore, onsite welding was kept to a minimum. Large pre-welded pieces were lifted on to the roof and field-bolted. Even the studs for composite stringers were pre-welded and the metal deck installed as single-span decks with proper end closures. Concrete with high, early-strength cement was used so the helipad could be used as soon as possible.

Fast Completion—with Steel

The helipad was completed from design to use in 56 calendar days. Such speed would not be possible without the teamwork and organization involving the owner, the contractor, the FAA and the design structural engineer. The traditional concept of project organization was abandoned and the teamwork concept put into place by the owner so that speedy construction was possible. □

Designer/Structural Engineer
Mullen & Powell-TechniStructures
Dallas, Texas

General Contractor
HCB Contractors
Dallas, Texas

Steel Fabricator
American Steel & Aluminum Company, Inc.
Grand Prairie, Texas

Owner
Parkland Memorial Hospital
Dallas, Texas

Dr. K. S. Rajagopalan is principal of Mullen & Powell, Techni-Structures, Consulting Engineers, Dallas, Texas.

William J. DeMuth, Jr., is project director and William H. Walther, assistant project director with Parkland Memorial Hospital, Dallas, Texas.

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