AMERICAN INSTITUTE OF STEEL CONSTRUCTION
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Chicago, IL 60611

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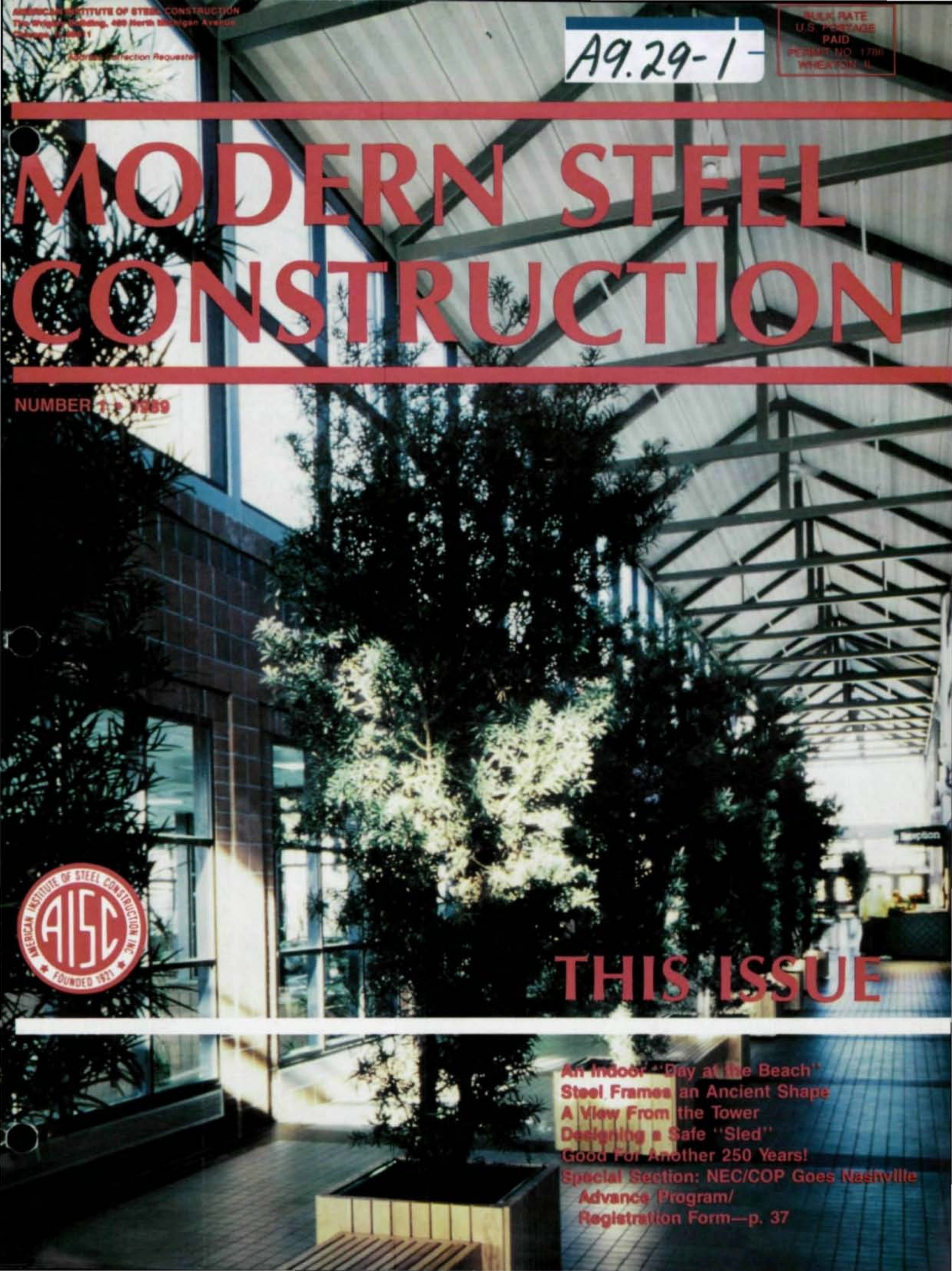
MODERN STEEL CONSTRUCTION

NUMBER 1 • 1989

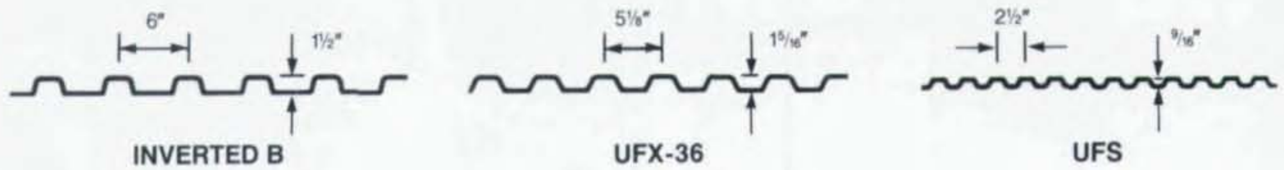


THIS ISSUE

UNITED STEEL DECK, INC.

DECK DESIGN DATA SHEET

No. 11



Questions and Answers About Form Deck

Q. How does *form* deck differ from *floor* deck?
Floor deck is the generic term given to *composite* deck — that is, deck that acts with the concrete, as positive moment reinforcing, to form a structural slab. Form deck simply acts as a stay-in-place form for the reinforced slab. Almost any deck can be a form deck, but the usual profiles are UFS, UFX or inverted B.

Q. How are the slabs designed?
By conventional reinforced concrete design — the reinforcement is usually draped mesh; that is the mesh is held up (into the negative bending region) over the beams (or joists) and draped into the positive bending region at the center of the span. Tables for uniform load, *based on allowable stress design*, are shown in the USD catalog. The deck profile can influence the design, particularly in the negative bending zone, because it eliminates some of the concrete available for compression. If slabs are cast on unshored galvanized deck, the deck is considered to be permanent and therefore carry the slab weight for the life of the structure; the slab only needs to be reinforced to carry live loads.

Q. What if the slab is under-reinforced?
This frequently happens — particularly on short (2′ to 3′) deck spans on joists. The common construction is a 2.5" slab with 66 x W2.9 x 2.9 mesh on ⁹⁄₁₆" form deck; the mesh does not meet ACI temperature requirements. However, if the deck is galvanized and is therefore permanent, it may be capable of carrying all of the applied loads even if the concrete turns to sand; this would be a worst case model and is a very conservative approach.

Q. How is the deck fastened to the bar joists or the structural steel?
Usually by arc puddle welding; if the deck is less than 0.028" thick (22 gage) welding washers should be used. Air powered fasteners, screws, and powder driven pins can also be used.

Q. Can form deck be used with composite beams and girders?
Yes — but the deck bottom rib dimension must be large enough to accept a ¾" stud. Our UFX-36 can be used but UFS cannot; B deck, either inverted or "right side up" is, of course, acceptable. Composite beam tables for UFX-36 are available on request.

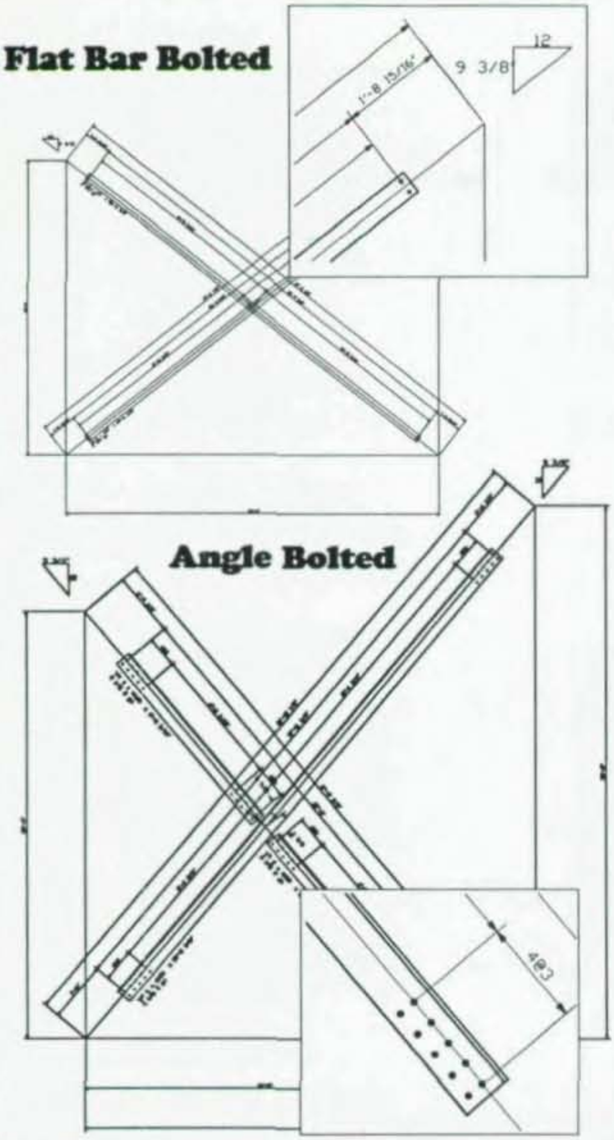
Q. Is diaphragm design data available?
Yes. The SDI Diaphragm Design Manual, second edition has tables for ⁹⁄₁₆" form deck. We can provide data on UFX-36.

Q. Are there fire rated assemblies?
Yes. The UL GXXX series covers many constructions. D753 and D863 cover UFX-36 type profiles on beams.

Q. Is form deck used for other purposes?
Yes. Exposed roofing; utility siding; dry installed roof systems; shelving; temporary covers; and draft curtains are some of the many uses. It is also used with non-structural insulating fills for roofs, but that is a different subject and we are out of room.

Remember, any time you need deck design data or pricing call us — Nicholas J. Bouras, Inc. We have the information available.

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



BraceCAD

BraceCAD is the first of a new family of Structural Software Company products, the -CAD programs. BraceCAD gets entered and computed dimensions from BraceCalc, translates that input into .DXF files, then plots out the desired brace through any PC-CAD program which recognizes .DXF files (AutoCAD, for example).

All of the braces on this page were created using BraceCAD in less than ten minutes each. BraceCAD also draws:

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K Bracing Non-Symmetrical)

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Tees (Welded &
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MODERN STEEL CONSTRUCTION

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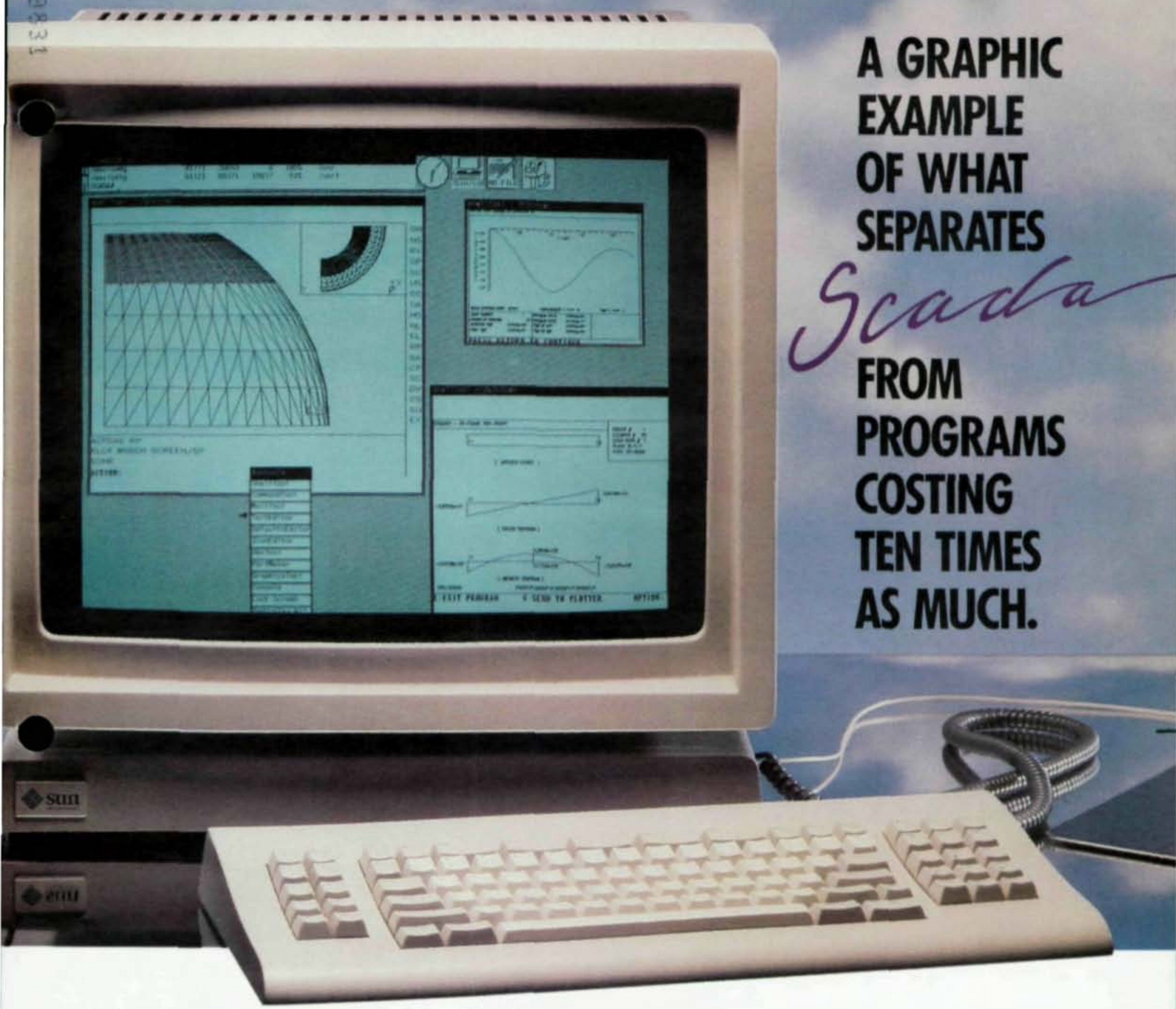
American Institute of Steel Construction, Inc.

The Wrigley Building
400 North Michigan Avenue
Chicago, Illinois 60611-4185
Phone: 312 / 670-2400

OOPs Dept.:
In Issue 6, we picked up the wrong photo on the San Francisco River Bridge (correct photo at l.). Our apologies to the bridge designer, FHWA, Western Bridge Div. and to steel fabricator member Egger Steel Company.



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TRW World Headquarters; Architect: Lohan Associates; Photographer: Nick Merrick, Hedrich-Blessing

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WESTMINSTER RECREATION CENTER

An Indoor "Day at the Beach"

by Richard Weingardt and Ron Rinker

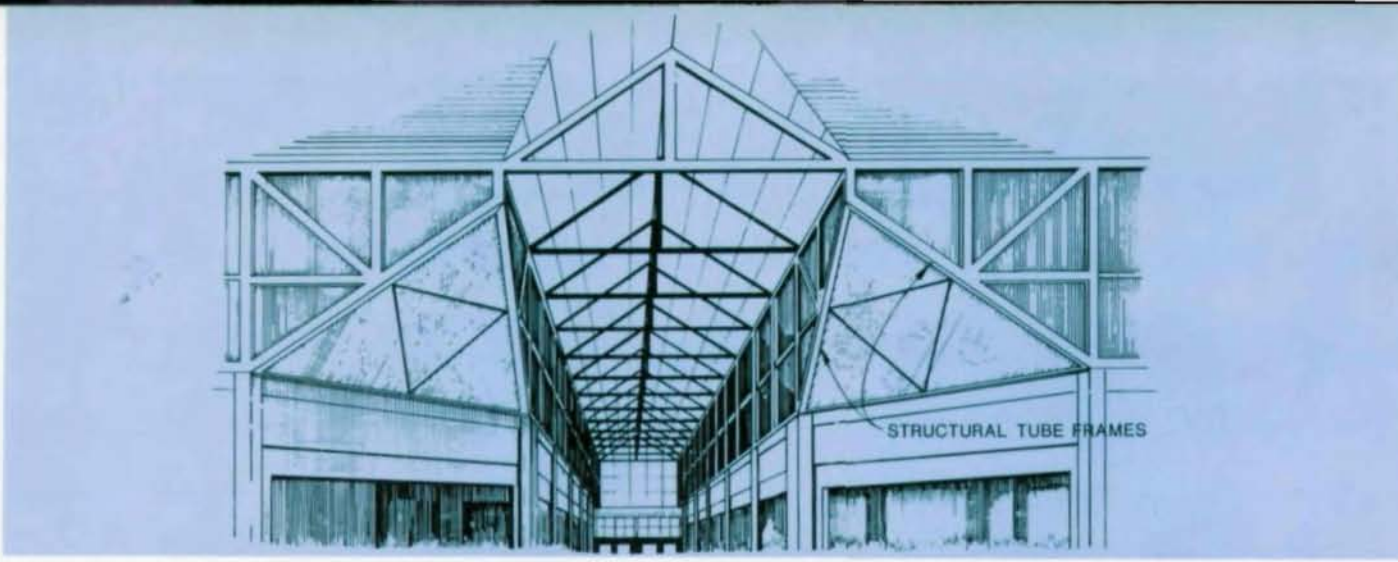
The City of Westminster wanted a state-of-the-art recreation center as the focal point in a new 100-acre park in their suburban community. The park, sloping dramatically to the west, affords a spectacular view of the Colorado Rockies. And the recreation center sits at the highest point of the park to take full advantage of these panoramic views. A magnificent site for the facility. However, the location has high wind forces, harsh temperature changes and devastating expansive soils. The choice of the the proper structural system proved to be critical to the project's success.

One of the objectives was to create a community center where people could participate—both passively and actively. The two-story building has a high volume, skylighted, circulation Galleria. Entrance to the building is through the upper floor. This level is primarily for passive activities, with lounges that overlook the gymnasium and swimming areas, a day care center, arts and crafts rooms and a multi-purpose room with a commercial kitchen. A large circular staircase leads to the lower level with its locker rooms, weight room, racquetball courts, gymnasium with a natural rock-climbing wall and leisure pool area.

European Leisure Pool Concept

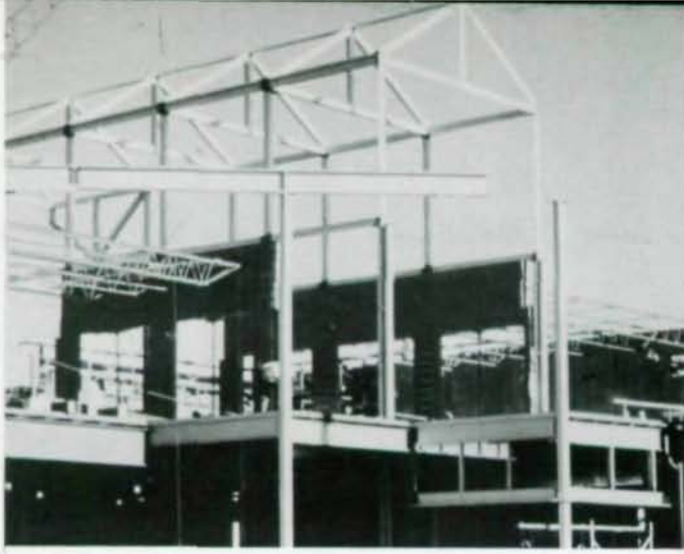
The Westminster indoor pool amusement complex includes three pools on multiple

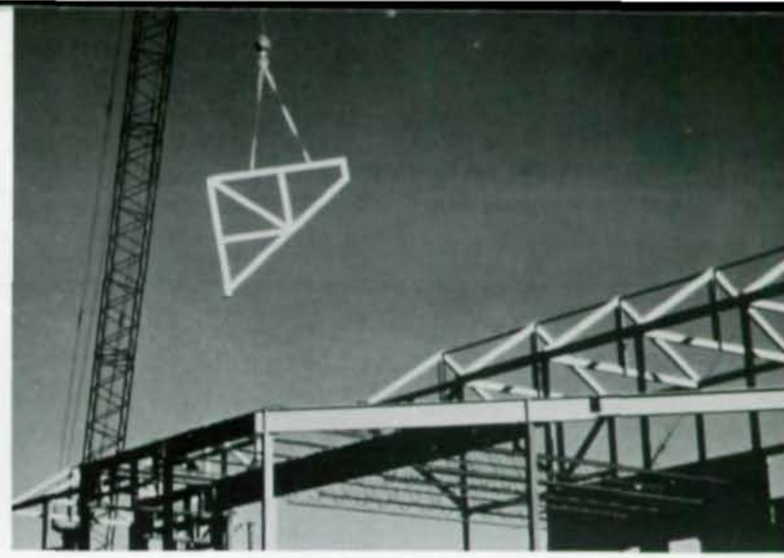
Westminster Center won Gold Nugget merit award from Pacific Coast Builders' Conference and is one of 10 recreation facilities nationally to receive 1988 Merit Award of Athletic Business Magazine*. Consulting Engineer's Council of Colorado awarded it an Engineering Excellence Award in 1988. Entrance is framed by landscaped parks and fountains.*



Three-dimensional structural tube frames support main galleria roof.

On our cover: *interior of galleria (below). Right, above, because of its many angles, levels, complex joinery and loading conditions, lightweight galleria required many systems—tubes, pipe columns, standard rolled sections and standard open-web joists. Erection of custom prefabricated tube gable trusses at far right. Jerry Butts photo.*





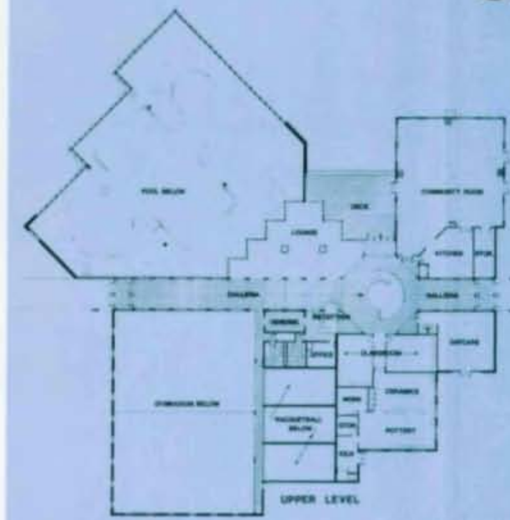
levels with a variety of slides, waterfalls, fountain sprays, bubblers and other entertainments. The deep pool at the uppermost level has platform diving, rope swings and a curved slide which drops to the middle pool. A five-foot waterfall from the deep pool splashes down into the activity pool and in the process creates a cave with view windows into the upper pool. The middle level also contains a 25-yd. activity pool for lap swimming, volleyball, pool basketball and instruction.

The lower level features a shallow pool with bubblers, mushroom spray, tot's slide and additional instructional areas—plus two large spa-type soaking pools, a sauna and a steam room. Trees and plantings, bridges and furnishings add to the festive environment of this water playground.

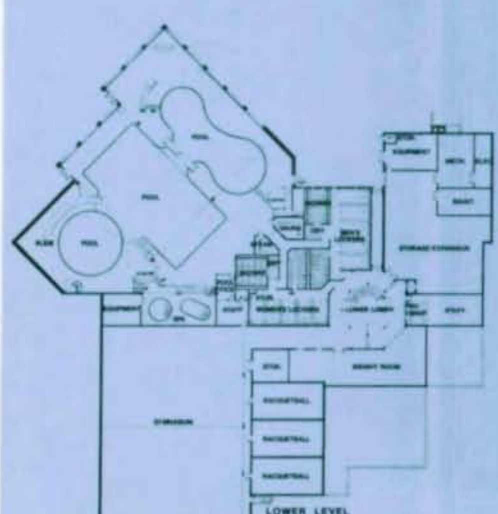
This leisure pool concept is very new to the U.S., although it has been used widely in Europe and is very popular in Canada. Pool water is heated by panels and newly developed, non-fogging, energy-efficient glass wraps the pool area to bring in the outdoors, light and views of the mountains. A food service area on the lower level provides a view to all of the water activity areas. An outdoor pool will be added in the future.

Architecture Possible with Steel

The desire for a light, airy feeling made selection of a structural steel a natural choice. The building is sited on a slope and is partially buried in the ground. A brick base rises from the ground and is topped by the light steel



Floor plan of main level (above). Below, lower level plan.



Interior shows three levels of European leisure pool concept.

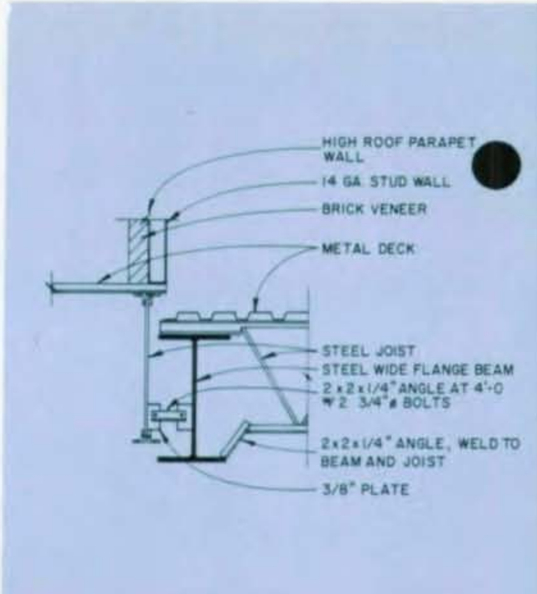
Exterior of pool wing shows high, two-story walls of non-fogging glass. Ed Leland photo.

structure which reduces the weight and mass of the building. Steel permitted a handsome architectural pattern to be developed while expressing the "skeleton" of the building. Additionally, to integrate rooftop solar panels into the architecture and to provide clerestory skylights, complex roof forms were needed. Structural steel was the most versatile system to achieve this. The roof forms at the atrium intersection of the Galleria required complex joinery.

High, two-story walls of glass with structural support members made as slender as possible were achieved by using structural steel. Full-height, vertical steel tubes are used structurally to support glass walls against the high winds which roar down from the Colorado mountains.

Structural Concerns

In addition to natural forces from winds, heavy snow loads and extreme temperature variations, the building pools themselves created structural concerns. Because the site contains highly expansive soils, any water leakage from the pools could cause large structural movements and extensive damage. The total weight of water in the pool wing of the building is in excess of 800 tons. Potential large movements from settlement and/or heaving soils require that the pool floor and structure be free of the superstructure to prevent a condition where the building would



Detail of roof isolation joint to allow for vertical moments caused by heaving, expansive soils.

try to tear itself apart because of differential movements.

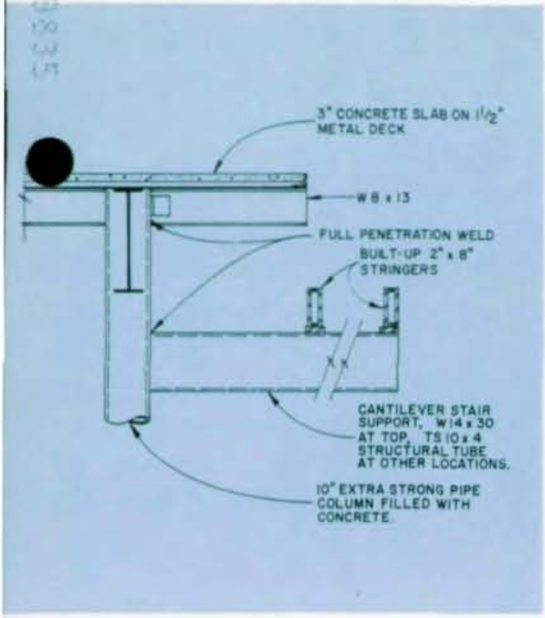
The building was engineered to allow the structural framework of the main building and the pool area to move independently of each other. Also the foundation system of the main building is separate from the pool structure and foundation. Because of the corrosive atmosphere of high humidity, all exposed steel was finished with a durable epoxy paint.

Structural Steel Systems

After extensive investigation into alternate structural framing systems, steel was selected because of economics and the architecture desired, as well as its light weight and flexibility. The superstructure above the pool floors has structural steel floor and roof framing and a combination of steel columns and masonry bearing walls.

The roof over the pool wing is three different levels. Only three interior columns support the pool roof and each doubles as a guard tower, high diving platform or observation deck. The structural design of the roof allows for solar panels to heat the pool water and skylights that admit daylight into this indoor version of a "day at the beach." The roof structure is also designed to support a gigantic serpentine slide that one day will circle the entire pool wing.

Large, 48-in. deep joist girders span columns over the pool wing; 32-in. deep longspan joists 8-ft o.c. run between the large joist girders. The roof is a 3-in. 20-ga. acoustical deck with an 18-ga. flat-bottom plate. The deck is designed as a diaphragm to resist lateral loads. The column-free gymnasium



Section through stair detail of cantilever beam support for stringers (above). W14x30 and tube sections cantilever off 10-in. pipe columns (r.).

Interior view of main circular staircase

roof is created with long-span, 72-in. deep joist girders which span 84 ft with 24-in. deep, open-web joists spanning the joist girders. The Galleria roof over the circulation corridors is custom prefabricated rigid gable trusses made up of structural 6-x 6-x ¼-tube members.

The main level floor is composite structural steel with concrete topping. Typical floor beams are 36-in. deep joist girders. Steel floor joists are 16-in. deep at 2-ft centers spanning the beams. Three inches of concrete topping overlay steel metal decking to complete the floor system.

Using structural steel proved to be a practical, economical solution for the large, main circular staircase: 10 x 4 structural tube or W14x30 beam sections are welded to and cantilevered off 10-in. dia. pipe columns to support the curved 8- x 2-in. stair stringers. Both the superstructure and the support system for the pools are supported on drilled pier foundations extending deep into bedrock.

Project Financially Successful

The center has proven to be an exceptionally popular and successful facility. The city had projected it would take three years before the center's operational costs would be fully covered by admission and user fees. In less than a year, they are operating without need for subsidy. The number of people who use the facility, from the city and the surrounding region, has surpassed Westminster's highest projections and expectations.

Structural steel played an important part in the success of the project. It allowed the engineer and architect the flexibility to design economically a complex and difficult facility within budget and the $8-million project was completed on schedule. □

Architect
Barker Rinker Seacat and Partners, P.C.
Denver, Colorado

Structural Engineer
Richard Wiengardt Consultants, Inc.
Denver, Colorado

General Contractor
J. E. Dunn Construction Company
Kansas City, Missouri

Owner
City of Westminster
Westminster, Colorado

Richard Weingardt, P.E., is president of Richard Weingardt Consultants, a structural engineering firm based in Denver, Colorado.

Ron Rinker is a partner of Barker Rinker Seacat and Partners, Architects, P.C., a Denver-based architectural firm.

STEELCASE INC.

Steel Frames an Ancient Shape

by Larry Hulst, with Toni Gould

Steelcase Inc., a world leader in today's office furniture industry, wanted a unique research and development facility. King Khufu (a.k.a. "Cheops"), a leader of ancient Egypt, wanted a place to stay for eternity. More than 4,000 years and half a world apart, both leaders chose to build pyramids.

Except for their shape, though, the two aren't much alike— and steel construction makes for one of the biggest differences.

Khufu's pyramid (called the Great Pyramid) on the west bank of the Nile outside Cairo, Egypt, is engineered solidly of limestone blocks—some two million of them, each averaging 2.3 metric tons. All that piled-up stone makes for little room inside. Despite a 13-acre base and a 481-ft original height, the Great Pyramid's interior spaces are limited to a couple passageways, a gallery and two rooms.

Dramatic Contrast

Structurally, materially and spatially, Steelcase's pyramid (properly called the Corporate Development Center, or CDC, located a few miles south of Grand Rapids, Mich.) provides a dramatic contrast.

Over a steel skeleton, the 128-ft high, 7-story CDC features polished granite at its base and a skin, on upper stories, of painted aluminum panels with polyisocyanurate insulation sandwiched inside. Ceramic frit glass on windows and skylights blocks glare, yet admit natural light and give occupants a good view of the prairie landscape of the 125-acre rural site.

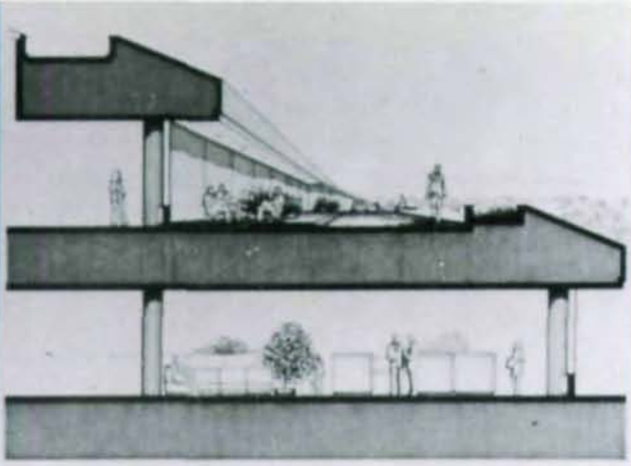
Within its total 575,000 sq. ft, the CDC provides work space for more than 700 personnel. Employee interaction areas of various sizes also are important design features. These spaces range from outdoor terraces on several levels to a central atrium that subdivides into four separate atria as the building steps up. Reaching the full height of the building, the atrium mimics the overall building shape, but with a major twist: top to bottom, its pyramidal shape is the *inverse* of the building's exterior contour. All employees must come to this "town square" to traverse vertically and to enter or leave the building.

Designed and engineered by The WBDC Group, the futuristic CDC represents a creative design response to exacting requirements that stemmed from three basic goals.

Three Basic Goals

Steelcase wanted the building to encourage an integrative (as opposed to linear) work process, which meant the design had to facilitate interaction and communication.

Dramatic Steelcase Inc.'s new headquarters near Grand Rapids, Mich.



Cross-sectional drawing details levels of CDC interior.

Photo shows steel spline framing where sides of pyramid me

Second, the environment had to encourage creativity— specifically, the owners wanted the building to bring the outdoors in, to have a light and airy feeling and to provide spatial excitement.

Finally, they wanted the exterior to reflect the company's commitment to design excellence, to make a straightforward declaration using strong, simple lines.

Building a pyramid was not, in itself a primary goal. But consideration of each major client requirement repeatedly led Architect Donald J. Koster to conclude a pyramidal form could work well to satisfy the owner's criteria. As well as it responds to the owner's needs, the design itself presented challenging structural systems requirements.

Challenge in Structural Requirements

The structural system had to be adapted to the building shape and planned uses. It also had to be compatible with a flexible power and communications distribution system. Finally, it had to provide flexibility during construction, requiring fast-track phasing under an extremely tight schedule, which called for the superstructure to be erected during winter months. All these criteria, WBDC engineers decided, could be met with a structural steel frame.

Adaptable to the demanding construction schedule, steel framing integrated well with the cellular decking system employed for power and communications distribution. Structural steel also accommodated the varying loads anticipated in different parts of the building. Besides providing for typical loading in office spaces and support-service facilities, the engineers had to allow for significantly heavier loading in other areas of the CDC, including laboratories and concentrated storage facilities.

Aerial view of completed exterior, sans landscaping. Elevation (below) shows intricate steel framing.

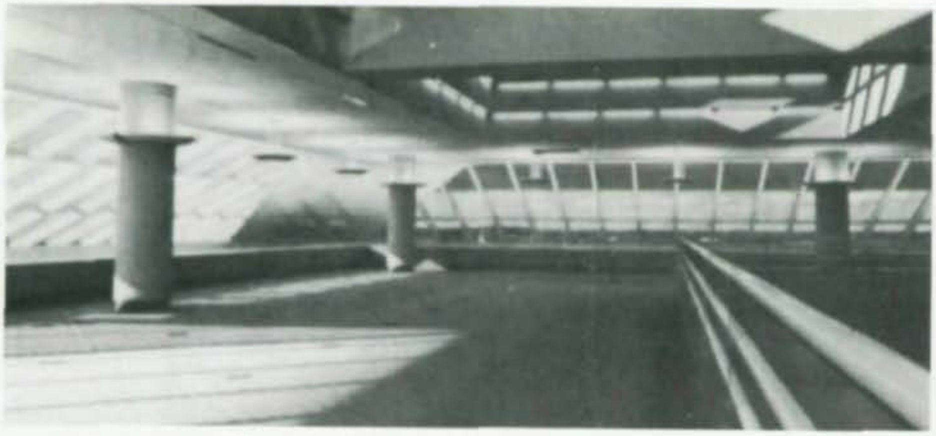
Another factor in favor of steel was its adaptability to the building shape. Among the particular challenges of the design are several spaces requiring relatively long spans: fairly large cantilevered areas; and the atrium, where the interaction of external and internal pyramidal shapes is a significant consideration. Structural steel suits all these areas well and also helps reduce building weight—a result which avoids overloading relatively weak soils that prohibited the use of conventional spread foundations.

Analysis of foundation alternatives led to the selection of augered, cast-in-place concrete piles. In all, 2,431 14-in. dia. piles with an average length of 46 ft. were placed.

The floor system consists of a 2½-in. concrete cover over 3-in. composite cellular steel floor deck, with bottomless trenches to distribute service to each cell. For maximum flexibility, the 274,000-sq. ft cellular deck features preset inserts for electrical service, on a 24-in. X 30-in. pattern. In addition, 45,000 sq. ft of non-cellular floor deck was used, providing a total supported floor area of 319,000 sq. ft. The floor system is supported by compositely designed beams of A36- and A572-Gr. steel, with welded shear studs spaced at approximate 9-in. centers. Nearly 6,000 tons of structural steel went into the building.

Since the base of the CDC is nearly industrial in function, the design includes docking facilities for 75-ft semi-trailer units. To avoid detracting from the look of the building exterior, receiving docks were designed below grade, requiring a column-free area of approximately 89 ft x 200 ft. The structure for this area also supports landscaping, driveways and parking above, and it must be able to support fire-fighting equipment. To maintain necessary floor-to-floor heights and truck clearances, 36-in. steel beams were specified. This solution was considered more feasible than either cast-in-place or precast concrete systems. Structural steel for underground structures also was extended into an adjacent area for electrical and mechanical systems.

Elsewhere, a significant challenge was presented by the intersecting planes of the inverted-pyramid atrium and the exterior building shape which, combined with diagonal floor cuts for escalators, prevented car-



Areas that house employee workstations (before partitioning). Note open, airy feeling ample light from skylights creates.

rying a number of columns straight through to the foundations. Heavy floor-loading requirements combined with diagonal transfer beams at upper levels, made it necessary to transfer large column forces to adjacent supports.

After analyzing several options for these carrying beams, the engineers specified rolled, 40-in.-deep sections of Gr. 50 steel. Weighing up to 593 lbs. per ft, these were judged to represent the most economical, timely approach to the problem. Approximately 250 tons of these beams were supplied by Trade Arbed.

During the early stages of the CDC design, wind tunnel testing was performed at the University of Michigan to determine wind-flow patterns around the pyramid shape. Results of these tests were checked against engineering calculations in the application of lateral forces—a procedure which King Khufu likely did not require for his structural system.

The corner ridges of the CDC form a visual and structural spline interconnecting all levels of the building. Structurally, the spline framing consists of three beams offset from each other to accommodate the intersecting roof planes, all connected by diagonal-angle framing. The continuity of this spline framing provides a central element in the lateral stability of the structure.

Steel work began on the CDC late in 1986 and was completed in the Spring of 1987. Early in 1989, Steelcase staff will occupy the building: the world's first major *contemporary* pyramid—framed by steel.

King Khufu would be amazed—and pleased! □

Architect/Structural Engineer
The WBDC Group
Grand Rapids, Michigan

Construction Manager
Barnes Construction
Grand Rapids, Michigan

Steel Fabricator
Haven-Busch Company
Grandville, Michigan

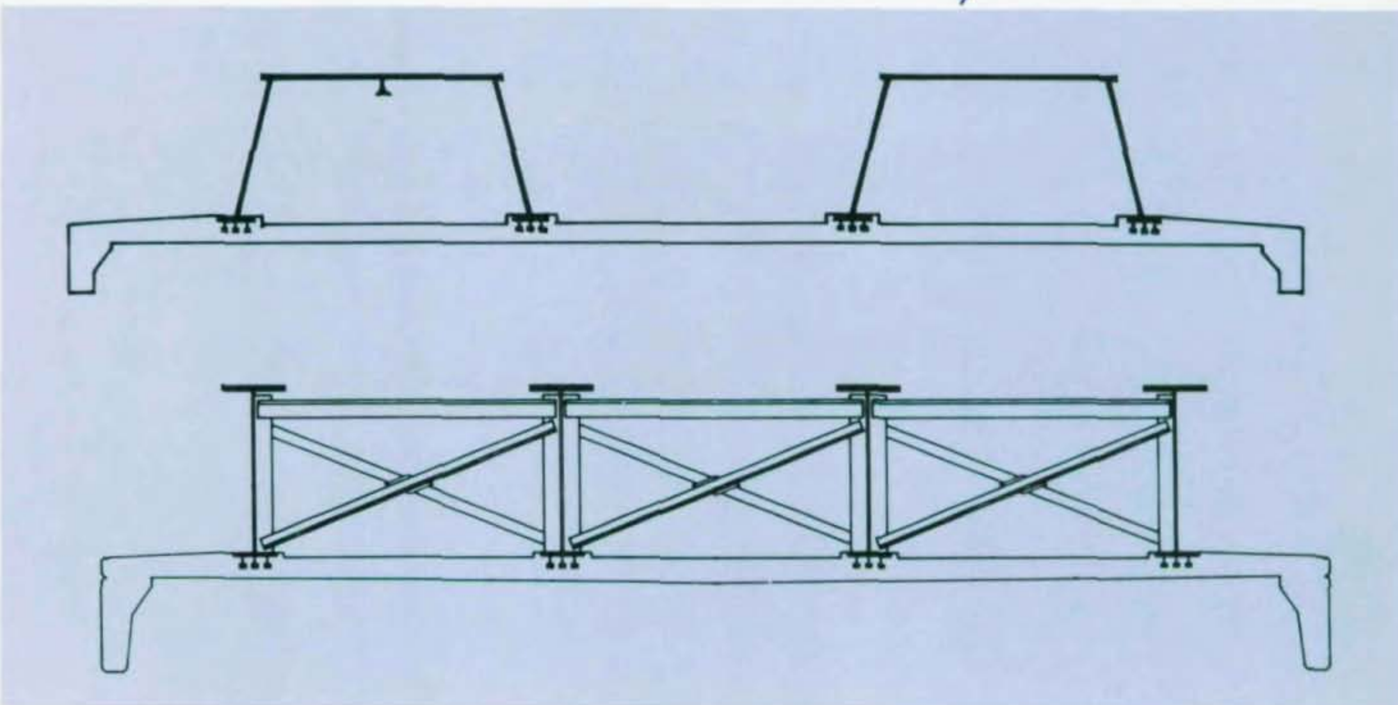
Owner
Steelcase Inc.
Gaines Township, Michigan

Larry Hulst, P.E., is manager, Structural Engineering Division, of the WBDC Group, Grand Rapids, Michigan.

Toni Gold is writer for the Marketing Division of WBDC.

Design of Highway Bridge Girders on the PC

upside down art



The American Institute of Steel Construction, Inc., is cooperating with Bridge Software Development International, Ltd., of Coopersburg, Pa., in an effort to provide software for computer-aided design of steel bridge girders. BSDI has developed the Line Girder System (LGS) package of computer programs, which enables the design engineer to take full advantage of today's desktop personal computers (PC's). Most software can perform quickly computations that were always required, but the LGS goes further—it permits a new level of decision-making through its interactive and user control features.

Designers can scrutinize results of their decisions, so a continual learning process occurs with LGS. The user becomes, in a fashion, his own "optimizer." For example, through interaction with the LGS, the user can examine the relationship between fatigue, yield stress and girder depth, or the relationship between compression flange buckling and diaphragm arrangement. This level of investigation can be performed without the uncertainty of costs and turnaround associated with mainframe computing, be they time-sharing or in-house. A professional, investigative approach to bridge design no longer has to be balanced against computing and man-hour costs.

The ability to investigate a three-span girder in less than 30 minutes permits confidence in review of in-house work as well as the ability to quickly develop hard information for proposals and to perform type, size and location studies. These speedy investigations include much more than an analysis purely for adequacy—they include evaluation of important variables such as girder depth, flange sizes and girder handling information such as field section lengths and weights.

Hardware Requirements

The LGS programs run on industry-standard MS-DOS microcomputers, which have a parallel port receiving RS232 shaped attachments. The programs are provided on 5¼-in. 360K floppy disks. All 10 executable programs of the LGS can be installed using less than two megabytes of disk space. If disk space is limited, the programs can be run from floppies or from a RAM drive.

Capabilities

The LGS programs provide the tools to design *straight* girders having:

- Up to 20 continuous spans
- Composite or non-composite action
- Composite or non-composite action in negative moment regions

- Constant thickness or vaulted concrete deck
- Splayed girder spacing
- Interior or exterior girder locations
- I-shaped or box-shaped
- Variable depth (I-girders)
- Specified vertical and rotational support stiffness
- Longitudinally or vertically mixed steel grades

Note: BSDI also has a 3-D program suitable for the design of curved girders. However, complete 3-D analysis and design is beyond the scope of the LGS program.

User Interaction

The entire LGS system is interactive in that the user is prompted for responses. Installation of the programs is even automated and interactive. There are, however, several advanced features which make the LGS an outstanding set of programs for the bridge designer:

- Model building is performed by the user interactively entering plane, deck and load information. The programs ensure that all data has been entered and is reasonable.
- Live-load selection or definition is interactive.
- Solution of the finite element problem and application of live loading to influence lines is monitored on the screen to inform the user as to the status of the programs.
- Any of the interactive reports the user deems valuable may be saved in a file and printed later.
- Interactive help messages are available for most responses. By entering an "H," the user causes a help message to be displayed. The program then returns automatically to the normal input mode.

It is easy to see why users of the LGS soon learn the impact of AASHTO provisions on design decisions and ways to improve constructability and lifetime structural performance. Instead of 10 years' experience being composed of one year's experience repeated 10 times, each new design using the LGS enhances experience and improves one's ability to meet the next design challenge.

Fees and Service

The initial licensing fee for the LGS package is $3,000, followed by an annual service fee of $750. Service includes:

- Enhancements to the LGS programs purchased
- Hot-line during business hours
- Updates to documentation
- Updates to programs reflecting changes in AASHTO Specifications
- News releases periodically

For additional information contact:
Technology and Research Department
American Institute of Steel Construction
400 North Michigan Avenue
Chicago, IL 60611
312/670-5411 • Fax 312/670-5403

Participation by the American Institute of Steel Construction in marketing the LGS package is not intended as a representation or warranty on the part of the Institute that the LGS package is suitable for any general or particular use or of freedom from infringement of any patent or patents. Any final design should not be used or relied upon for any specific application without competent professional examination and verification of its accuracy, suitability and applicability by a licensed professional engineer. All technical services related to the LGS package are provided by BSDI, including updates, software maintenance and a hotline for direct service to LGS users. □

Soda. . .designs your least-weight steel structure fast. . .and automatically

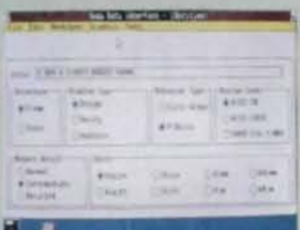
Finally, a practical structural engineering software package that not only analyses but automatically designs a least-weight (optimal) steel structure.

SODA represents the perfect blending of state of the art structural engineering and modern optimization research. SODA is a truly practical steel design optimization package that permits the designer to concentrate on engineering instead of routine calculations, thereby reducing design time and costs.

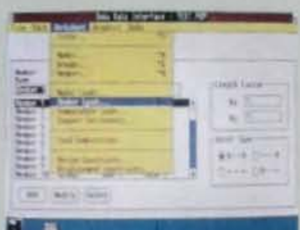
SODA automatically and completely designs a least-weight planar steel frame or truss from section databases in complete conformance with design code requirements. The design by SODA is complete, constructable and ready to implement. There is no need to re-analyse and re-size as is the case with other steel design programs. The software designs not only member by member, but by considering the entire structure as a system. The design satisfies both strength and deflection requirements.

- Design codes supported:
  - AISC WSD 1978 Specification
  - AISC LRFD
  - Canadian CAN3 - S16.1 - M84 Limit States Design
- Microsoft® Windows environment
- Mouse or keyboard interaction
- Members selected from AISC or CISC database or from user's custom data base
- Comprehensive yet concise user's manual
- 30 day evaluation period, refund if not satisfied
- Runs on IBM PC XT/AT or compatible
- Minimum 640 KB and hard disk required

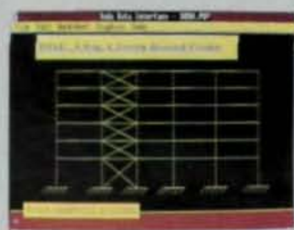
® - Microsoft is a registered trademark of Microsoft Corporation.



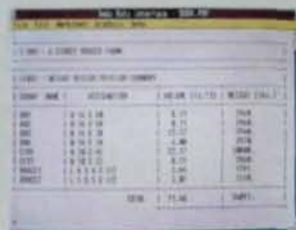
Input and editing is quick and easy.



User interface is accomplished with mouse and drop down menus.



Graphics displays are accessible at any time.



The optimal design is presented in a logical and concise manner.

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soda
STRUCTURAL OPTIMIZATION DESIGN AND ANALYSIS

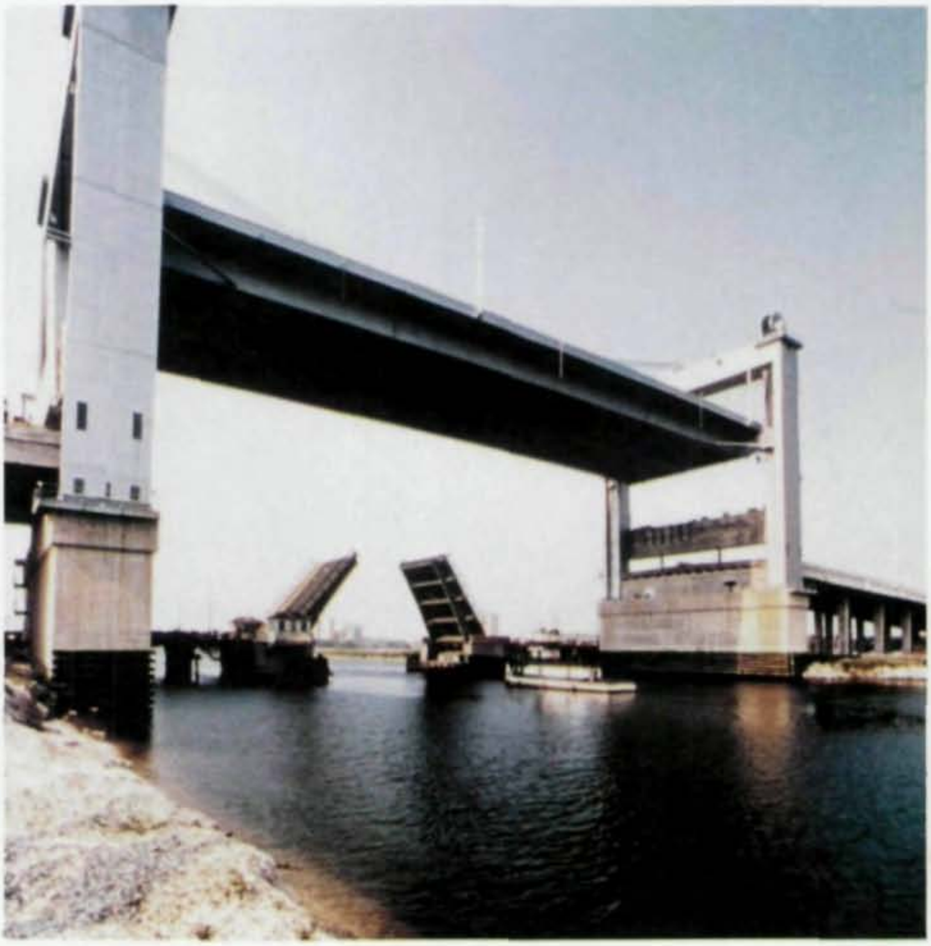
Steel "Expands" a View

DANZIGER BRIDGE

A View from the Tower

by Louis Garrido

A most-needed structure, the new Danziger Bridge across the Industrial Canal replaces a deteriorated, 50-year-old Strauss, double-leaf trunnion bascule span on U.S. 90 in New Orleans, La. The project is part of the federally funded bridge replacement program.



The new, impressive structure has a semi-high level 320-ft vertical lift steel box girder span over the navigation channel with 150-ft high steel towers at each end. The length of the main span was chosen in order to clear the entire width of the canal at this location, thus eliminating the need for expensive protective fenders and dolphins and providing an unobstructed path to ocean ships and large, heavy barges using this waterway. Total length of the bridge is 3,270 ft abutment to abutment.

The new bridge carries three lanes with shoulders in each direction with opposing traffic separated by a median barrier. With three lanes in each direction, and a combination of an acceleration lane and a sidewalk, the 320-ft vertical lift steel, box-girder span is 108 ft wide, about the size of a football field. Vertical clearance for the movable span in the closed position is 50 ft above high water elevation, providing navigation for more than 90% of the waterway traffic without interrupting highway traffic. In the raised position, vertical clearance above high water is 125 ft. The Industrial Canal connects the Intracoastal Canal with the Gulf of Mexico through the Gulf Outlet.

The height of the towers from the top of the piers to the centerline of sheaves is 150 ft. Tower legs, 113.5 ft c. to c., have a T-shape made of welded plates with vertical stiffeners and cross frames in a horizontal plane. A large strut, at the top where the sheaves are mounted on a steel pedestal, completes the tower frame. Extending the full height of the towers are inside stairs, one leg for each tower. A house for the bridge tender is in the north leg of the west tower, 20 ft above the deck and about 90 ft above ground.

The 108-ft by 320-ft long lift span has three main, welded-steel rectangular boxes 14-ft deep spaced 35 ft apart by a steel orthotropic deck. The rectangular boxes are fabricated of ASTM A572 and A588 steel for main plates and A36 for secondary members. The orthotropic deck, which serves as the top flange of the main boxes, is ½-in. thick plate with welded trapezoidal ribs spaced at 26 in. o.c. framing into cross beams in 14.5-ft centers. The orthotropic deck, topped with 2½ in. of rubberized asphalt, provides smooth riding and proper skid resistance.

Normally a Steel Truss

Normally, a lift span of these dimensions

(continued on pg. 26)

MAKING THIS BUILDING S
WOULD GIVE MOST CO

But not Vulcraft. We saw it as one of our greatest challenges ever. Because we not only supplied steel joists and joist girders for the project, we also helped design the framing system so that only limited structural damage could be expected from an earthquake measuring up to 7.5 on the Richter scale.

The Evans & Sutherland building, which contains millions of dollars worth of sensitive computer equipment, is located within a mile of the Wasatch Fault in Salt Lake City.

would have required a steel truss with overhead members that clog the vision of the bridge tender so he cannot completely assess if traffic is clear before opening the structure for navigation. With this design of the bridge, passage is visible without the nagging overhead clutter of a truss bridge, and the operator commands an unobstructed view of the whole structure.

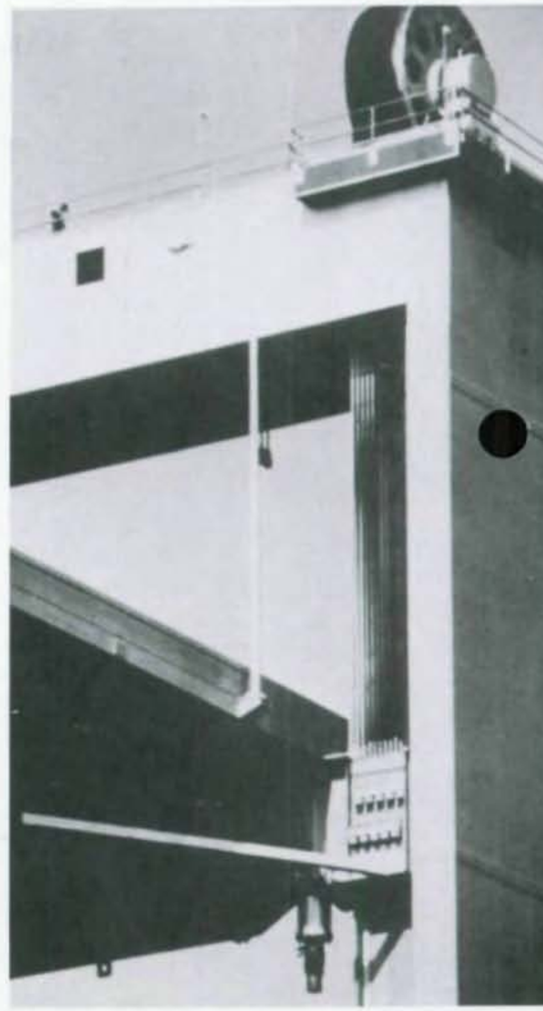
At each end, the lift span frames into a large plate girder extending the width of the roadway. These lifting plate girders carry the entire weight of the span. The lift span, total weight 2,200 tons, is supported by 80 2-½-dia., 6 X 25 improved plow-steel wire ropes, with 20 ropes attached at each end of the lifting girder. The wind load acting on the lift span is transmitted to the towers through the span guides when it is raised.

Fabrication of box girders, orthotropic deck, towers, end lift plate girders and other built-up members required shop welding. All field connections were made with high-strength ASTM A325 bolts. Those members are designated as fracture-blast-cleaned in accordance with SSPC-SP6-Commercial Blast Cleaning and inspected for surface flaws prior to fabrication.

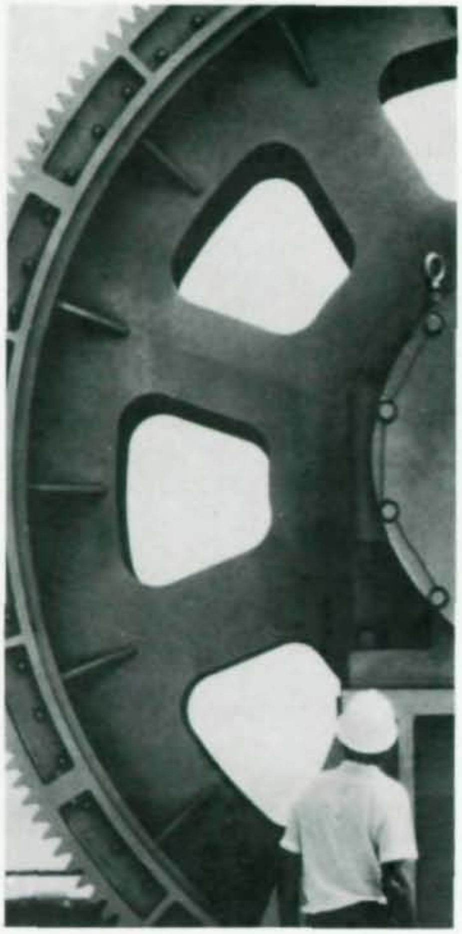
Span Shop-fabricated

The lift span was shop-fabricated in three sections both longitudinally and transversally and shop-assembled, following progressive assembly method, in two sections in the transverse direction. Each section contains two main box girders, floorbeams (including end lift plate girders), diaphragms and crossframes.

Each tower leg was shop-fabricated in four tiers and shop-assembled with all the tiers in one contiguous section, also following progressive assembly methods. The top strut was assembled in one contiguous section with only the top tier of each leg. Because of the large cross section of the tower legs, shop assembly of the joints with mill ends required 70% of the main material bearing area to be in contact, with any element of



Danziger Bridge designed so lifting mechanisms does not obscure highway or waterway traffic.



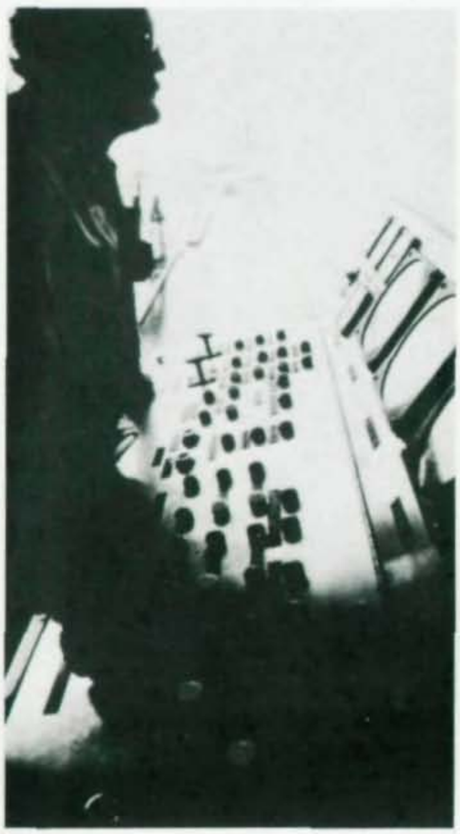
Giant gear lifts span. Compare size with that of man in foreground.

the main material having a minimum of 60% of its bearing area in contact. A maximum gap of 0.03 in. was permitted for parts not in contact and a gap not exceeding 0.005 in. did qualify as contact.

For the erection of the left span, two falsework towers between the main piers, 65 ft each side of the centerline navigation channel, were built to provide a minimum of 130-ft horizontal clearance.

Straightness and alignment of towers was checked carefully to ensure smooth operation of the movable span. This required each section be set accurately in position with bolt holes in true alignment before bolting the splices. Vertically, measurements were taken each morning or night to avoid the temperature effects of the sun. The top strut was also erected in early morning before sunrise. A tolerance of one inch vertically and a one-inch deviation in squareness for each tower, was permitted from theoretical position, as viewed normal to the longitudinal centerline of the bridge.

The counterweight is two steel trusses attached directly to the ropes. The trusses are embedded in concrete. The size of the counterweight is 7.75 ft X 18.5 ft and provides five pockets to accommodate 1,000 balance concrete blocks. Each counterweight has a supporting device at the top of the tower, allowing the concrete to be poured at the upper limit of its 75 ft of travel. This device permits the future change of ropes or repair to the



Unobstructed view from the tower (l.) speeds traffic, promotes safer operation.

counterweight with the span in the closed position. Balance chains offset the imbalance of ropes when the span is raised.

Construction for the lift span required 6.6 million lbs. of structural steel. The total cost of the bridge, including approaches, was about $38 million. The Danziger Bridge over the Industrial Canal at New Orleans, La., on U.S. 90, locally known as the Chief Menteur Highway, which serves both automotive and marine traffic efficiently and safely, was open to traffic in April 1988. □

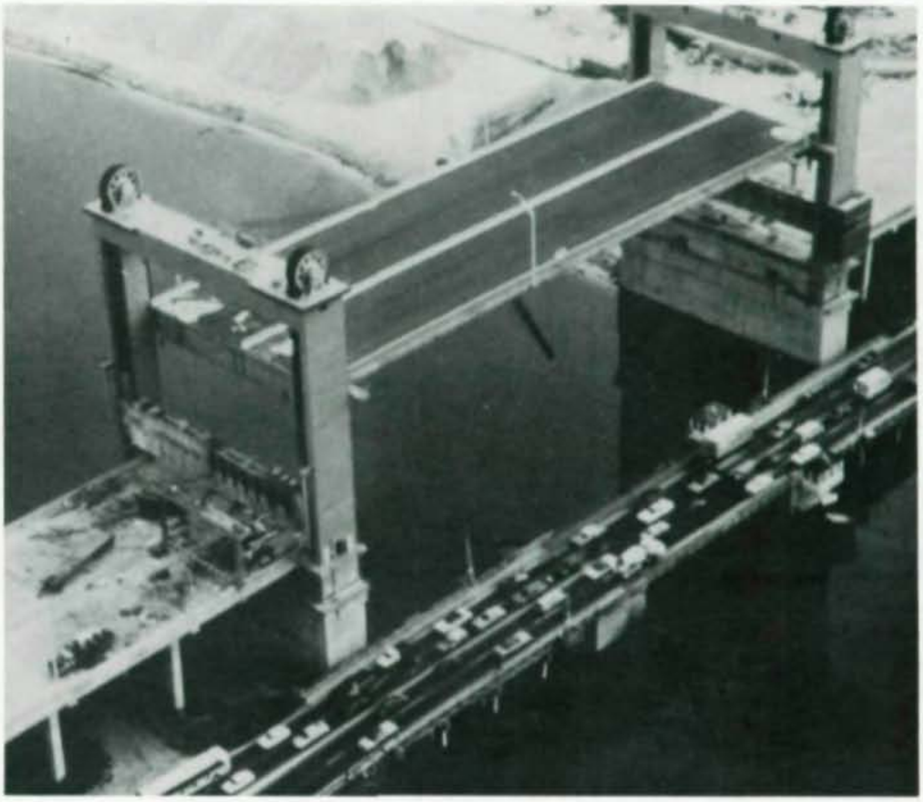
Designers
Sverdrup and Parcel & Associates (main bridge)
St. Louis, Missouri, and
David Volkert and Associates (approaches)
Mobile, Alabama

General Contractors (joint venture)
Williams Brothers Construction Co., and
Ciambro Corporation
New Orleans, Louisiana

Steel Fabricator
USS Fabrication
Orange, Texas

Owner
Louisiana DOTD

Louis Garrido is bridge design engineer for the Louisiana Dept. of Transportation and Development, Baton Rouge, Louisiana.



Lift span, in up position, dwarfs 50-yr. old bridge.

RESOLUTION PLAZA

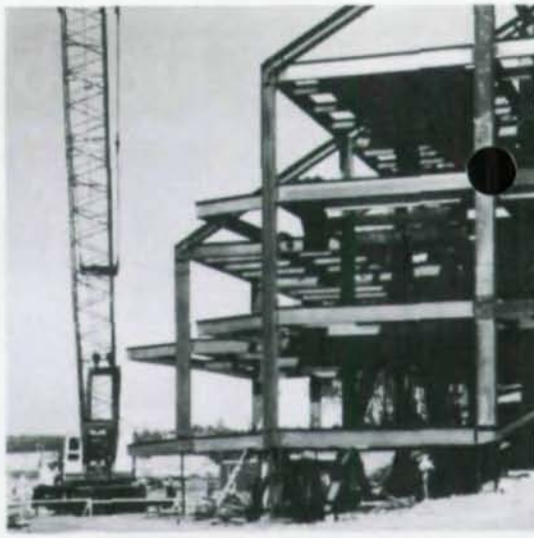
Designing a Safe "Sled"

by Peggy Confer

Structural steel provided the strength and adaptability necessary to build an award-winning structure on a previously "unbuildable" prime location in downtown Anchorage. Resolution Plaza, a six-story, 82-ft tall, 57,276 sq. ft office building was named the top commercial construction project in Alaska for 1986 by *Alaska Construction and Oil Magazine*. One core services the building with two elevators. Setbacks in the floor plan allow decks on four levels to open from interior spaces to an unobstructed view of Knik Arm of Cook Inlet and the Chugach Mountains. There are two main entries to the building, one at the first floor and a grand entrance at the fifth floor that opens onto the intersection of Third and L Streets. The building is supported entirely from eight pile caps and has no traditional spread footings. This aspect of the building is concealed by a stucco "skirt" wall from the underside of the building to the ground. Mechanical gear is also hidden by this skirt.

Site Challenges

The major challenges for this building came from the site, next to Earthquake Park. This is at the northern edge of what is known as the L Street slide area, a result of the 1964 earthquake. The City of Anchorage became concerned with construction in this area after reviewing a report by Woodward-Clyde in 1982 entitled, "Anchorage Office Complex



Steel framing design solves seismic problem for Resolution Plaza structure.

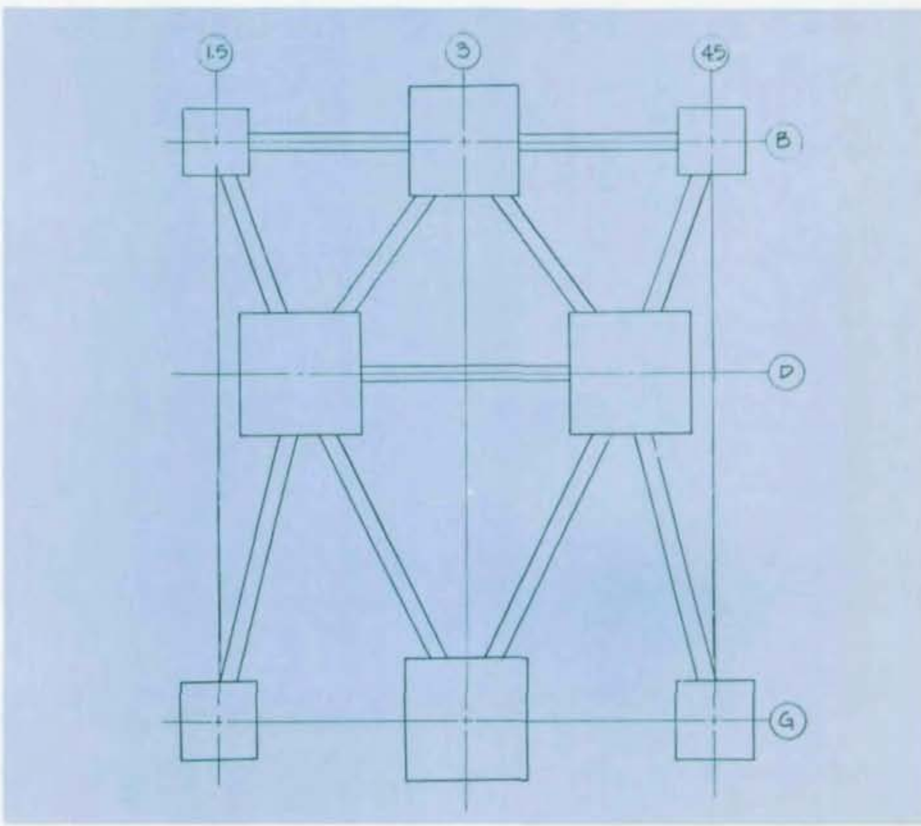
Geotechnical Investigation, Anchorage, Alaska." This report raised the possibility of large vertical and horizontal seismic motions in the area. The site slopes 50 ft from L Street to the parking lot below. The soil, a layer of loose to dense sand and gravel of varying depth over clay deposits, was not considered able to carry heavy loads. The site was considered fragile, with minimal cut and fill recommended by the geotechnical engineer. Steel friction piles were also recommended as the most appropriate type of foundation support to spread the load through the sands and gravel to lower concentrated loads on the clay below and to minimize disturbance of the soil in general. The geotechnical report gave a 10 to 20% probability in 50 years of vertical and horizontal movements on the order of 10 ft, and a one to five percent probability of movements on the order of 20 ft.

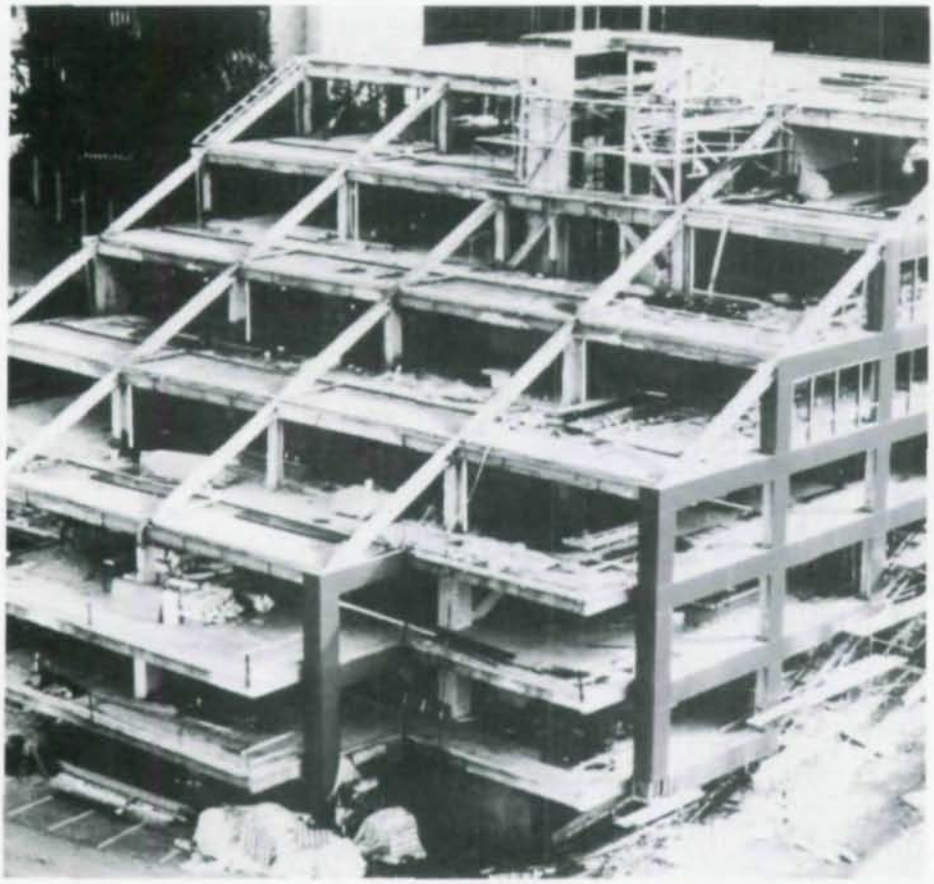
Design Approach

The final configuration of the building was the result of months of study by the geotechnical engineer and weeks of meetings between the owner, architect and engineer. The owner expected to put a 12-story building on the site similar to the larger ones around it in the downtown area. The site seismic considerations eliminated this option, the possibility of major soil displacements would put the building in danger of tipping over. Brainstorming resulted in a concept the architect called the "sled," a very low structure with a wide base to minimize rotation problems. Thus it remained for the structural engineers to design a safe sled.

Structural engineers were confronted with a tough situation not addressed by the Uniform Building Code. Therefore, they set about to develop a criteria which, based on the possible horizontal and vertical soils movements presented by the geotechnical engineers, would produce a structure in which life safety risks were reduced to a level similar to a normal code structure subject to earthquake loading. The engineers set about to design a building which would maintain structural integrity to protect the life safety of the occupants under various foundation failure modes suggested by various soil failure mechanisms described in the geotechnical report. If the lower soil block fails and line B pile caps drop (see figure), the building will cantilever from the two remaining rows of pile caps. If the line D pile caps fail, the building will span from B to G. If the piles fail in bending due to lateral motion, the pile caps are designed to act as spread footings. Some resistance to lateral motion is provided by batter piles. The entire soil block on which the building is founded may move downhill, in which case the piles would fail in bending and the pile caps would become spread footings. Comments by Forell & Elssesser (hired by the City of Anchorage to review the design) resulted in the addition of grade beams to tie the pile caps together. Steel pipe provided the most economical solution for the grade beams. The geometry of the pilecap layout would be maintained by a trusswork of pipe struts so

Foundation plan of unusual "sled" structure.





Steel-framed "sled" design meets major challenges on site in highly seismic area.

Architect
The McKinley Architects

Structural Engineer
KPFF Consulting Engineers

General Contractor
Hoffman Construction

Developer
Quadrant Capital Investment

the building might rotate and drop several feet in elevation, but be structurally intact to allow safe evacuation after a seismic event.

The final configuration has five longitudinal frame/trusses, grids one through five and *three transverse trusses, grids B, D and G.* All moment connections are detailed to meet the ductility requirements of the Uniform Building Code. The braces are full-tension capacity using full penetration welds of flanges and web.

Possibly the most unique feature of the structure is the pile cap design. Each column base plate is attached vertically by only two 1½-in. dia. A307 anchor bolts. This limits the amount of down drag which can occur because of differential vertical soil movements. Horizontal capacity is provided by a ring of steel bars welded to the lower plate. Lateral release is achieved by local bending of the piling. The pipe struts between the pile caps provide assurance that even if the building should lift off its foundation, when it came to rest it could set back on its foundation because the geometry was maintained by the struts.

The total weight of the building had to be kept to a minimum. Steel framing with composite *2-in. steel deck and 2½-in. concrete* cover was chosen for the floor system. The typical bay is 21 by 30 ft. The story height is 11 ft-4 in. With this limited story height it was necessary to provide penetrations through the beams for the mechanical system. These were round, mainly unreinforced penetrations. Honeycomb core aluminum faced panels mounted flush with the window *glass provide a strong, lightweight cladding.*

Construction

Access to the site and space available for construction was limited. Mobile cranes were used for all the work. A crane with adequate reach for the longest picks was positioned at the lower end of the site for the duration of steel erection. The building site had less than an acre available for steel shakeout, so steel was carefully inventoried by computer and packed in trailers. Trailers were ordered from the marshalling yard as their contents were needed for the carefully planned erection sequence. The contractor had difficulty with temporary shoring of the steel because of the soft ground at the site so maximum use was made of the pile caps as stable support for shores. Careful attention was given to the order of joint welding. Conscientious attention to welding procedures and preheat for the very large complete penetration welds kept rejections to a minimum. □

Peggy Confer was a structural engineer with KPFF when this feature was written.

TRINITY CHURCH
Good for Another 250 Years!

by Cornelis J. de Boer

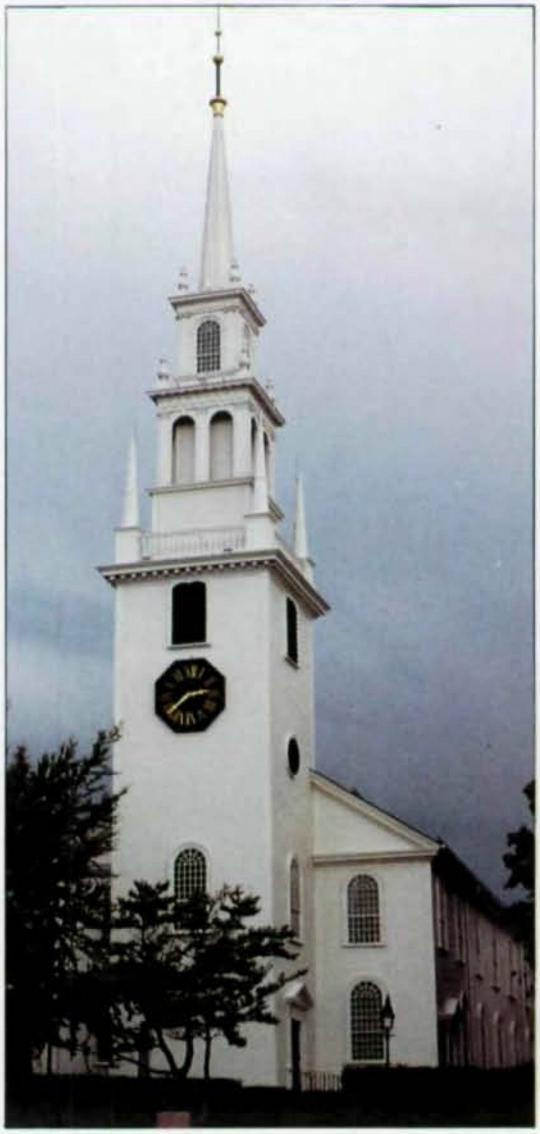
Trinity Church in Newport, R. I., is a heavy timber frame building built in 1726 by Richard Munday. Its design is closely related to London churches of Sir Christopher Wren which were masonry structures in concept and execution. Transforming masonry structures into timber frame structures with mortise and tenon connections left the church vulnerable to live-load deformation, primarily because of a weakness in resisting lateral loads.

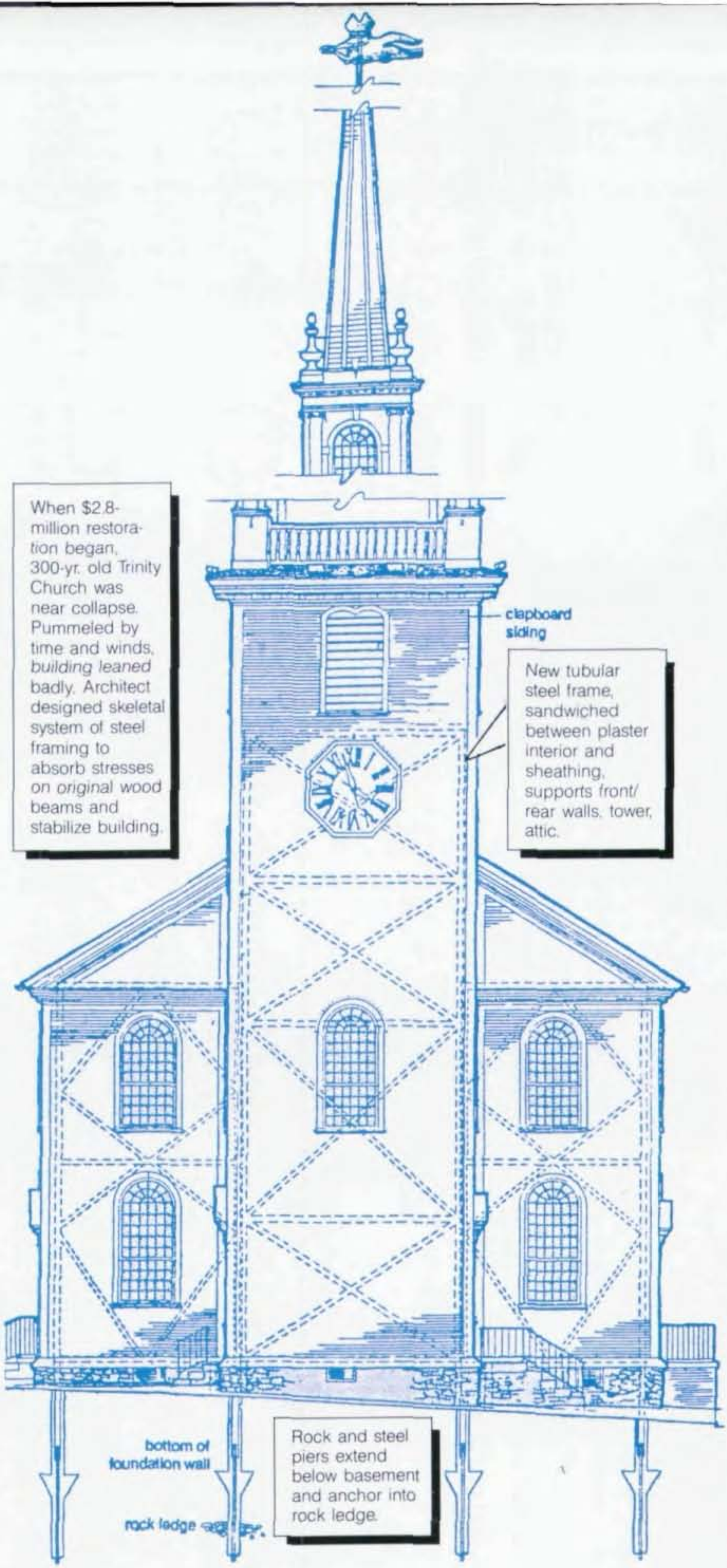
Over the years, the relentless southwest winds have pushed the church toward the north, leaving it six inches out of plumb from sill to plate—and over one foot out of plumb at the base of the tower spire. The structure has also deformed in plan. The center bays (it is seven bays long) are deformed farther to the north than two (east and west) end bays.

There was no reason to believe the ongoing deformation of the timber frame would stop and the frame stabilize. Aging, degradation of the wood and careless modifications and repairs had left the frame in a seriously weakened, deformed condition. After prolonged analysis, a decision was made to reinforce and stabilize the wood frame in its wracked position.

Detailed engineering analysis led to the conclusion that reinforcing had to be done with steel. Primarily, this was so because stresses were such that wood was not a feasible material. Fire-safety considerations made it necessary to design the steel frames so that no on-site welding was required (in close proximity to combustible materials).

The final design is five vertical frames of tubular steel fitted into the wood frame, which





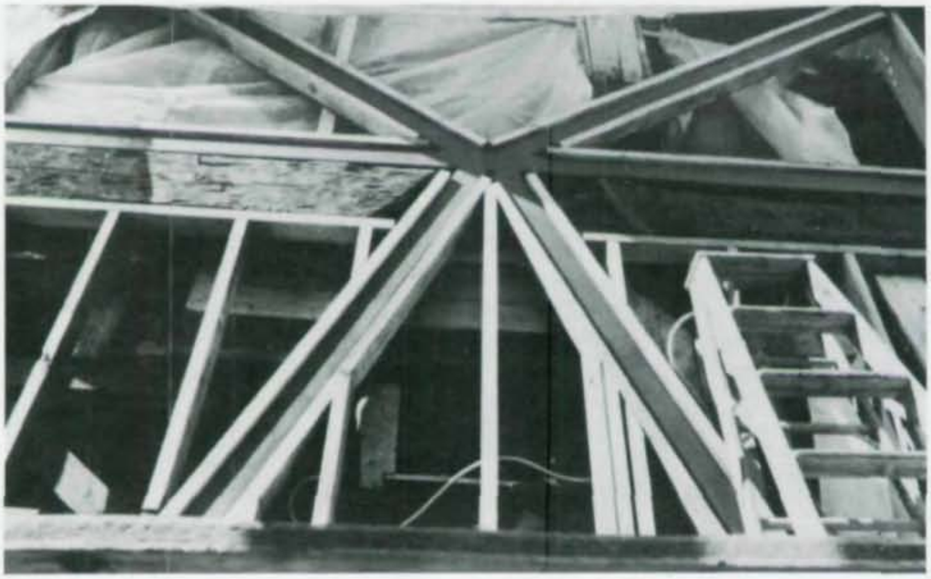
When $2.8-million restoration began, 300-yr. old Trinity Church was near collapse. Pummeled by time and winds, *building leaned* badly. Architect designed skeletal system of steel framing to absorb stresses *on original wood* beams and stabilize building.
clapboard siding
New tubular steel frame, sandwiched between plaster interior and sheathing, supports front/ rear walls, tower, attic.
bottom of foundation wall
rock ledge
Rock and steel piers extend below basement and anchor into rock ledge.

was then bolted to the steel; and two horizontal trusses (of steel angles), one in the attic on the floor and one in the tower. All the steel frames, both vertical and horizontal, were tied into each other. And the whole assembly was anchored through deadmen into bedrock 20 to 30 ft below grade. Essentially, now, the wood frame has only to hold itself up, since wind loads are now resisted by the steel frame.

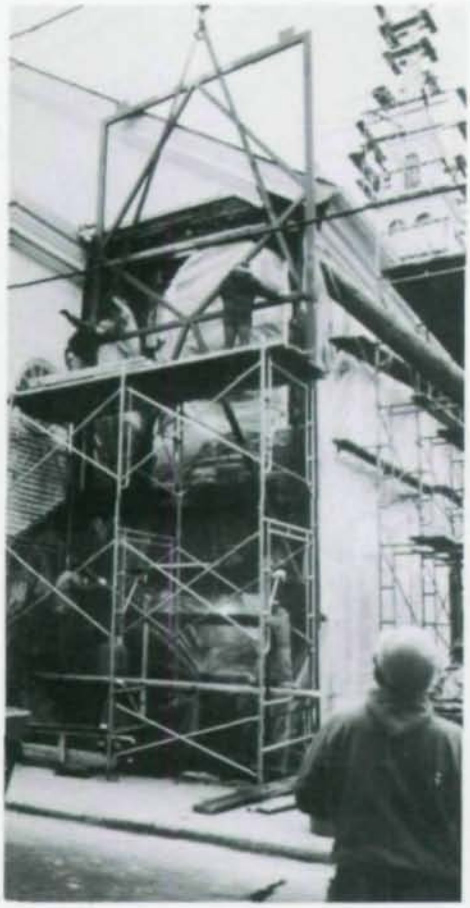
Erection of the steel panels went well, considering the need for tightness of fit, the wracked condition (in three dimensions) of the wood frame and very restricted site conditions. Much credit for success of the steel frames goes to the steel fabricators for their detailed measuring of the wood frame and their craftsmanship in fabricating and erecting the pieces

With proper maintenance and some luck regarding earthquakes, fires and hurricanes, the owners feel the church should be stable for another 250 years. □

(continued)



New tubular steel framing (above) supports old wood beams. Below, connections are bolted on attic truss (no welding permitted).



Steel frame drops into position on east wall.

Architect
Irving B. Haynes and Associates
Providence, Rhode Island

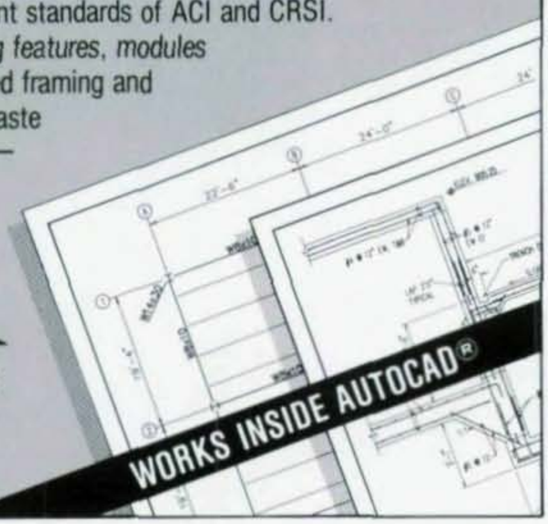
Structural Engineer
The Yoder Corporation
Providence, Rhode Island

Construction Manager
Dimeo Construction Company
Providence, Rhode Island

Owner
Trinity Church
Newport, Rhode Island

Cornelis J. de Boer, AIA, is an associate with Irving B. Haynes and Associates, Providence, Rhode Island.

View of nave looking toward chancel of historic building



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JUNE 21-24, 1989

SPONSORED BY THE

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

1989 National Steel Construction Conference The Only "All-Steel" Show

The 1989 National Steel Construction Conference combines, for the third consecutive year, the AISC National Engineering Conference and AISC Conference of Operating Personnel. It is the only annual "all-steel" conference in the world, a "meeting of the minds," with special sessions focusing on the specific interests of structural steel fabricators, consulting engineers, architects, owners, public officials, erectors, detailers, researchers and educators.

The Conference continues to be the premier meeting place for engineering professionals, the best place to obtain the most information about buildings and bridges designed and built in steel.

Workshop sessions get down to basics, the nuts-and-bolts details of designing, fabricating and erecting structural steel: specifications, computerized design, Load and Resistance Factor Design, autostress, connection design, project management, shop and field inspection and safety, quality certification, productivity, welding, bolting, cleaning, painting—every aspect of the construction process from concept to completion.

The focus is on practical solutions to common problems, but it has also been the first forum for introducing the latest research on structural steel design, recent code changes and technological advances.

This year's highlights will include the introduction of the **9th Edition, Manual of Steel Construction** —the first revision of the Allowable Stress Design Manual in nine years; the premier presentation of the 1989 T. R. Higgins Lecture; continuing dialogue in the debate over responsibility for connection design; guidelines for avoiding "bad bolts" and complying with EPA toxic waste disposal regulations; a new Fracture Control Plan for heavy weldments.

Special presentations will focus on the Minneapolis Convention Center, the Bishopsgate Office Complex (London) and an overview of Scandinavian advances in steel bridges and tunnels, as well as recent U.S. "jointless," truss and cable-stayed bridges.

Poster Session

The 1989 National Steel Construction Conference will again conduct a Poster Session, scheduled for Thursday, June 22, 1:15 -2:30 p.m. Selected papers will be presented by authors in informal discussion groups, using Bulletin Board displays of graphics and illustrations in lieu of slide presentations.

Authors who wish to submit presentations for the Poster Session may do so by providing the Planning Committee with a one-page abstract on the topic on 8 1/2-x 11-in. paper. Authors whose papers are accepted for presentation in the Poster Session will be furnished on site with a 4-ft x 8-ft tackboard mounted on a standing easel, preprinted with the paper title, author's name and company or university affiliation.

Authors will mount their graphics, illustrations, photographs, etc., on the tackboard (mounting pins furnished) anytime between the hours of 11 a.m. and 6 p.m. Wednesday, June 21. Posters will remain on display until 5 p.m. Friday, June 23.

Authors participating in the Poster Session receive no honorarium, reduction in registration fees or allowance for travel or other expense. Authors are expected to be present to mount their posters, to participate in discussions during the Poster Session and to remove their own materials.

Authors should mail their single-page Abstracts, before April 1, 1989, to Lona R. Babbington, Conference Coordinator, AISC, 400 N. Michigan Avenue, Chicago, Ill. 60611. Authors will be notified of the Committee's decision by April 15.

Poster sessions are **not** intended to be used for commercial purposes and may not be used as advertisements for services or products. AISC has the right to reject or remove any poster material.

Convention Headquarters

The Opryland Hotel in Nashville, Tennessee is the site of the 1989 National Steel Construction Conference. One of the largest convention centers in the nation, Opryland is part of a complex that includes the Grand Ole Opry House and Opryland U.S.A. A recent expansion has nearly doubled the meeting space at Opryland. All sessions will be held in the hotel, and over 100 exhibit booths have been reserved in the Ryman Exhibit Hall.

The Conservatory's 10,000 tropical plants cover a two-acre area between two wings of guest rooms.

The new expansion, an interiorscape even larger than the Conservatory, called the Cascades, emphasizes water: streams, brooks, waterfalls and a lake of almost a half-acre. All under glass and surrounded by 824 new guest rooms.

Opryland Hotel has seven restaurants and lounges as well as several retail shops for the convenience of guests.

MSC to Publish Special Show Issue

Modern Steel Construction will publish its May/June 1989 issue as The 1989 National Steel Construction Conference Official Program issue, and has expanded circulation for the first three issues of 1989 (January/February, March/April and May/June) to offer information on the National Steel Construction Conference to the widest possible audience.

The Pattis Group, Lincolnwood, Ill. is MSC's advertising representative. Call Eric Nieman (312/679-1100) for details on advertising in this Special Issue.

PRELIMINARY PROGRAM SUMMARY

SCHEDULE OF EVENTS—PRELIMINARY

(Note: "R" Sessions are Repeats; all Workshops and Seminars will be repeated at least once.)

Wednesday, June 21

1:30-5:00	Educator Session
1:30-5:00	AISC Professional Member Forum
1:30-3:00	Plenary Session—Dealing with the Shop Work Force: New Hires, Shop Rules, Productivity & Employee Relations
3:30-5:00	Workshop Sessions/Seminars 1 2 3
6:30-7:30	AISC Cocktail Party

Thursday, June 22

8:45-9:15	Plenary Session—AISC Position, ASCE Manual on Quality of the Constructed Project
9:15-10:00	Plenary Session—Panel: Responsibility for Connection Design
10:30-11:15	General Session: Bishopsgate Office Complex (London)
11:15-Noon	General Session: Major Scandinavian Bridges and Tunnels
10:30-Noon	Workshop Sessions/Seminars 1R 2R 4
1:15-2:30	EXHIBIT SESSION POSTER SESSION
2:30-3:55	Workshop Sessions/Seminars 3R 4R 5 6 7 8 9
4:00-5:30	Workshop Sessions/Seminars 4R 5R 6R 10 11 12 13

Friday, June 23

8:30-9:15	Plenary Session: AISC Marketing's Design Analysis Service
9:15-10:00	Plenary Session: 9th Edition, AISC Manual of Steel Construction
10:30-Noon	Workshop Sessions/Seminars 7R 10R 14 15 16 17 18
1:15-2:45	Workshop Sessions/Seminars 8R 9R 11R 12R 14R 19 20
3:30-5:00	Workshop Sessions/Seminars 13R 15R 16R 17R 18R 19R 20R

Saturday, June 24

8:30-9:30	Plenary Session: T. R. Higgins Award and Lecture
10:00-11:30	Plenary Session: Material and Fabrication Considerations for Heavy Weldments: Minneapolis Convention Center
11:30	Drawing for Attendance Prizes
12 Noon	Adjourn

Workshop Sessions

(See next two pages for program details.)

1. Dealing with Shop Work Force
2. Welding Procedures
3. Tubular Structures
4. Connection Design Responsibility
5. Toxic Waste Disposal
6. Economical Steel Connections & Details
7. New Seismic Design Developments
8. Eccentric Bracing for Lateral Loads
9. Long-span Steel Bridge Construction
10. Surface Preparation & Painting
11. New Welding Technology, Specifications and Concepts
12. New Steel Connection Concepts
13. Design Guides & Software
14. Water Base Paint Procedures
15. High-strength Bolts
16. Steel Bridge Advances
17. ATLSS
18. Serviceability Considerations
19. 9th Edition Manual
20. Shop & Erection Problems

Product & Service Workshops

This year the National Steel Construction Conference introduces a new education/information feature: special sessions, sponsored and produced by exhibitors, which offer a forum where companies who supply the structural steel industry can share the latest technological advances in products and services.

These Product/Service Workshops will be conducted during specific time periods, not in conflict with regular Conference Sessions, and the schedule will be included as part of the Official Conference Program. Companies with similar interests may join forces to present a single workshop. Exhibitors who wish to participate in the Product/Service Workshops should contact Lona Babbington, Conference Coordinator, at 312-670-5432.

EXHIBIT HOURS:
Wed., June 21, 11:00 AM-8:00 PM
Thurs., June 22, 10:00 AM-8:00 PM
Fri., June 23, 8:00 AM-3:00 PM
Special Exhibit Session:
Thursday, June 22: 1:15-2:30 PM
(No workshops or seminars scheduled.)

Spouses' Program
The General Jackson
Grand Ole Opry
Opryland USA
"Music, Music, Music"

PROGRAM TOPICS

Note: "Workshops" are devoted primarily to discussion; **"Seminars"** offer more formal presentations with brief question-and-answer periods following; no other programs are scheduled during **"Plenary Sessions;" "General Sessions"** are, however, held concurrently with workshops.

General and Plenary Sessions

Dealing with the Shop Work Force—New Hires, Shop Rules, Productivity & Employee Relations
Representatives of fabricating firms and industry consultants discuss shop rules, evaluating and processing new employees (physical examination, hearing test, drug testing, etc.), on-the-job employee relations and effect of company personnel procedures on productivity.
Wednesday, June 21: 1:30—3:00 p.m. (Plenary Session)
See Also Workshop #1:
Wednesday, June 21: 3:30—5:00 p.m.
Thursday, June 22: 10:30—Noon

AISC Position, ASCE Manual on Quality of the Constructed Project
AISC has issued a statement on a proposed Chapter 21 of the American Society of Civil Engineers' **Manual on Quality of the Constructed Project,** objecting to assignment of responsibility for connection design as outlined in the proposed chapter. AISC staff will explain the Institute's position in greater detail.
Thursday, June 22: 8:45—9:15 a.m. (Plenary Session)

Responsibility for Connection Design (Panel)
Panel includes fabricator, engineer, architect and owner in discussion of one of the most-debated engineering issues of the 1980s: responsibility for connection design.
Thursday, June 22: 9:15—10:00 a.m. (Plenary Session)
See also Workshop #4:
Thursday, June 22: 10:30—Noon
Thursday, June 22: 2:30—3:55 p.m. (Repeat)
Thursday, June 22: 4:00—5:30 p.m. (Repeat)

Bishopsgate Office Complex (London)
Exposed steel framework requiring no fireproofing (curtainwall is of fire-rated construction) utilized large clear spans and column transfers for constricted site in London as new and unique solutions respond to century-old tradition of iron, steel and glass in Britain.
Thursday, June 22: 10:30—11:15 a.m. (General Session)

Major Scandinavian Bridges and Tunnels
Emphasis in design on fabrication and erection considerations result in very economical Scandinavian steel bridges with many alternative solutions; Denmark's Great Belt bridge and tunnel project is given special emphasis.
Thursday, June 22: 11:15—Noon (General Session)

AISC Marketing's Design Analysis Service
Project design analysis services available from AISC Marketing to those in the process of evaluating framing materials for buildings and bridges are described.
Friday, June 23: 8:30—9:15 a.m. (Plenary Session)

9th Edition, AISC Manual of Steel Construction
The 9th Edition of AISC's **Manual of Steel Construction** is scheduled for publication in mid-1989, the first revision of the Allowable Stress Design Manual in nine years. AISC staff will premier the new edition in this special presentation.
Friday, June 23: 9:15—10:00 a.m. (Plenary Session)
(See also Workshop #19):
Friday, June 23: 1:15 a.m.—2:45 p.m.
Friday, June 23: 3:30—5:00 p.m. (Repeat)

The 1989 T. R. Higgins Lecture
Judging for the T. R. Higgins Lectureship is now in process. The winner, and topic, of the 1989 T. R. Higgins Lecture will be announced in the Official Program of the National Steel Construction Conference (to be distributed in March 1989) and presented for the first time at the Conference.
Saturday, June 24: 8:30—9:30 a.m. (Plenary Session)

Material and Fabrication Considerations for Heavy Weldments: Minneapolis Convention Center
The fabricator for this complex project describes the problems encountered in fabrication to meet the design constraints, especially regarding heavy weldments. Coordination and cooperation of the entire construction team (steel producer, fabricator, erector and designer) were required for satisfactory resolutions.
Saturday, June 24: 10:00—11:30 a.m. (Plenary Session)

WORKSHOPS AND SEMINARS

1 Dealing with the Shop Work Force (Workshop)
Discussion continues from plenary session (shop rules, conditions for new hires, physical exam, hearing test, drug testing, employee relations and increased productivity.
Wednesday, June 21: 3:30—5:00 p.m.
Thursday, June 22: 10:30 a.m.—Noon (Repeat)

2 Welding: Procedures, Techniques, Inspection & Control (Workshop)
A discussion of correct welding procedures, techniques and inspection; control of distortion.
Wednesday, June 21: 3:30—5:00 p.m.
Thursday, June 22: 10:30 a.m.—Noon (Repeat)

3 Tubular Structures-Fabrications and Connections (Workshop)
Discussion of typical connections and fabrication techniques for tubular sections.
Wednesday, June 21: 3:30—5:00 p.m.
Thursday, June 22: 2:30—3:55 p.m. (Repeat)

4 Responsibility for Connection Design (Workshop)
Workshops continue discussion from Thursday morning's Plenary Session, offering opportunity for expanded presentations by panel leaders and a more informal forum for industry dialogue.
Thursday, June 22: 10:30 a.m.—Noon
Thursday, June 22: 2:30—3:55 p.m. (Repeat)
Thursday, June 22: 4:00—5:30 p.m. (Repeat)

5 Disposing of Toxic Waste (Workshop)
There are EPA regulations for proper and legal disposal of toxic waste (i.e., paint residue, etc.). You cannot just dump it in the back yard; if, however, you have already done so, you will have to clean it up. Proper procedures are described, with ample time for answers to your questions and an opportunity for you to share your company's efforts to solve its own problem.
Thursday, June 22: 2:30—3:55 p.m.
Thursday, June 22: 4:00—5:30 p.m. (Repeat)

6 Economical Steel Connections and Details (Seminar)
A discussion among fabricators on what constitutes economical connections and details. Real examples will be

presented for comments by the audience.
Thursday, June 22: 2:30—3:55 p.m.
Thursday, June 22: 4:00—5:30 p.m. (Repeat)

7 New Developments in Seismic Design of Steel Structures (Seminar)
Review of the new 1988 edition of the NEHRP Recommended Provisions for Development of Seismic Regulations for New Buildings: state-of-the-art guidelines for building in U.S. earthquake-risk areas. Second presentation summarizes effects of supplemental damping in both retrofit and new building design for improved seismic resistance and analyzes several commercially available damping devices.
Thursday, June 22: 2:30—3:55 p.m.
Friday, June 23: 10:30 a.m.—Noon (Repeat)

8 Eccentric Bracing for Lateral Loads (Seminar)
Continuing research indicates use of eccentrically braced frames (EBFs) can be much greater than originally intended (use in high seismic areas). Design concepts for EBFs in low to moderate seismic regions and in non-seismic areas will include actual examples of use and economics (LRFD approach emphasized). Second paper describes recent experimental results on behavior of long, flexural yielding links in EBFs.
Thursday, June 22: 2:30—3:55 p.m.
Friday, June 23: 1:15—2:45 p.m. (Repeat)

9 Innovations in Long-span Steel Bridge Construction (Seminar)
Features both truss and cable-stayed advances: design and erection of three-span continuous truss (Warren-type) Cooper River Bridge described; overview of progressive design developments leading to bigger, more economical cable-stayed bridges in U.S.
Thursday, June 22: 2:30—3:55 p.m.
Friday, June 23: 1:15—2:45 p.m. (Repeat)

10 Surface Preparation & Painting (Workshop)
Problems and solutions are offered for the proper surface preparation of structural steel members to attain required surface and profile. Procedures for using zinc-rich paints are also described.
Thursday, June 22: 4:00—5:30 p.m.
Friday, June 23: 10:30—Noon (Repeat)

11 Welding Technology—New Specifications and Concepts (Seminar)
A Fracture Control Plan for heavy weldments which encompasses design considerations, material requirements, quality control for both fabricator and erector (including verification of performance by independent testing agency) is described. The new AISC Specification provisions for welding tension splices in heavy shapes and plates are also presented.
Thursday, June 22: 4:00—5:30 p.m.
Friday, June 23: 1:15—2:45 p.m. (Repeat)

12 New Concepts in Steel Connections (Seminar)
New and comprehensive (yet simple) design procedures for single plate shear tab connections, forming the basis of new 9th Edition AISC-ASD Manual tables, are described; National Institute of Standards and Technology describes recent tests to determine behavior of gusseted connections for laterally braced steel buildings.
Thursday, June 22: 4:00—5:30 p.m.
Friday, June 23: 1:15—2:45 p.m. (Repeat)

13 AISC Design Guides & Software (Seminar)
AISC staff will describe and explain the various design guides and software available through the Institute's Publication Department.
Thursday, June 22: 4:00—5:30 p.m.
Friday, June 23, 3:30—5:00 p.m. (Repeat)

14 Use and Application of Water Base Paint (Workshop)
A discussion of water base paint. Can it solve the disposal problem and still be satisfactory from both application and maintenance standpoints? Procedures for proper application are included in the presentation.
Friday, June 23: 10:30—Noon
Friday, June 23: 1:15—2:45 p.m. (Repeat)

15 H.T. Bolts—Purchase Order, Testing, Selection of Type and Installation (Workshop)
Quality, and source, of high strength bolts continues to be a subject of controversy and potential hazard in the structural steel industry. This workshop offers guidelines on selection of bolt type, testing requirements and proper preparation of purchase orders. The how-to of determining manufacturing source by head and nut marking is described.
Friday, June 23: 10:30 a.m.—Noon
Friday, June 23: 3:30—5:00 p.m. (Repeat)

16 Advances in Steel Bridge Design (Seminar)
Raleigh-Durham Airport's Taxiway "E" illustrates benefits of jointless deck with welded steel plate girders, special focus on treatment of effect of aircraft's acceleration and braking; results of experimental test program evaluating behavior of autostress-designed continuous plate girder bridge with precast prestressed deck panels are also presented.
Friday, June 23: 10:30—Noon
Friday, June 23: 3:30—5:00 p.m. (Repeat)

17 Research on Behavior, Design and Erection of *Steel Connections at the ATLSS Center* (Seminar)
An overview of the work at the ATLSS Center as well as presentations of test results on behavior and strength under monatonic and cyclic loading and pre-load vs. snug-tight in bolt installations.
Friday, June 23: 10:30—Noon
Friday, June 23: 3:30—5:00 p.m. (Repeat)

18 Serviceability Considerations in Steel Structures (Seminar)
Presentation on optimization techniques which offer designer the ability to quantify efficiency of resistance to lateral loads in high-rise buildings early in design.
Friday, June 23: 10:30—Noon
Friday, June 23: 3:30—5:00 p.m. (Repeat)

19 AISC's New Allowable Stress Design Specification and the 9th Edition of AISC's Manual of Steel Construction (Workshop)
AISC's Manual Committee will continue the morning's Plenary Session with a broader, more detailed discussion of "what's new" in the 9th Edition and some suggestions on utilizing the revised version.
Friday, June 23: 1:15—2:45 p.m.
Friday, June 23: 3:30—5:00 p.m. (Repeat)

20 Shop and Erection Problems (Workshop)
Three experienced, knowledgeable (and successful) steel erectors bring to the forefront some very common erection problems—and offer very cogent advice on how to avoid both the problems and the disastrous consequences that often follow in their wake.
Friday, June 23: 1:15—2:45 p.m.
Friday, June 23: 3:30—5:00 p.m. (Repeat)

SPOUSES' PROGRAM

Those registering for the COMPLETE Spouses' Program will receive tickets for **all** events listed below. Anyone wishing to register for any one or more of these events INDIVIDUALLY, may do so by selecting Events A, B, C and/or D on the Conference Registration Form (see opposite page).

Event A—Wednesday, June 21: 6:30—7:30 p.m.
Get-acquainted Cocktail Party, in the Exhibit Hall. Includes drinks, hors 'douevres and entertainment. (Note: this event is also included in the Conference Registration Fee.)

Event B—Thursday, June 22: 11:00 a.m.—12:45 p.m.
"Food and Foliage" aptly describes this Nashville-style Welcome Brunch. The lavish display includes popular selections from the famous Opryland Sunday Brunch menu. And we've invited one of Opryland's "green thumb" experts who care for the 10,000 thriving plants in the hotel's three-acre Conservatory & Cascade to give us some informative tips on the selection, care and maintenance of house and landscaping plants.

Event C—Thursday, June 22: 1:00—5:00 p.m.
Amid the Tennessee magnolias is the oldest home in Nashville, Judge John Overton's Travellers' Rest, dating to 1799. A functioning weaving house, smokehouse, formal garden and a display of prehistoric Indian relics enhance the site. On the way we'll stop for a visit at a most unique chapel/museum: the Upper Room with its many depictions of the "Last Supper" and an unusual collection of cultural and religious artifacts commemorating man's quest for eternal truths.

Event D—Friday, June 23: 9:30—5:00 p.m.
Cheekwood is one of the South's most beautiful private estates, housing modern galleries of fine art and architectural treasures from numerous private and public collections. We'll lunch in Cheekwood's Pineapple Room, with its wonderful garden view and then visit Green Hills/Bandywood Fashion Square. Green Hills is Nashville's most exclusive mall: three department stores, 40 shops, and Bandywood is sometimes described as the "most exciting l/4-mile in Tennessee."

Spouses' Program Registration Fee: $90.00
(Includes Events #A, B, C & D)

OPTIONAL EVENTS

Event #1—Thursday, June 22, 7:00—10:30 p.m.
General Jackson Showboat dinner cruise & revue offers a total entertainment experience, featuring a sumptuous prime rib dinner and spectacular musical production—with additional musical excitement on all four decks. (Includes transportation to boat, dinner, show & gratuities; cash bar.)
Price per person: $42.00

Event #2— Friday, June 23, 7:00—9:15 p.m.
We'll provide private tram cars for a **"Down-Home" Country Barbecue** in our own little corner of Opryland—right next door to the Grand Ole Opry. There'll be continuous entertainment by some of Nashville's brightest talent, who'll stop "pickin' and singin'" just in time for you to walk across the street to the Grand Ole Opry's evening show. (Complimentary beer and wine, cash bar for mixed drinks.)
Price per person: $30.00
(See Event # 3 for Grand Ole Opry Tickets, priced as separate event.)

Event #3—Friday, June 23, 9:30—11:00 p.m.
A visit to Music City is not complete until you've attended a performance of the longest-running live radio show in the world, the Grand Ole Opry.
Ticket Price (including tax): $13.00

Event #4—Saturday, June 24, 2:30—5:00 p.m.
The extravagant musical production **Music, Music, Music** is presented in the Acuff Theatre, featuring a cast of 22 singers and dancers and a 16-piece orchestra. Music star Brenda Lee is featured.
Ticket Price (including tax): $10.00

Event #5—Saturday, June 24, 9:30—11:00 p.m.
Grand Ole Opry Saturday night performance.
Ticket Price (including tax): $13.00

Event #6—Opryland USA Theme Park 3-day Pass
The world's only musical showpark, Opryland USA, offers up to 12 daily shows in simultaneous performance devoted to gospel, rock 'n' roll, bluegrass, contemporary country and songs of the Old West, more than 21 thrilling rides, a variety of restaurants, specialty shops, sidewalk artists, craftsmen, and games. Through AISC, you may purchase theme park tickets valid for three consecutive days' admission at the price usually charged for a one-day park admission.
Price per pass (including tax): $18.00

Airline Discounts

American Airlines has been designated as Official Carrier for the Conference. American will offer 5% off the lowest published fare at time of booking (subject to $30 service fee when applying for a full or partial refund once tickets are issued). This special fare must be purchased at least 7 days in advance, based on class availability and is valid to Nashville from the 48 states, Hawaii, Puerto Rico and the Virgin Islands.

American has set up a special number for the Conference. You or your travel agent should call:

1-800-433-1790 and refer to
AISC Star Number: S68274

REGISTRATION AND ROOM RESERVATION FORM

Registration Fees: (Please circle appropriate fees)

AISC Member Fee: $275.00 (before May 1)
$325.00 (after May 1)
(Includes AISC Active, Associate & Professional Members)

Non-Member Fee: $325.00 (before May 1)
$375.00 (after May 1)

Educator Fee: $100.00
(Employed full-time at accredited architectural or engineering college or university.)

Student Fee: $ 75.00
(Letter from faculty advisor or equivalent required)

Exhibitor, in Booth (no charge)

Added Exhibitor: $ 75.00

Spouse's Fee: $ 90.00

Registration Fees Include all General and Plenary Sessions, workshops, seminars, coffee breaks, luncheons Thursday and Friday, the Get-acquainted Cocktail Reception Wednesday evening and a printed, bound copy of the Proceedings. Exhibitors are entitled to one registration for each booth reserved. "Added Exhibitor" fee is payable **ONLY** if in excess of one person per booth.

Registration Cancellation Policy: Cancellations received before June 16, 1989, 100% of pre-paid registration fees will be refunded; after June 16, 50% will be refunded. (Those cancelling after June 16 will receive their copy of the Conference Proceedings.)

Partial Registration Fees
(You may pre-register for only one day or half day. Circle your choices below.)

Half Day Sessions: (Lunch not included)

Wednesday Afternoon	$ 50.00
Thursday Morning	$ 65.00
Thursday Afternoon	$ 65.00
Friday Morning	$ 65.00
Friday Afternoon	$ 65.00
Saturday Morning	$ 25.00
One Day Sessions:	
Thursday (includes Lunch)	$150.00
Friday (includes Lunch)	$150.00
Exhibit Visitor:	$ 5.00
Total Partial Registration Fees	$______

Registration for Optional Events

Event	No. Tickets	Total Price
#1—General Jackson (Thurs., 7 p.m.)	____@ $42.00	$ ______
#2—Down-Home Barbecue (Fri.,7 p.m.)	____@ $30.00	$ ______
#3—Grand Ole Opry (Fri., 9:30 p.m.)	____@ $13.00	$ ______
#4—Music, Music, Music Matinee (Sat., 2:30 p.m.)	____@ $10.00	$ ______
#5—Grand Ole Opry (Sat., 9:30 p.m.)	____@ $13.00	$ ______
#6—Opryland Theme Park 3-Day Pass	____@ $18.00	$ ______
#A—Cocktail Party (Wed., 6:30 p.m.)	____@ $20.00	$ ______
#B—Food & Foliage (Thurs., 11 a.m.)	____@ $25.00	$ ______
#C—Travellers' Rest (Thurs., 1 p.m.)	____@ $20.00	$ ______
#D—Cheekwood, Lunch & Shopping (Fri., 9:30 a.m.)	____@ $40.00	$ ______
Total Optional Event Fees		$______

PLEASE REGISTER: (Type or Print)

Name ______ Nickname (for badge) ______

Company ______ Title ______

Mailing Address ______

City and State/Zip ______ Bus. Phone ( ) ______ Home Phone ( ) ______

If Spouse or other guest is registering for Complete Spouses' Program, or individual Spouses' or Optional Events, please complete next line for badge:

Name of Individual Registering for Other Events ______ Nickname (for badge) ______

Hotel Registration—Opryland Hotel

☐Single ($110) ☐Double ($122)

Do you wish to reserve an inside garden-terrace room (at an additional $25)?
☐Yes ☐No

NOTE: Rooms are subject to 7 3/4% sales tax and 4% room tax. Rooms must be guaranteed by a separate check, payable to the Opryland Hotel, in the amount of one night's stay or by credit card (see space below). You must notify Opryland of any cancellation 72 hours in advance in order to receive a refund of your deposit. Opryland will honor and guarantee reservations received by May 16, so mail this form promptly.

☐ I enclose check for $________ payable to the Opryland Hotel.

☐ Please charge my Credit Card # ________

Circle card Used: American Express VISA MasterCard Diners Carte Blanche Discover

Expiration Date: ________

Signature (if any credit card charges): ________

Conference Fees Payable:

Registration Fee:	$______
Spouse's Fee:	$______
Partial Registration Fees:	$______
Optional Events:	$______
TOTAL CONFERENCE FEES DUE:	**$**______

☐I enclose check (U. S. funds) payable to AISC in amount of total fees.

☐Please charge my Credit Card # ________

Visa or MasterCard Only (Circle One): VISA, MasterCard

Expiration date ________

MAIL COMPLETED FORMS, CONFERENCE FEES AND HOTEL GUARANTEES TO:

American Institute of Steel Construction, Inc.
1989 National Steel Construction Conference
P.O. Box 804556
Chicago, Illinois 60680-4107
Phone inquiries and information: (312) 670-5422 or 5432

MSC#1

Plus: More than 100 Exhibit Booths

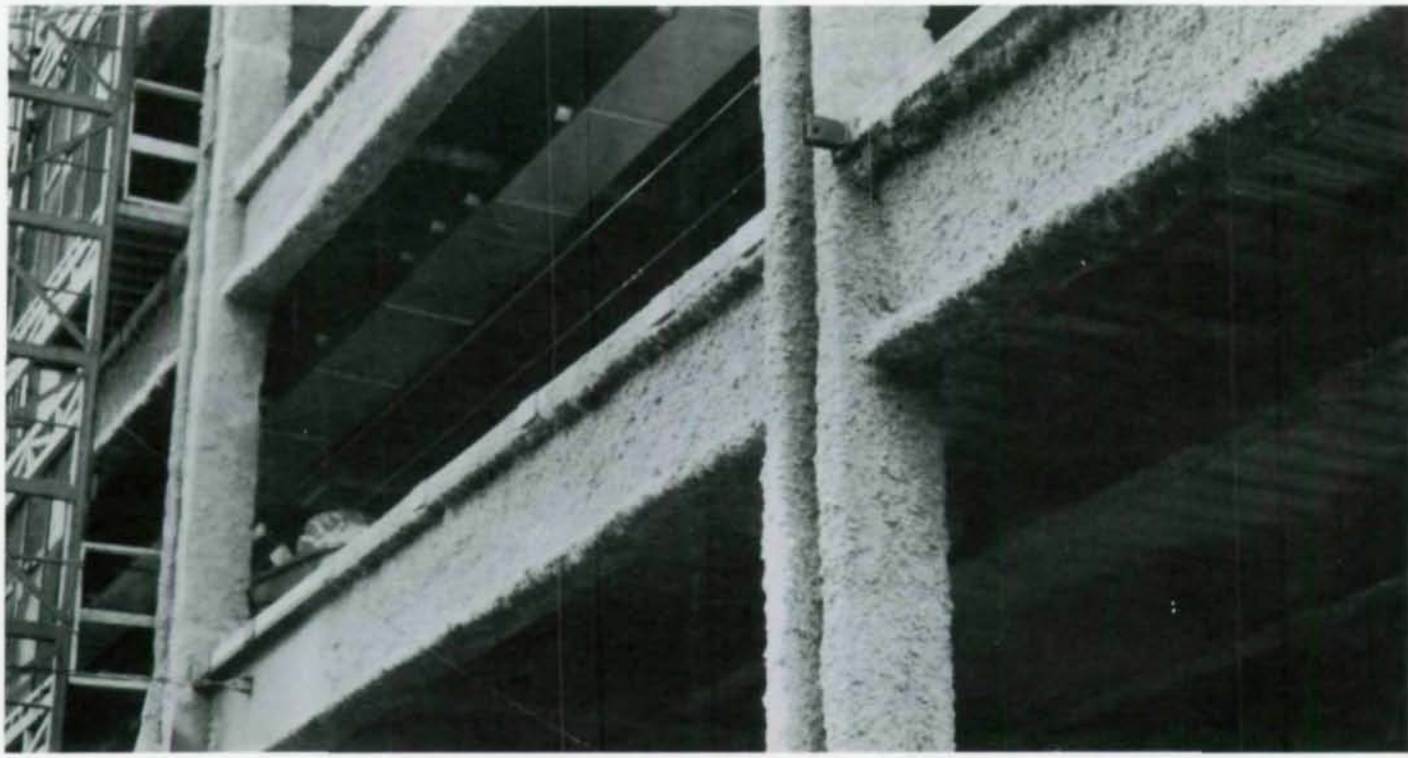
The Ryman Exhibit Hall of the Opryland Hotel has been dedicated to more than 100,000 square feet of exhibit space. A special Exhibitor's Brochure is available for individuals and firms who want to display products or services. Call Lona Babbington at AISC (312-670-5432) for your copy, or for more information on exhibiting.

Last year's exhibitors (most plan to return in 1989) included:

American Welding Society
Armstrong-Blum Mfg. Co.
Associated Piping & Engineering Company
AISC Marketing, Inc.
Carboline Co.
Cleveland Steel Tool Co.
Compudron, Inc.
Computers & Structures
COMEQ
Data Management Systems, Inc.
Derr Construction Company
Design Data
D & M Drafting (Dogwood Technologies)
Elite Equipment
Engineering Design Automation
Epic Metals
FABTRACK
Geometric Data Flow
Graeme & Murray Consultants, Ltd.
Hilman, Inc.
Hypertherm
Jancy Engineering
Jet Wheelblast Equipment, Div. B & U Corporation
JH Engineering
Kaltenbach, Inc.
LeJeune Bolt Company
The Lincoln Electric Company
Lohr Structural Fasteners, Inc.
Mountain Enterprises
MDX
Peddinghaus Corporation
Pettitt Lawrence, Ltd.
S. G. Pinney & Associates
Pneutek, Inc.
Production Machinery, Inc.
Research Council on Structural Connections
Research Engineers, Inc.
Richmond Erectors
Richmond Steel
The Sharon Companies
Southern Coatings, Inc.
Steel Deck Institute
Struct-Fast Inc.
Structural Software Company
Tnemec, Inc.
TradeARBED, Inc.
J & M Turner, Inc.
Valmont Industries
Vernon Tool Company
Waterloo Engineering Software
W. A. Whitney Corporation
Yamazen, U.S.A.

Already added for 1989:

Behringer, Inc.
Franklin Manufacturing
Gossman & Associates
Intergraph
Metal Fabricating Systems
Mi-Jack Products, Inc.
Nucor Fasteners
Welded Tube Institute



STEMFIRE

AISC Steel Member Fire Protection Computer Program

This new AISC computer program developed by Hughes Assoc. determines safe and economic fire protection for steel beams, columns and trusses. It is intended for use by architects, engineers, building code and fire officials, and others interested in steel building fire protection. STEMFIRE is based on rational procedures developed by the American Iron and Steel Institute that extend the published Underwriters Laboratories, Inc., fire resistive designs to other possible rolled structural shapes and common protection material requirements. For a required fire rating, STEMFIRE determines minimum spray-on thickness for various rolled steel shapes as well as the ceiling membrane or envelope protection for trusses. This methodology is recognized by Underwriters Laboratories, Inc. and has been adopted by the three national model building codes in the USA.

The software data base contains all the pertinent steel shape properties and many listed Underwriters Laboratories, Inc. *Fire Resistance Directory* construction details and their fire ratings. In this manner, user search time is minimized and the design or checking of steel fire protection is optimized. Hence, STEMFIRE is easy to use with little input effort to quickly produce specific design recommendations.

Minimum Equipment Requirements

- IBM PC, XT, AT or compatibles
- MS.DOS operating system
- One 5¼" floppy disk drive and hard drive
- 256K bytes of memory
- IBM compatible dot matrix printers or Hewlett Packard Laserjet

STEMFIRE Program Package

- *Two 5¼" floppy disks containing executable software bearing AISC copyright*
- Users Manual, with instructions and sample problems

Order Form

MAIL TO: AISC, STEMFIRE Order, P.O. Box 806276, Chicago, IL 60680-4124

I enclose payment of $______ for qty. of ______ STEMFIRE at $96.00 each. (Member price: $72.00. Please give AISC Membership Number__________)

Name & Title ____________________

Company ____________________

Address ____________________

City ____________ State______ Zip______

Phone number (______) ____________
Area

Please enclose remittance. No C.O.D. orders. In New York, California and Illinois, add sales tax. Shipping charges prepaid in the U.S. On shipments outside the U.S., add 10% of total purchase for postage and handling. Visa and MasterCard accepted.

Check one: ☐ Visa ☐ MasterCard

Charge to my card # ____________________

Expiration date __________ Signature ____________

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