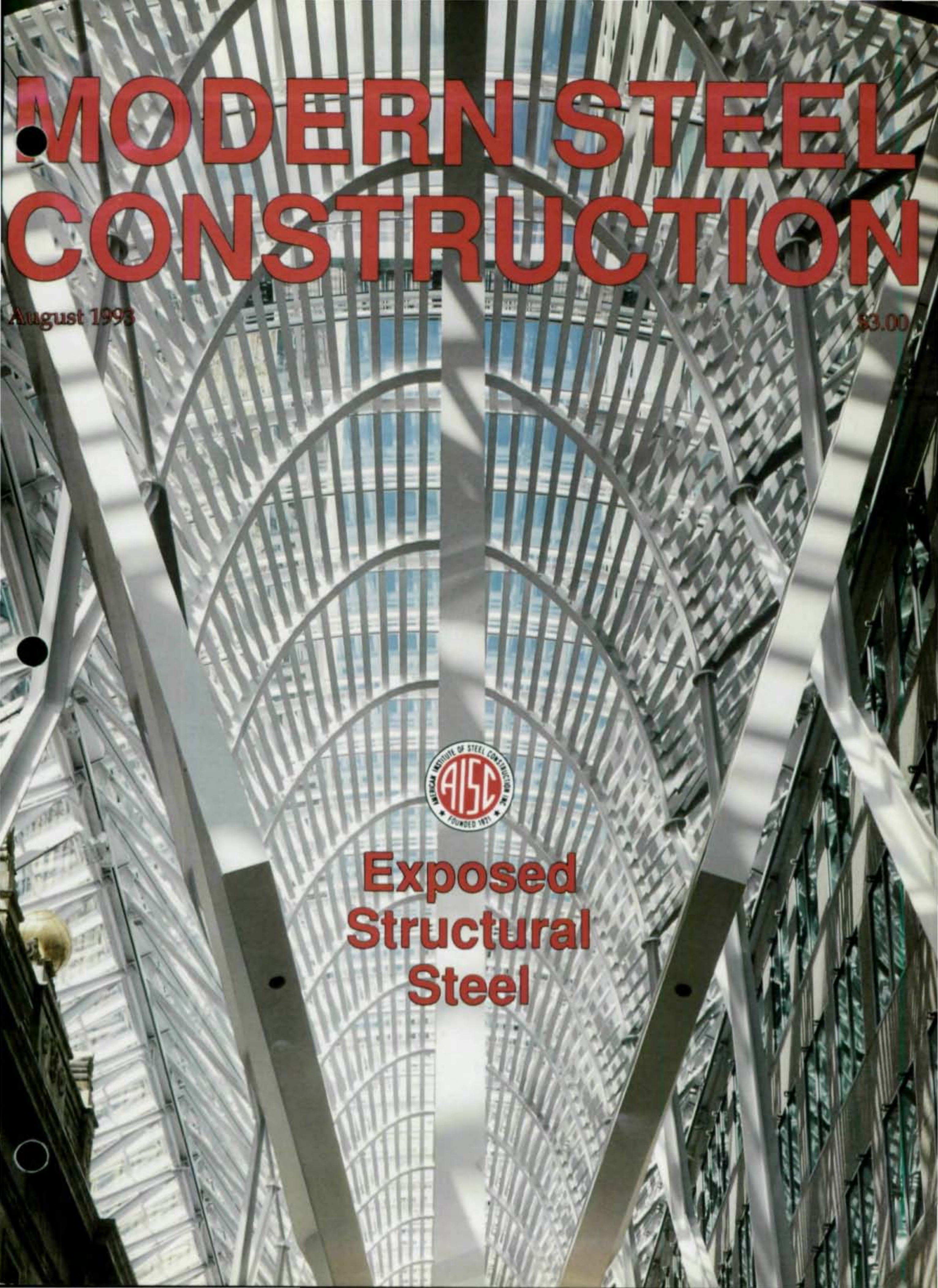
MODERN STEEL CONSTRUCTION

August 1993

$3.00



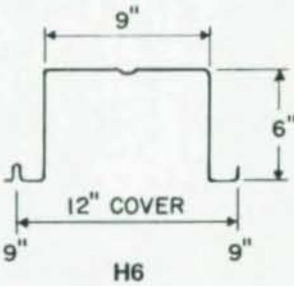
Exposed Structural Steel

UNITED STEEL DECK, INC.

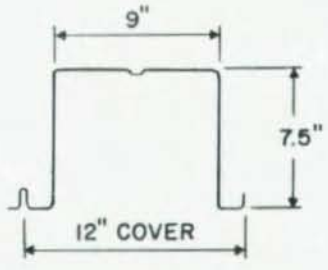
DECK DESIGN DATA SHEET

No. 19

DEEP DECK – 6" and 7.5" H



H6



H7.5

32' Maximum piece length.

Profile	Gage	Wt., psf	Section Properties			Allowable End Reaction, lbs. Bearing Width		
			Ip	Sp	Sn	3"	4"	5"
H6	18	4.5	7.28	2.24	2.36	690	780	870
	16	5.5	9.79	2.90	2.99	1210	1350	1480
H7.5	18	5	12.17	3.02	3.15	640	720	810
	16	6	16.22	3.92	4.04	1140	1270	1400

SINGLE SPAN TOTAL LOADS, PSF

Profile	Gage	Span														
		18'	19'	20'	21'	22'	23'	24'	25'	26'	27'	28'	29'	30'	31'	32'
H6	18	77	73	69	*62*	*55*	*49*	*45*	*41*	*37*	*34*	*32*	*30*	*28*	*26*	*25*
	16	119	107	*95*	*84*	*75*	*68*	*61*	*56*	*51*	*47*	*44*	*41*	*39*	*36*	*34*
H7.5	18	71	67	64	61	58	56	53	51	49	47	46	44	43	41	39
	16	127	120	114	109	104	99	91	*83*	*76*	*69*	*64*	*59*	*54*	*51*	*48*

Notes: Loads controlled by 3" end bearing are underlined.
Loads controlled by deflection (L/240) are shown in *italics*.
All other loads are controlled by bending. 10 psf has been added to deflection loads to account for roofing dead load. The designer is urged to check the fastener uplift resistance.

Also Available

Acoustic (perforated web) sections; Cellular sections with 24" cover; Custom adaptation of rib width, depth, and web angles; Multi Span and Diaphragm Load Tables are available on request; Complete information on all deck products — ask for catalog 303-11.

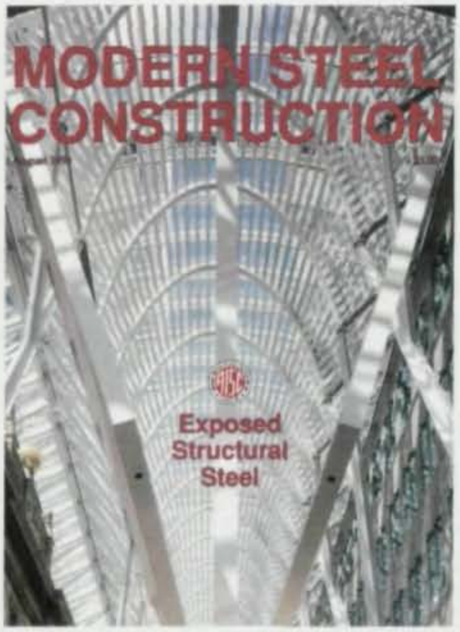
NICHOLAS J. BOURAS, INC.
P.O. BOX 662, 475 SPRINGFIELD AVE.
SUMMIT, NEW JERSEY 07902-0662 (908) 277-1617

ASSOCIATE MEMBER
USD
MEMBER
STEEL DECK INSTITUTE sdi


• HIGH YIELD STRENGTHS (up to 65 KSI) - even for ultra-heavy sections.
• OUTSTANDING TOUGHNESS PROPERTIES.
• EXTREMELY LOW CARBON EQUIVALENT — ensures excellent weldability.
A NEW PROCESS... QST.
The secret is in ARBED's revolutionary new in-line QST process.
OTHER RECENT ARBED INNOVATIONS:
ARBED-ROLLED 40", 44", and "TAILOR-MADE" (WTM) series — famous for high section moduli, great lateral buckling resistance, and big savings in fabrication costs and weights. These products are also available in the new HISTAR quality as is our standard WF series and H BEARING PILES.
NEW LITERATURE AVAILABLE
Send now for complete data on all these ARBED products, contact Trade ARBED, INC., 825 Third Ave., New York, NY 10022. (212) 486-9890, FAX 212-355-2159/2421. In Canada: TradeARBED Canada, Inc., 3340 Mainway, Burlington, Ontario, Canada L7M 1A7. (416) 335-5710, FAX 416-335-1292.
HISTAR
A new generation of rolled beams and column shapes for economical steel construction.
Once again, ARBED leads the industry by featuring a trendsetting combination of mechanical, chemical and technological properties:
TRADE ARBED Inc.
INNOVATORS OF STEEL CONSTRUCTION PRODUCTS.

MODERN STEEL CONSTRUCTION

Volume 33, Number 8 August 1993



The breathtaking Galleria at BCE Place in Toronto is an example of public art at its best. The city required the developers to spend 1% of their construction budget on public art and the developer opted to add those funds to the cost of a needed atrium and create an incredibly beautiful space. Photo courtesy of Robert Burley/Design Archive

FEATURES

NEWS AND DEPARTMENTS

Modern Steel Construction (Volume 33, Number 8). ISSN 0026-8445. Published monthly by the American Institute of Steel Construction, Inc. (AISC), One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001.

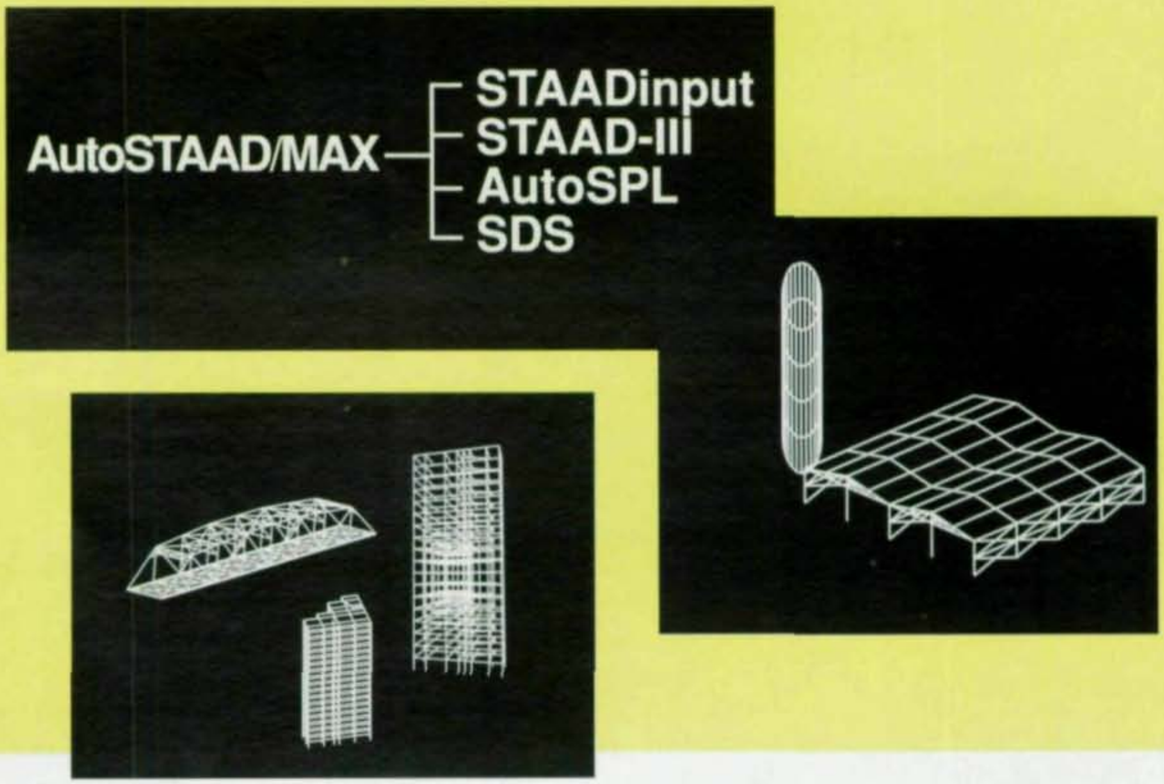
Advertising office: Pattis/3M, 7161 North Cicero, Lincolnwood, IL 60646.

Subscription price:
Within the U.S.—single issues $3; 1 year $30; 3 years $85.
Outside the U.S.—single issues $5; 1 year $36; 3 years $100.

Postmaster: Please send address changes to Modern Steel Construction, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001.

Second-class postage paid at Chicago, IL and at additional mailing offices.

Introducing AutoSTAAD/MAX...



closing the loop between CAD and Structural Engineering

Research Engineers, Inc., the maker of STAAD-III, is proud to announce the arrival of AutoSTAAD/MAX - the world's first structural engineering software that is truly and seamlessly integrated with CAD. Now you can do your entire structural engineering within AutoCAD - from model generation to analysis, design, drafting and detailing.

AutoSTAAD/MAX enhances the productivity of the structural design office to a whole new level by making available the power of STAAD-III within the versatile AutoCAD graphics environment.

Continuous and automatic flow of information ensures efficiency and accuracy never witnessed before in the structural design office.

Whether you are a Fortune 500 A/E firm or a small design office, AutoSTAAD/MAX is guaranteed to raise your production efficiency to new heights.

Research Engineers, Inc

1570 N. Batavia Street, Orange CA 92667
Phone: (714) 974-2500 Fax: (714) 974-4771

1-800-FOR RESE

USA UK GERMANY FRANCE CANADA NORWAY INDIA JAPAN KOREA

Editorial Staff
Scott Melnick,
Editor and Publisher
Patrick M. Newman, P.E.,
Senior Technical Advisor
Charlie Carter,
Technical Advisor

Editorial Offices
Modern Steel Construction
One East Wacker Dr.
Suite 3100
Chicago, IL 60601-2001
(312) 670-5407

Advertising Sales
Pattis-3M
7161 North Cicero
Lincolnwood, IL 60646
(708) 679-1100
FAX (708) 679-5926

AISC Officers
Stephen E. Egger,
Chairman
Frank B. Wylie, III,
First Vice Chairman
Robert E. Owen,
Second Vice Chairman
Robert D. Freeland,
Treasurer
Neil W. Zundel,
President
David Ratterman,
Secretary & General Counsel
Lewis Brunner,
Vice President,
Membership Services
Geerhard Haaijer,
Vice President,
Technology & Research
Morris Caminer,
Vice President,
Finance/Administration

Structure As Sculpture

After attending a ball game at the Skydome in Toronto last week, I took a quick walk over to BCE Place. As I've previously mentioned, during the past few years I've become a bit of a steel "groupie" and it's not unusual for me to stop and gawk at just about any bit of exposed structure. But this time, I wasn't alone. As I stood at one end, I watched a procession of people walking through the Galleria with their necks bent back to provide a better view of the towering space. And it dawned on me that the designers of the Galleria and Heritage Square had successfully transcended from architecture to pure art. The steel frame had gone from structure to sculpture. (To get an idea of what these people were looking at, check out this month's cover and then turn to page 22).

The Holocaust Memorial and Museum in Washington, DC (page 14) also echoes the theme of structure as sculpture, though in this case the architect was not attempting to create beauty. Rather than creating an uplifting place, the museum's architect used such techniques as skewing the frame to create a feeling of unease befitting its exhibits. The third story in this issue (page 30) provides an interesting juxtaposition to the Holocaust Museum. While the Museum's structure creates a feeling of darkness, the brightly painted steel at the Universal CityWalk Complex is designed to create a feeling of joyous freedom.

Before leaving BCE Place, I stopped and chatted with John Zanutel, one of the center's security guards. He mentioned that the Galleria is actually becoming a bit of a tourist attraction, with many European visitors actually adding it to their agenda.

In our hurried world, it's quite rare to see people stopping to look at a structure. Usually, when people look at a building, their eyes are attracted either to its sheer size or to some ornamental feature. Bridges sometimes reach a level of structural beauty that seizes the human eye, but completed buildings rarely do. And that's a shame.

I suppose it's a question of economics. Creating a beautiful structure typically adds to the cost of the project. Some speculative developers can justify that cost by using a building's beauty to help attract tenants. Others, such as BCE Place, are forced by municipalities to create public art. And corporate entities often desire showcases.

But there can be another payback, too. As I watched people gazing admiringly at the arched roof of the Galleria and the complex majesty of Heritage Square I noticed a common expression—happiness. **SM**

00532

Our breakthrough 3-D technology can't be shown in a 2-D ad.

Call for your first hand demonstration of the SDS/2 Detailing System.

Break through time-consuming 2-D, line-by-line graphics with the 3-D technology of the SDS/2 Version 5.4 gives you the ability to automatically produce shop drawings and other information about a structure never before possible. The benefits are invaluable to design engineers, steel fabricators and detailers...or anyone who is involved in the conception and production of steel.

The SDS/2 Software Solutions are the ultimate steel fabrication tool. All information created in SDS/2 or transferred through DesignLINK from third-party design software, can be used throughout all phases of design and fabrication. The SDS/2 Software Solutions include:

- **Engineering Analysis and Design Module**
- **Production Control Module**
- **Estimating Module**
- **Detailing Module**
- **CNC Interface**
- **DesignLINK**

Call Design Data to arrange your personal demonstration or to request additional information.

DESIGN DATA

"First in...software, solutions, service"

402-476-8378 or **1-800-443-0782**

High Strength Structural Steels From Chaparral Put The Heat On Everything Else.
To discover the many advantages of Chaparral's high strength structural steel, put it up against any other construction material.
Price. Price is one of the greatest strengths of Chaparral steel. In fact, steel is less expensive today than it was 10 years ago. So you can now get all the benefits of structural steel at virtually the price of rebar.
Availability. At Chaparral, there's no waiting on rolling schedules. We are a stocking mill which means our inventories are ready when you need them. And because we're centrally located in Midlothian, Texas, we can get your order to you fast, no matter where you are.
High Strength ASTM Grade Steel. Chaparral pioneered stock availability of ASTM high strength steels at the same price of ASTM A36 steels. Engineers can now upgrade material strength without raising the costs. Certified ASTM A572 grade 50, A529 grade 50, A36, Canadian 44W and 50W are all readily available at one low A36 price.
Easy To Design With. Today's engineers are finding steel is the easiest material to design with by far. Many use available software packages that simply don't exist for other materials. And if you have any product questions, expert help is only a phone call away. Just contact AISC for engineering assistance at (312)670-5417.
Recyclable. Not only is steel a recycled product, but it's also recyclable. Unlike other construction materials, steel can eventually be scrapped, recycled and reused again and again. Environmentally safe, steel is good for the future and your company.
Steel is the building material of the 21st century. And Chaparral is one of the most efficient steel producers in the world. We have the best prices and the best service. Call us, and learn first hand why things are heating up at Chaparral.
CHAPARRAL STEEL
Toll Free (800) 527-7979 Ext. 1241
In Texas (800) 442-6336 Ext. 1241
300 Ward Road, Midlothian, TX 76065-9651

Steel Interchange

Steel Interchange is an open forum for *Modern Steel Construction* readers to exchange useful and practical professional ideas and information on all phases of steel building and bridge construction. Opinions and suggestions are welcome on any subject covered in this magazine. If you have a question or problem that your fellow readers might help to solve, please forward it to *Modern Steel Construction*. At the same time feel free to respond to any of the questions that you have read here. Please send them to:

Steel Interchange
Modern Steel Construction
1 East Wacker Dr.
Suite 3100
Chicago, IL 60601

Answers and/or questions should be typewritten and double spaced. Submittals that have been prepared by word-processing are appreciated on computer diskette (either as a Wordperfect file or in ASCII format).

The opinions expressed in *Steel Interchange* do not necessarily represent an official position of the American Institute of Steel Construction, Inc. and have not been reviewed. It is recognized that the design of structures is within the scope and expertise of a competent licensed structural engineer, architect or other licensed professional for the application of principles to a particular structure.

Information on ordering AISC publications mentioned in this article can be obtained by calling AISC at 312/670-2400 ext. 433.

The following responses to questions from previous Steel Interchange columns have been received:

What fatigue category is a full penetration weld between a tube column and a base plate?

Although a particular weld detail is not exactly covered in the latest AISC and AASHTO specifications at my disposal, I would feel safe to utilize and classify it as fatigue Category C or D, depending on the conditions summarized below. For high fatigue (versus static) stresses, I would specify geometrical weld details and fabrication procedures that assure Category C performance. For lower fatigue-vs-static stresses, I would specify conditions that assure Category D performance. For both choices, all geometrical weld details and welding procedures must clearly be specified by the designer and carefully be followed by the fabricator.

First, to obtain a full penetration butt (or groove) weld, a continuous backup bar (say 1" by 1/4") that tightly fits to the inside of the chosen column tube needs to be formed and tack welded to the base plate. The tack welds should be placed on the outside of the backup bar so that they will later on be embedded in the butt weld. For some selected column tubes, a 1-inch-long section of the next smaller standard tube size may be used if it fits tightly to the inside of the selected tube column.

Second, all sides of the lower column tube end must be beveled (30°), including the four corners, before the tube is slipped over the backup bar. After the AWS-required gap between the bottom edge of the column tube and the top of the base plate is assured, the weld material for the butt weld and the fillet can be put in place.

Third, a concave fillet must be specified to obtain a smooth transition to the base plate. A convex fillet would increase the stress concentration factor associated with this type of weld. If inspection after welding finds severe undercuts and/or overlays, touch-up welding and/or grinding may be required to provide a smooth contour for the transition between the outer face of the tube and the base plate.

Fourth, a non-destructive inspection of the butt/fillet weld must be conducted. The most economical procedure for this structural detail would be ultrasonic inspection. X-ray inspection is considered meaningless, especially for the corner regions of the column.

In my opinion, the above conditions would qualify the connection to fall under fatigue Category C. Currently, full penetration butt welds for plates and shapes covered in the AISC and AASHTO specifications fall under fatigue Category C when the weld reinforcement (weld excess) of the full-penetration butt weld is left in place. However, the weld excess for such welds is expected to cause a smaller stress concentration factor than a butt weld with a concave fillet, and definitely with a convex fillet. Therefore, a concave fillet must be used and carefully contoured. These conditions are considered necessary for safety reasons even though they may be costly.

But what if the fatigue stresses in the subject connection are relatively low by comparison with the static stresses? In that case it would seem more cost efficient to designate the joint as fatigue Category D. This would allow elimination of costly grinding and non-destructive testing.

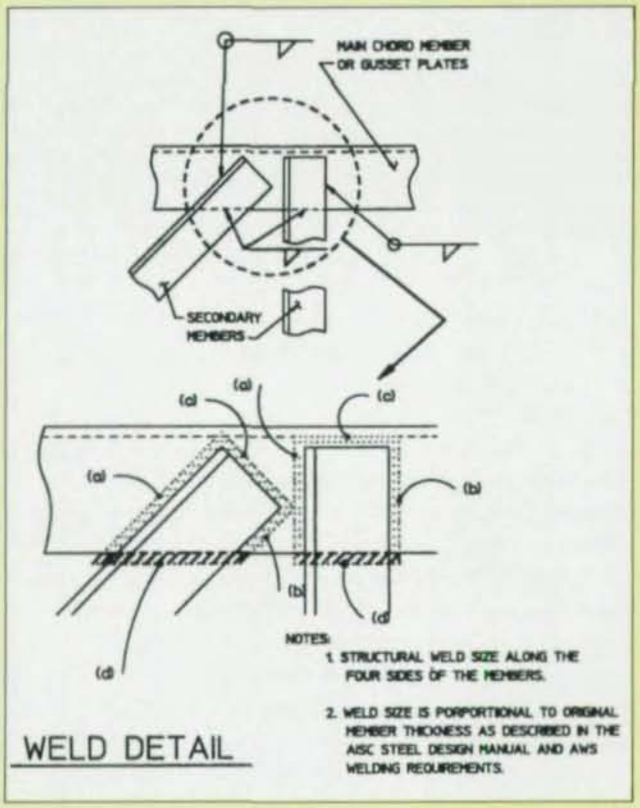
Karl H. Klippstein, P.E.
Structural Engineering Consultant
Pittsburgh, PA

Comments on weld considerations discussed in the April 1993 Steel Interchange:

After reviewing the weld detail in the April 1993 issue, I have two comments.

The first has to do with the way that the welds are called out in the weld detail. It appears to me that the all around call out is incorrect, especially if weld "d" is then called out separately. Weld symbols are the link between design and fabrication and if the weld call out is incorrect, how can the designer expect the fabrication to be correct. Weld symbols don't get

Steel Interchange



enough respect. I see plans where the engineer calls out welds incorrectly on the structural plans and then approves fabrication plans with different but equally incorrect weld symbols. I think that more care should be taken in calling out welds. Both the AISC and AWS codes are pretty specific in describing the proper way to show weld symbols.

My second comment concerns question B: If weld "d" is used to develop the strength of the connection, are there restrictions or parameters that must be placed on the weld (i,e, placement, size, etc.)? The AWS does place restrictions on fillet welds on opposite sides of a plate and states that the weld should not be continuous to both sides of the plate. It appears to me that if weld "d" is used it should stop short of the edges of the member so that the weld is not continuous to both sides of the element.

Matthew Beck, P.E.
Wardsboro, VT

The figure accompanying the *Steel Interchange* discussion on weld considerations (reprinted here) contains one of the most common Code (AWS D1.1-92) violations we find on structural drawings. First, the welding symbol pointing to the hidden side of the joint is redundant with the welding symbol shown to be all-around. More importantly, however, is the fact that the all-around supplementary symbol would require a Code violation of the requirement stated in paragraph 8.8.5. Specifically, such a weld symbol would require an uninterrupted deposit of weld on the opposite sides of a common plane of contact between two parts, which is prohibited. While welds (a), (b), and (c) may be continuous with each other, the code requires that the weld must be interrupted at the corners common to (a) and (d) and to (b) and (d). This is due to the deleterious effects of the resulting weld profile on the weldment.

In regard to the strength of a welded angle-to-gusset plate connection, since there is no provision in the Code which would disallow the use of weld (d), it may be used. However, there are several other Code provisions which should be considered.

While welds (a) and (b) would appear to provide the optimum efficiency in transferring reactions between the elements, weld (c), or plug welds, may be necessary to avoid the potential shear lag effects of using only welds (a) and (b). This consideration is the rationale behind the provision of paragraph 8.8.1 of the Code. Although this paragraph refers specifically to flat bars, it would be prudent to satisfy those provisions for angle shapes as well.

A Code requirement which can easily be misapplied in this situation is paragraph 8.8.6.1. While this paragraph may appear to require returns at the (c) end of welds (a) and (b), paragraph C8.9 of the commentary explains this is not the case.

Richard W. Mudd, P.E., C.W.I.
Standard Testing
Oklahoma City, OK

New Questions

Listed below questions that we would like the readers to answer or discuss.

If you have an answer or suggestion please send it to the Steel Interchange Editor, Modern Steel Construction, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001.

Questions and responses will be printed in future editions of Steel Interchange. Also, if you have a question or problem that readers might help solve, send these to the Steel Interchange Editor.

Some Building Codes permit a reduction in NDT for welders with less than a 5% rejection rate. How big a sample is used to get the 5%?

Bill Schindler
Herrick Corp.
Pleasanton, CA

The National Symposium on Steel Bridge Construction

November 11-12, 1993
Atlanta Airport Hilton, Atlanta, Georgia

SYMPOSIUM TOPICS

- State Plans for Implementing Metric Conversion to Meet FHWA Mandates
- Painting Strategies for Maximum Economy and Useful Life
- Weathering Steel - Success Stories Worth Hearing
- Cost Effective Design and Details
- Seismic Design
- Bridge Research Leading the Way to the Future
- **International Panel on Innovative Designs**

PRE-SYMPOSIUM WORKSHOPS NOVEMBER 10, 1993

"Cost-Effective Steel Bridges"
"Bridge Painting, Problem or Opportunity"

Continuing Education Credits (CEUs) will be awarded.

Co-Sponsored by:

Amer. Assoc. of State Highway and Transp. Officials
The American Institute of Steel Construction
The American Iron and Steel institute
The Federal Highway Administration

For more information contact:

American Institute of Steel Construction
One East Wacker Drive, Suite 3100
Chicago, IL 60601-2001
Phone (312) 670-2400
Fax (312) 670-5403

High Strength Weathering Steel
Structural & Plate
Grade Specifications

A588 / A572
• Angles • Beams • Squares
• Flats • Plates • Rounds • Channels

A606 - Type 4
• Sheets • Coils

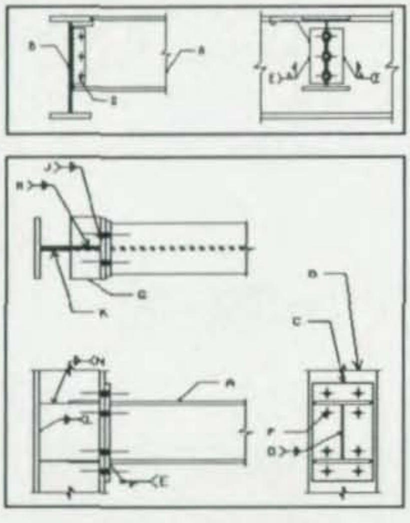
A242 - Type 1
AR360 • A514 Gr. A&E
Plates

CS
Central Steel Service, Inc.

1-800-868-6798

P.O. Box 326 • Pelham, AL 35124
205/664-2950 • Fax: 205/663-3391

DESCON
DESIGNS AND DETAILS STEEL CONNECTIONS



FOR A FREE DEMO DISK
CALL OR WRITE TO

OMNITECH ASSOCIATES
P.O. BOX 7581
BERKELEY, CA 94707
(510) 658-8328

STEEL CALENDAR

After a short summer vacation, the **AISC Lecture Series** is scheduled to resume next month. The seminars have been an overwhelming success so far, often attracting more than 100 participants and very positive reactions.

"I was surprised that so many people wanted to here about such advanced subjects, but the response has been very positive," according to Charles Carter, an AISC Staff Engineer.

The seminars present information on eccentrically braced frames, partially restrained connections, low-rise buildings, and connection design. Registration is only $60 ($45 for AISC members). Included as part of the registration fee is a meal and more than a dozen handouts and publications, including: AISC Design Guide 5: Low & Medium Rise Buildings (a $16 value); ASD Simple Shear Connections (a $16 value); LRFD Simple Shear Connections (a $16 value); Seismic Provisions for Structural Steel (a $5 value). And pre-registrants also receive the other five AISC design guides (an $80 value).

The seminars are scheduled for:

Birmingham, AL	9/9
Miami	9/14
Orlando	9/16
Rochestor, NY	9/22
Albany, NY	9/23
Atlanta	9/28
Richmond, VA	9/30
Cleveland	10/19
Columbus, OH	10/20
Cincinnati	10/21
El Paso	11/16
Oklahoma City	11/18

For more information, contact: American Institute of Steel Construction, Inc., One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001 (312) 670-2400; fax: 312/670-5403.

Steel Design Seminar Series—design of Steel Connections (conducted by the Steel Structures Technology Center). The one-day, professional level program will discuss joint analysis methods, design criteria and methods, constructability and economical design. Seminars are scheduled for:

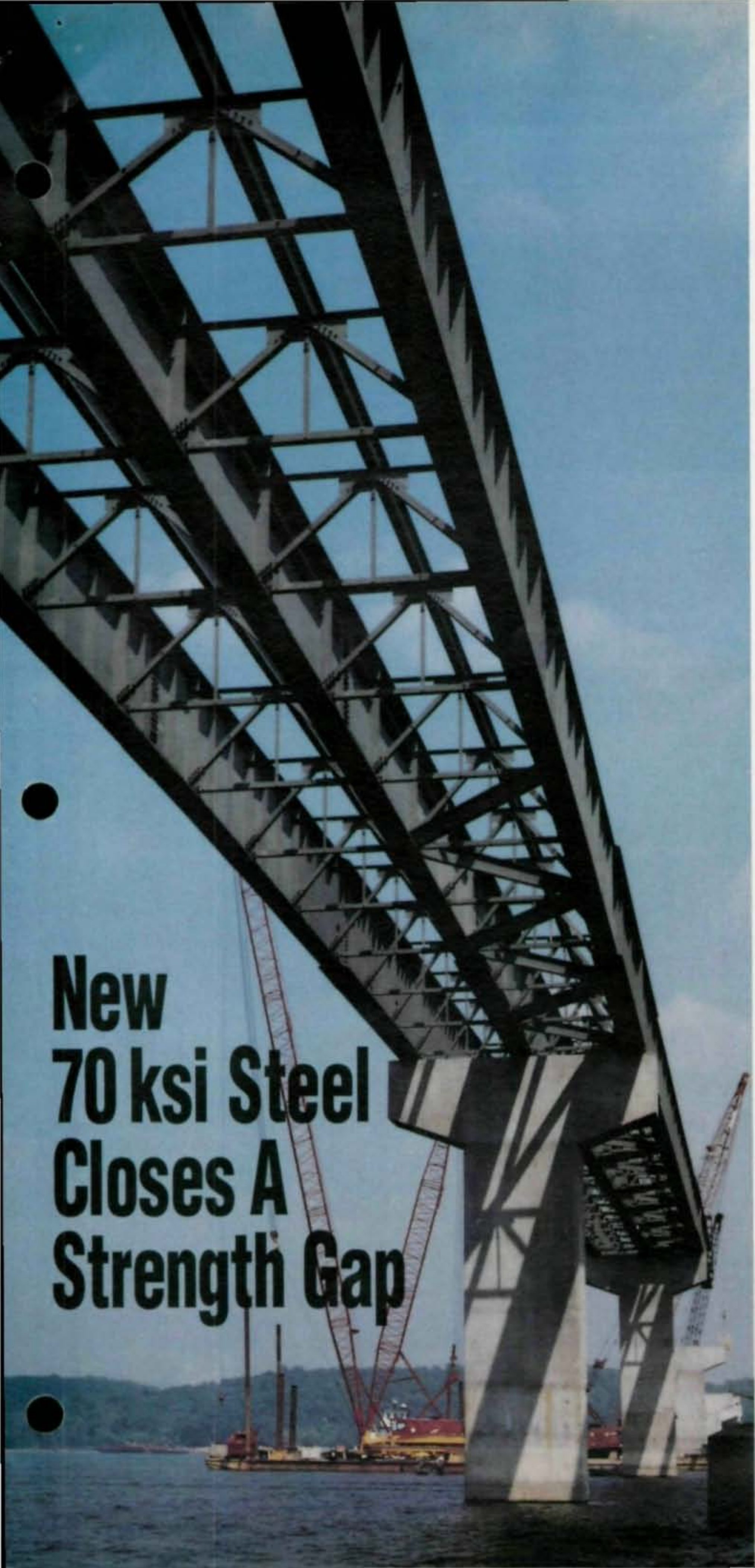
Detroit	9/13
Chicago	9/15
Minneapolis	9/16
New York	10/4
North Haven, CT	10/5
Boston	10/6
Portland, ME	10/7
Portland, OR	10/25
Seattle	10/26
Kansas City	11/4
Costa Mesa, CA	11/29
Los Angeles	11/30
San Francisco	12/2
Sacramento	12/3

The fee for the seven-hour seminar is $145. For more information, contact: Steel Structures Technology Center, 40612 Village Oaks Dr., Novi, MI 48375 (313) 344-2910; fax: 313/344-2911.

Development & Design of Colorado Rockies Ballpark (October 5 in Westminster, CO). Breakfast seminar features both the structural engineer and a member of the Denver Ballpark Commission. For more information, contact: Jim Anders at (214) 369-0664.

National Symposium On Steel Bridge Construction (November 11-12 in Atlanta). Symposium topics include: state plans for implementing metric; painting strategies for maximizing economy & useful life; weathering steel; cost effective design & details; and seismic design. The symposium also includes an international panel on innovative designs. For information, contact: AISC, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001; (312) 670-5407; fax 312/670-5403.

Amoco Building Recladding—Lessons Learned (November 11 in Chicago). All-day seminar discussing entire renovation project from design to the final recladding. Sponsored by Chicago Committee on High-Rise Buildings. For more information, contact: Ian Chin (312) 372-0555; fax: 312/372-0873.



The 3,950 foot Paris Landing Bridge in Tennessee includes the first application of new USS COR-TEN B-QT Steel (ASTM A-852), quenched and tempered to provide 70 ksi (480 MPa) minimum yield strength. It was developed by U.S. Steel to close the gap between the 100 ksi, and 50 ksi yield strength steels used in bridge construction. The new structure is a multiple span plate girder bridge, replacing an existing steel truss design.

COR-TEN B-QT was selected for the flanges of the main beams in areas of high stress. The increased yield strength of COR-TEN B-QT achieves the required strength, allows a constant web design, and avoids the expense of haunch girders. COR-TEN B-QT is weldable utilizing shop and field methods similar to those required by 50 ksi COR-TEN B Steel (ASTM A-588, Grade A). COR-TEN B-QT is a weathering steel with greater atmospheric corrosion resistance than carbon steel. By following the FHWA guidelines for the use of uncoated weathering steel, it virtually eliminates the need for painting with possible significant cost savings.

U.S. Steel has led the industry with structural steel innovations like COR-TEN B-QT. You will be seeing more from U.S. Steel to confirm steel's cost and functional advantages in bridge construction.

USS®

U.S. Steel Group
A Unit of USX Corporation

Owner and Designer:
Tennessee Department of Transportation

Fabrication:
Carolina Steel Corporation

Prime Contractor:
McKinnon Bridge Company, Inc.

Steel Erector:
ABC Contractors, Inc.

USS and COR-TEN are registered trademarks of USX Corporation

The Holocaust Memorial Museum reflects the industrial style of architecture common in 1930s Europe--but with a twist. For example, the bridges stretching over the skylit roofs recall those over the Warsaw ghetto. Also, the skylights' steel frames are skewed to present a "twisted" image. Photo at right by Jou Min Lin, Pei Cobb Freed & Partners; photo far right courtesy of Pei Cobb Freed & Partners.

Monument To Horror

The new Holocaust Memorial Museum is designed to be visually disruptive

By Leo Argiris, P.E.

In April, the nation's newest monument was unveiled in Washington, DC. The U.S. Holocaust Memorial Museum has the difficult mission of educating visitors about the enslavement and extermination of millions of lives in Europe before and during the second World War.

To fulfill that mission, architect James Ingo Freed of Pei Cobb Freed & Partners, New York City, designed a structure that, rather than standing simply as a container for exhibits, would be part of the exhibition itself. The building uses materials lifted from industrial architecture of 1930s Europe—the same architecture used in the concentration camps. But Freed goes a step further and evokes symbolism from structural elements. For ex-

ample, bridges recall those over the Warsaw ghetto, and towers echo those that guarded concentration camps. In addition, architecturally exposed steel, reminiscent of 1930s construction, appears throughout the building.

The 245,000-sq.-ft. Museum is organized around the Hall of Witness, a long, three-story-high space topped with a skewed skylight and four bridges. Two rows of five-story towers—four on each side—line two sides of the hall. Adjacent and connected to this building stands the Hall of Remembrance, a 60'-high, 6,000-sq.-ft., six-sided structure. While much of the structure is constructed of concrete, large areas of structural steel were employed to satisfy architectural requirements.

1930s Industrial Architecture

The Museum posed challenges unlike any faced before by the project structural engineer, Weiskopf & Pickworth, New York City.

Chief among these was the need to make the structural steel visually recall 50-year-old techniques while still satisfying modern structural codes. Specifically, the architect required the appearance of built-up riveted plates and angles, often including turnbuckles and clevises.

To recall plate and angle construction, three basic structural elements were used. Two of these elements consist of a steel plate and four equal leg angles, with one element in the form of a cruciform and the other in the form of a wide flange section with two angles forming the top and bottom flanges. The third element uses rods tied with turnbuckles and clevises to the web plates of the cruciform and I shapes.

The structural engineer first explored the possibility of actually riveting pieces of steel together. This method, long abandoned in the U.S., might have been possible if it was needed on only a small scale. At the Museum, however, 487 tons of steel were required—eliminating riveting as a viable option.

Instead, we decided—in collaboration with the architects—that members would be bolted together at an 8" spacing to closely resemble riveting. We also used groove welds, ground smooth, in key loca-

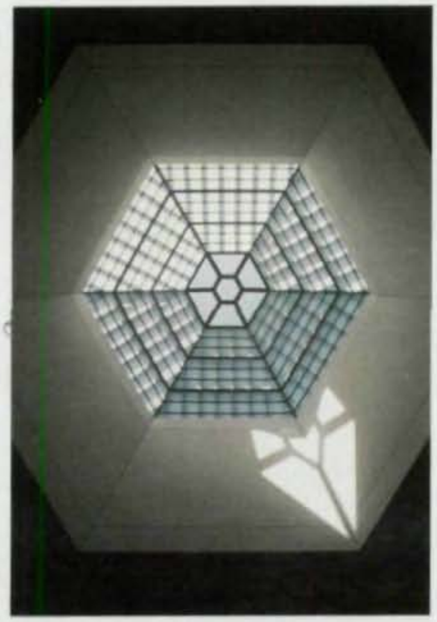
Here's some food for thought: **CadVantage** Structural (CVS) allows steel detailers to immediately produce 75% more output per day! CVS serves up the most flexible and simple format in the industry, while offering the fastest, most accurate and affordable detailing system on the market.

*Cad***Vantage** - it's great food for any system.

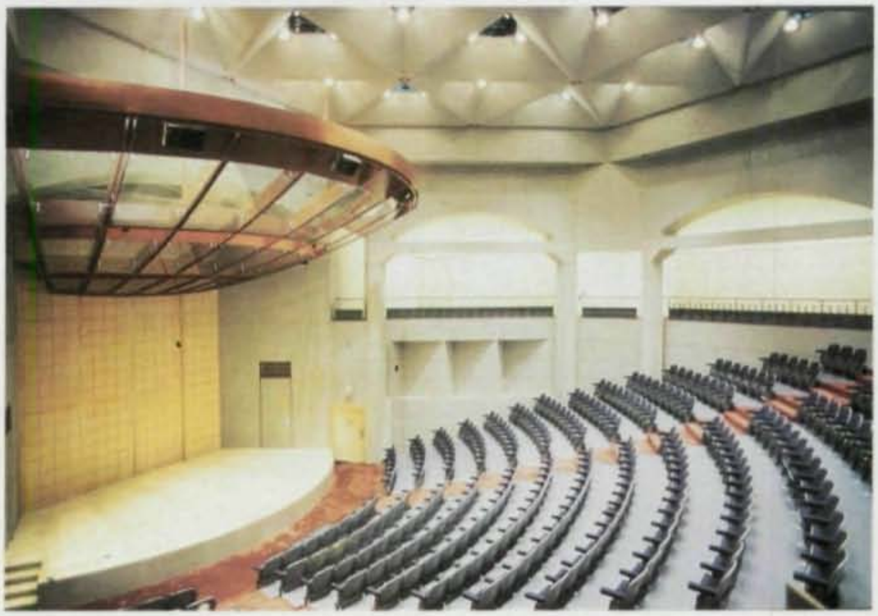
CAD FOOD

*Cad*Vantage

For a FREE demo disk and more information, call 704-344-9644.
*Cad***Vantage**: *619 South Cedar Street / Studio A / Charlotte, North Carolina 28202*



The Hall of Remembrance includes a 6,000-sq.-ft. exhibit hall topped with a hexagonal skylight and a 414-seat below-grade theater. Conventional steel shapes were used in the skylight to minimize shadows. Photo at left courtesy of Pei Cobb Freed & Partners; bottom photo by Jou Min Lin, Pei Cobb Freed & Partners. Shown at right is the monitor truss for the Hall of Witness with the skybridges in the background. Photo courtesy of Pei Cobb Freed & Partners.



tions to ensure the continuity of the members while still providing a smooth look.

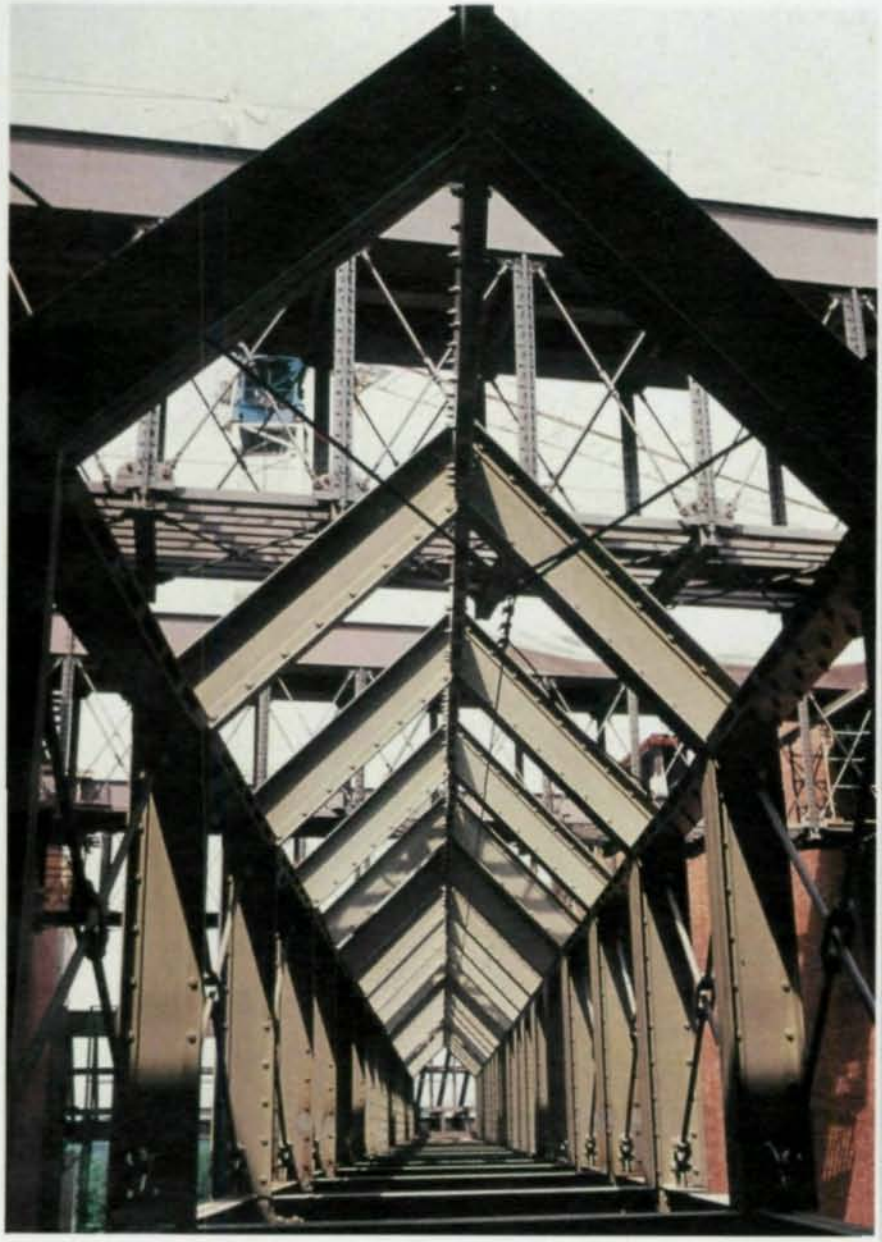
Precise detailing and fabrication of the steel members and connections were of paramount importance. The architect developed full-scale models of the connections and actually sent photographs of these models, rather than drawings, to W&P during the development of our structural details.

To ensure that the design intent was carried out and erection schedules were met, the architect, structural engineer and steel fabricator—AISC-member The Rome Iron Group—labored together through each connection. Rome Iron produced full-scale mock-ups of the key connections to perfect the fabrication process before assembling the actual members.

Hall Of Witness Skylight

The Museum's centerpiece is the 7,500-sq.-ft. Hall of Witness topped by a 152′-long by 48′-wide skylight. The skylight makes its statement not only through the replication of exposed steel plates and angles, but also through its skewed or twisted glass surface. A peaked hat, or "monitor" cuts diagonally across the length of the skylight.

While developing schemes for



the structural framing of the skylight with its monitor shape, we experimented with a number of structural forms including folded beams, tied arches and steel trusses. Architecturally, the truss scheme worked the best.

To minimize the thermal contractions and expansions in the long dimension of the skylight, we divided the skylight into four independent modules. Each module is flanked by two trusses spaced 32′ apart spanning the width of the 48′-wide atrium. Within the 8′ spacing between modules, thermal movements are accommodated for a 32′ segment rather than the full 152′ length.

To frame the monitor, two diagonal trusses connect the end trusses of each module while rafters and purlins complete the framing. The "skew" is created as the monitor truss cuts across the skylight. Remaining at the same elevation, the monitor starts in one corner at one end of the room and arrives in the opposite corner at the opposite side of the room. As its location between the hall's side walls changes, the monitor meets the top chord of the 48′ truss in a different place at each truss. Therefore, each top chord of the truss takes on a different angle as it reaches up to

YOUR COMPETITION ALREADY KNOWS

Your competition knows that using the ***Structural Material Manager*** is simply smarter than processing steel lists by hand.

Consider this: Hundreds of steel fabricators, suppliers and detailers have abandoned old-fashioned manual material list calculations and now use their IBM PC-compatibles with ***SMM*** to do the job more *quickly* and *accurately*.

- Main Module computes weights, surface areas, bolt counts and lineal totals. It also sorts lists into proper order by section size, length, grade, etc.
- Length-Nesting Module produces optimum cut-lists from in-house stock, vendor stock or the best combination of both.
- Estimating Module tallies material costs, shop hours and field hours.
- Production-Control Module prints shipping lists, loading tickets and job status reports.
- Can import lists directly from **CadVantage** or your own ASCII text files.
- In daily use by hundreds of steel fabricators, suppliers and detailers.

IF YOUR COMPETITION ALREADY KNOWS, CAN YOU AFFORD NOT TO?
Call for a *FREE*, no-obligation demo disk with all modules and the full system's operator's manual.

Call Today For Your Free Demo Kit!

E.J.E. INDUSTRIES, INC.
Computer Software for Steel Professionals
287 Dewey Avenue, Washington, PA 15301

Phone (800) 321-3955
or (412) 228-8841
Fax (412) 228-7668

When you're in a tight corner, only one Thickness Gauge measures up.

345 DIGITAL COATING THICKNESS GAUGE

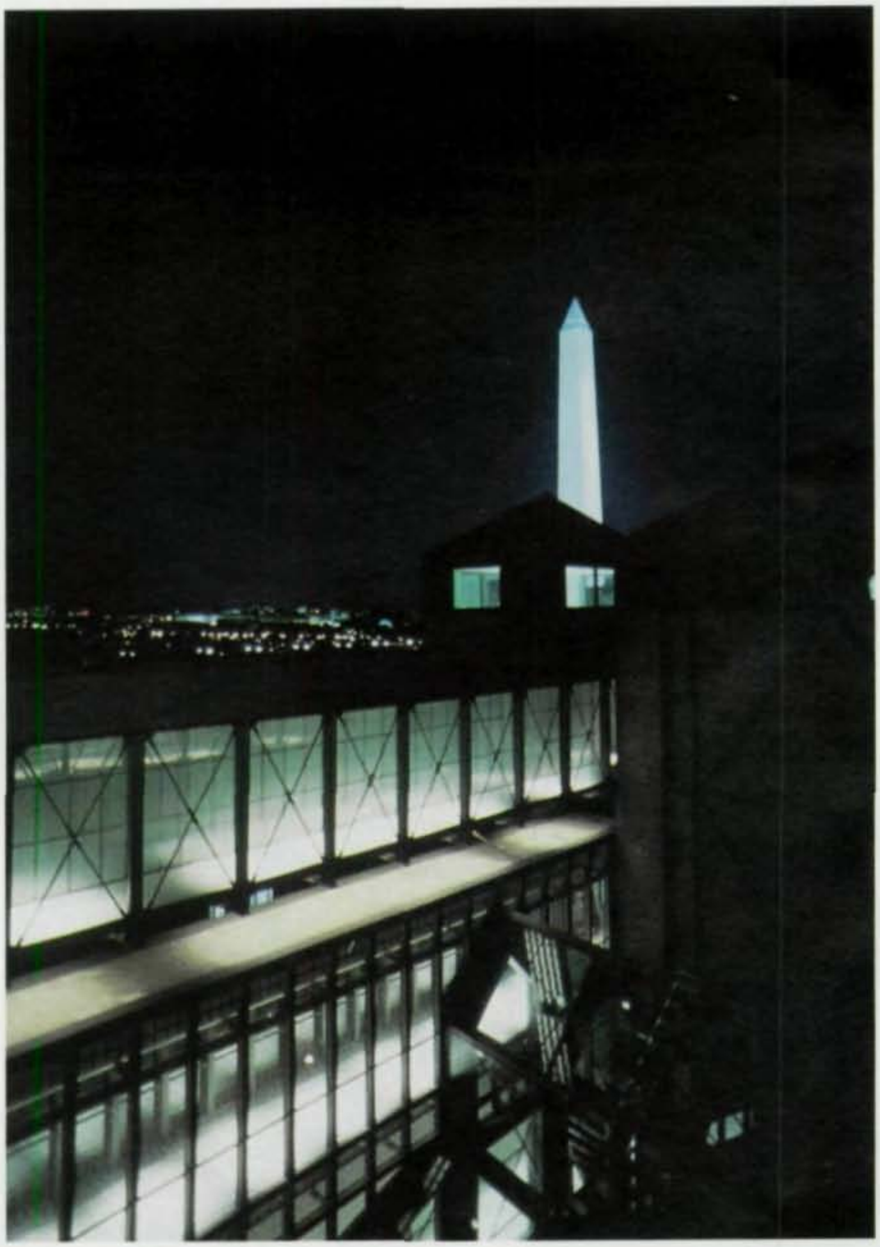
The **new** low cost Elcometer 345 is the most versatile of all thickness gauges.

Available in four models, the 345 measures any non-magnetic coating on steel or all non-conductive coatings on non-ferrous substrates with its integral or separate probe.

Simple to use and shirt-pocket size, wherever you use a thickness gauge, you can be sure the new Elcometer 345 fits your needs. Perfectly.

elcometer®

For detailed catalog please contact
ELCOMETER INC.
1893 Rochester Industrial Drive
Rochester Hills, Michigan 48309
Tel: (313) 650 0500 Toll Free within USA
800 521 0635 Fax: (313) 650 0501



When you're in a tight corner, only one Thickness Gauge measures up.

345 DIGITAL COATING THICKNESS GAUGE

The **new** low cost Elcometer 345 is the most versatile of all thickness gauges.

Available in four models, the 345 measures any non-magnetic coating on steel or all non-conductive coatings on non-ferrous substrates with its integral or separate probe.

Simple to use and shirt-pocket size, wherever you use a thickness gauge, you can be sure the new Elcometer 345 fits your needs. Perfectly.

elcometer®

For detailed catalog please contact
ELCOMETER INC.
1893 Rochester Industrial Drive
Rochester Hills, Michigan 48309
Tel: (313) 650 0500 Toll Free within USA
800 521 0635 Fax: (313) 650 0501

meet the monitor.

Each module required a three-dimensional analysis to determine the distribution of forces between the various truss members. At the same time, each rafter and truss segment required an individual evaluation to determine the precise geometry of the elements for fabrication.

In keeping with the vocabulary of the exposed structural steel, we designed the top and bottom chords of the trusses as I-shaped members built from ½" plates with equal leg angles. The vertical members of the trusses are cruciform-shaped plates and angles, while the diagonals are tie rods. The main skylight trusses called for chords and verticals to be assembled with ½" web plates. Instead of making individual members, Rome Iron eliminated a substantial amount of welding by starting with a 50′ x 10′ x ½" plate and cut the outline of the entire truss in one piece. This minimized many of the defects and distortions likely with a welded assembly. Angles were then bolted onto this plate to form the I- and cruciform-shaped members.

Footbridges

Four glass and exposed steel pedestrian bridges span the Hall of

Shown at left is a night view of the Holocaust Memorial Museum. At right is an image of the Hall of Witness skylight showing the skewed steel designed to create the illusion of twisted, damaged metal. Photos by Jou Min Lin, Pei Cobb Freed & Partners. Shown above is another view of the skewed skylight (photo courtesy of Pei Cobb Freed & Partners).

Witness at the Museum's fifth floor. A fifth bi-level bridge spans between the towers at the third and fourth floors. Designed to evoke the ambiguity of near transparency, the bridges feature a walking surface of glass block laid between steel tee sections. People will "walk on air" while visitors in the Hall of Witness below will see shadowy, ghost-like images overhead. Transparent window walls located within the exterior steel construction form the sides and provide a view of the skylight below. Only the roof is constructed of cast-in-place concrete.

We designed the bridges as two 32"-deep box girders at the roof level, which support all of the gravity load of each bridge. In addition to supporting the cast-in-place roof and the bridge below, the girders double as a staging platform for window cleaning for the Hall of Witness skylight below.

The box girders, composed of $\frac{1}{2}$" vertical steel plates and $\frac{3}{4}$" horizontal plates provide the lateral and torsional stiffness to serve both functions effectively. A row of hangers, spaced 5'-4" on center and shop assembled in a cruciform shape, support the vertical loads. To provide the lateral wind bracing of the deck, a secondary system of

MAX WEISS
STEEL SHAPING SPECIALISTS

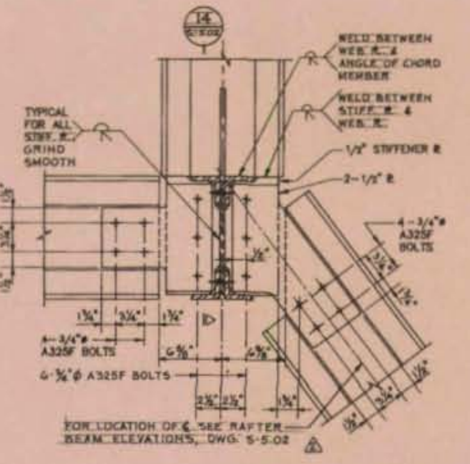
UNUSUAL SHAPES AREN'T UNUSUAL AT MAX WEISS.

ROLLING & FORMING
BLACKSMITHING
WELDING & MACHINING
INDUSTRIAL AND CONTRACTORS SUPPLIES

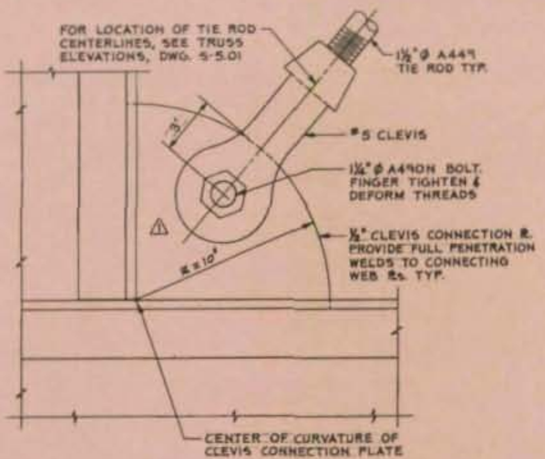
IRREGULAR CURVES, VERTICAL OFFSETS, ELLIPTICAL SHAPES, CIRCLES, OR SEGMENTS WITH OR WITHOUT TANGENTS

If it's structural steel that needs to be bent, for major architectural projects or for unique applications, chances are, Max Weiss bends it. If you have a question or problem in bending, call, FAX or write Dept. M93 for a solution. **TAKE IT TO THE MAX.**

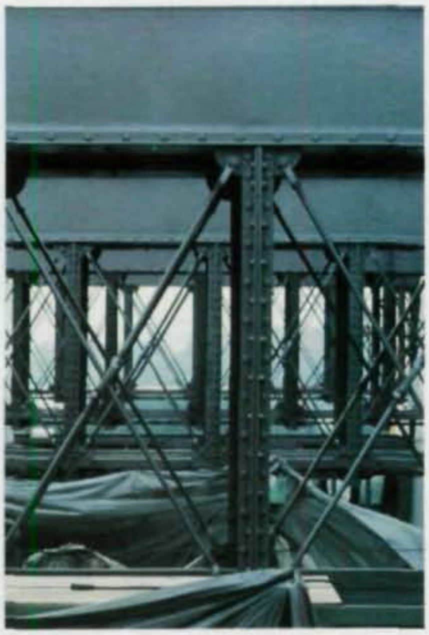
MAX WEISS CO, INC.
8625 W. Bradley Road
Milwaukee, WI 53224 USA
Telephone: 414-355-8220
MAX FAX 414-355-4698



Typical Rafter to Monitor Connection



Typical Clevis Detail



1¼"-diameter cross-braced tie rods below the floor works with the floor support members as a lateral truss. Diagonal tie rods with turnbuckles in the vertical sides of the bridges add to the lateral stability of the bridge deck level.

The bridges were erected before the skylight to avoid the possibility of skylight damage from falling objects. Nighttime erection provided better access to the site and staging area, full access to the only tower crane, and avoided any disruptions to other trades working in the atrium below. Each bridge was erected over a four-night cycle.

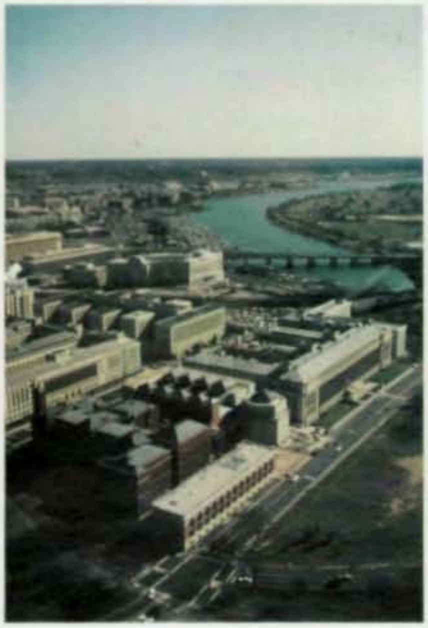
Hall Of Remembrance

After visitors to the Memorial Museum complete the exhibition, they enter the Hall of Remembrance, a six-sided, 60'-tall, 6,000-sq.-ft. room. While the Hall of Witness and exhibit spaces are dark and confining, the Hall of Remembrance is open and light-filled. And just as the architecture is different, so too were the structural challenges.

We selected a structural steel frame for the Hall of Remembrance for a number of reasons. Since the floor of the Hall is the ceiling over a below-grade theater, steel allowed us to easily clearspan 72'. Using a steel frame also accommodated the Hall's sloped ceiling and offset columns. And finally, the steel frame eliminated the need for shoring concrete formwork in the 60'-tall space.

The steel frame consists of 12 columns around the perimeter of the Hall. To provide an offset in these columns at elevation 66', we introduced tension and compression rings to provide stability for sloped columns. A 70' clearspan roof is interrupted by a hexagonal skylight that rises at the center of the Hall to a peak. Once again, we used a tension ring at the base and a compression ring at three-quarter of the height of the skylight to stabilize diagonal rafter beams. Conventional rolled shapes were used in the skylight framing to minimize shadows.

Below the Hall of Remembrance, the steel columns from



Shown on the opposite page are close up views of the turnbuckle bridges and the exposed steel Hall of Witness skylight (photos courtesy of Pei Cobb Freed & Partners; drawings courtesy of Gustavo Amaris, Weiskopf & Pickworth). Shown above is a daytime view of the museum with Washington, DC, in the background (photo courtesy of Jou Min Lin, Pei Cobb Freed & Partners).

above blend well with the architectural concrete forming the walls of the 414-seat Meyerhoff Theater. These columns were encased in architectural concrete prior to erection.

Structural steel also helped to provide state-of-the-art acoustics in the theater. An acoustical canopy composed of a grid of steel plates with infill glass panels was hung from the second floor framing.

The U.S. Holocaust Memorial Museum is open to the public and tickets are free. However, to ensure entrance at a specific date and time, visitors are encouraged to call TICKETMASTER at (800) 551-7328 to reserve tickets for a service charge of $3.50.

Leo Argiris, P.E., is an Associate of Weiskopf & Pickworth, a New York City-based structural engineering firm.

IN ADDITION TO ANGLE, RAIL, PIPE, CHANNEL, AND BEAM ROLLING CAPABILITIES, WE ROLL TUBES, CHANNELS, AND BEAMS THE HARD WAY. IF WE CAN BE OF SERVICE PLEASE CALL OR FAX.

WHITEFAB INC.
Birmingham, AL

Phone (205) 791-2011 FAX (205) 791-0500

LRS LEVINSON REGISTERED STEELS

LEVINSON STEEL CO.
100% Domestic Inventory Mill Traceable
18,000 Ton On-Hand Inventory

For the office serving you call:
1-800-538-4676

Birmingham
FAX (205) 328-4427
Pittsburgh
FAX (412) 266-7656

A Country Road In Steel

Branching, sloped steel columns topped with a trellis-like space frame create an urban interpretation of an old country road

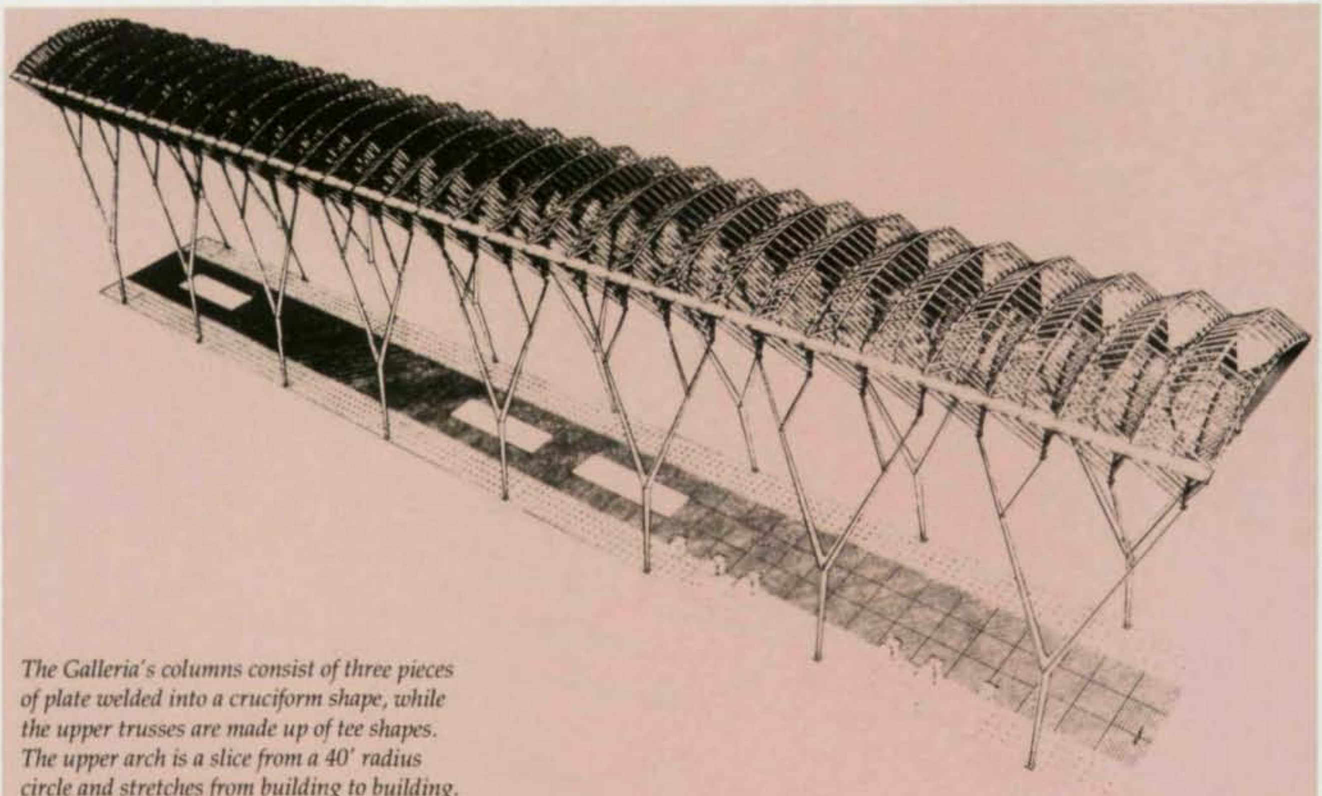
The steel columns and trusses at the Galleria in Toronto's BCE Place are designed to be symbolic of a country path surrounded by maple trees.Photos by Robert Burley/Design Archive.

If the breathtaking Galleria and Heritage Square project is any indication of the success possible when a city requires developers to create public art, then every U.S. municipality should quickly follow Toronto's example.

"In Toronto, 1% of a project's construction budget must be devoted to public art," explained Tonu Altosaar, a partner with *Bregman + Hamann Architects in* Toronto. "The question is, in a major project, where do you put public art?" In the case of BCE Place, a 5.4-acre, \$1.2 billion mixed-use complex that includes more than 2.4 million sq. ft. of office space as well as 65,000 sq. ft. of retail, the designers opted to create a huge sculptural atrium.

A design competition was held, and the winner was Spanish architect Santiago Calatrava, who envisioned a network of steel arches and latticework. "The design is essentially sculpture," according to Altosaar. "The concept was to create a country road with maple trees on either side." Calatrava's interpretation features rows of "trees" that branch twice, once at 24' and the second time at 48'. The tree columns then support a trellis-like structure of arched trusses, with the top of the galleria rising 90'. When the sun shines through the glass roof, the resulting shadows are indeed reminiscent of a wooded path.

The atrium connects the various buildings that make up BCE Place, including the 57-story Canada Trust Tower and 47-story Bay-Wellington Tower. The complex also includes 12 additional buildings



The Galleria's columns consist of three pieces of plate welded into a cruciform shape, while the upper trusses are made up of tee shapes. The upper arch is a slice from a 40' radius circle and stretches from building to building.

Estimating

Isn't it time to make the move to computerized estimating? In these days of declining profits and increased competition, couldn't you use a tool that will produce more bids with the same personnel and increase the accuracy of each bid? If so, SSC's Estimating program is the tool you need!

Call now and ask about our SUMMERTIME SAVINGS while they're still available

(800)776-9118

STRUCTURAL SOFTWARE CO.
SOFTWARE FOR THE STEEL INDUSTRY
P.O. Box 19220, Roanoke, VA 24019
(703)362-9118

New Automated Drawing Log

Tracks drawings, revisions, and transmittals

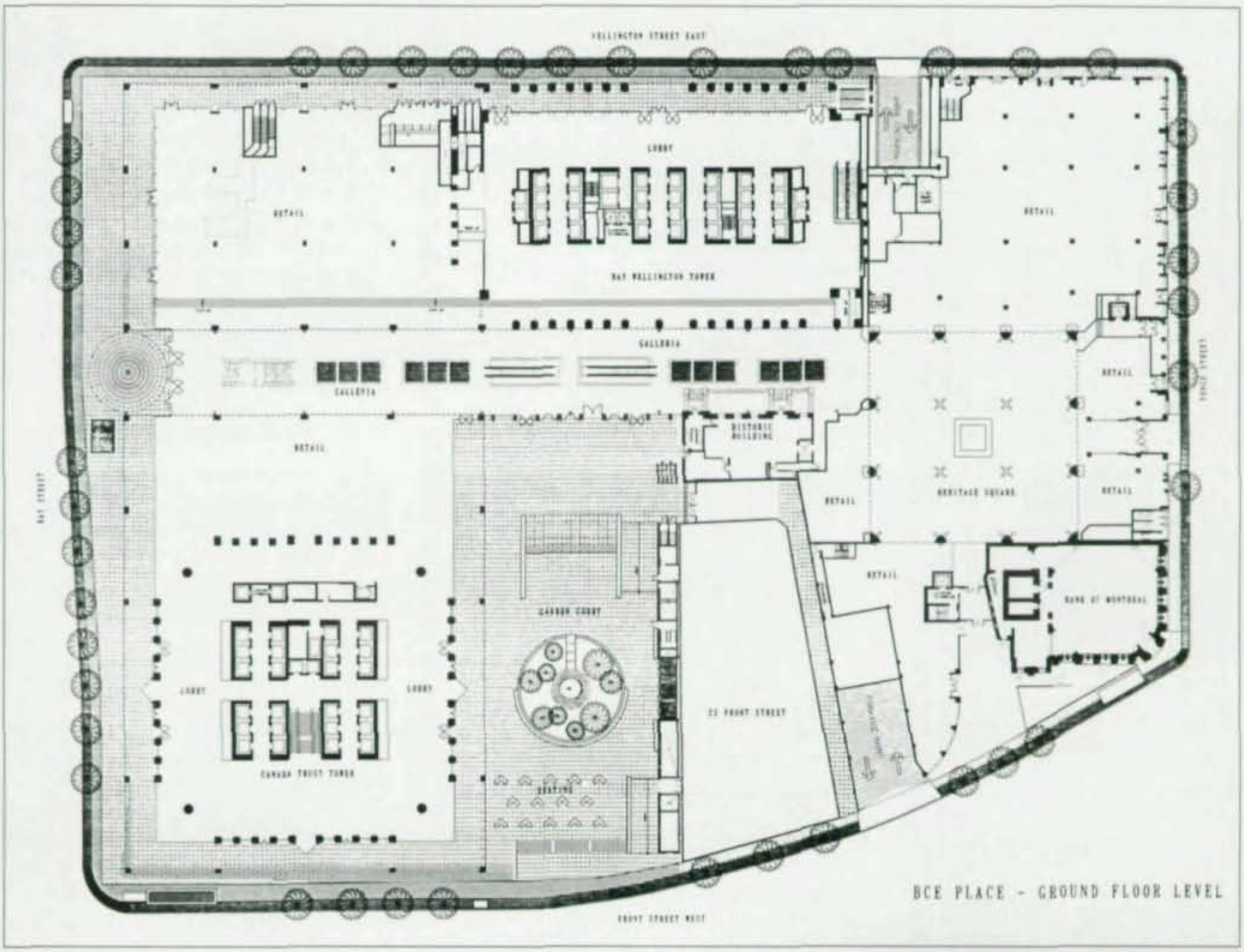
Only $299.00

Ask for a free demo disk

Other popular SSC products:
Production Control
Inventory Control
Purchase Orders
Combining

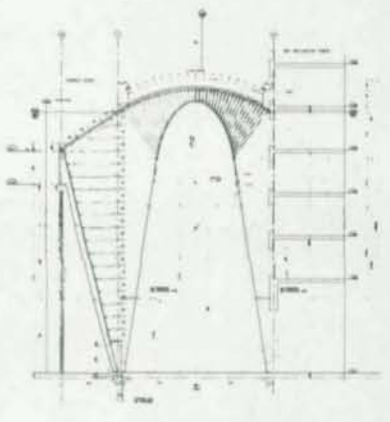
Ask for a demo

00541



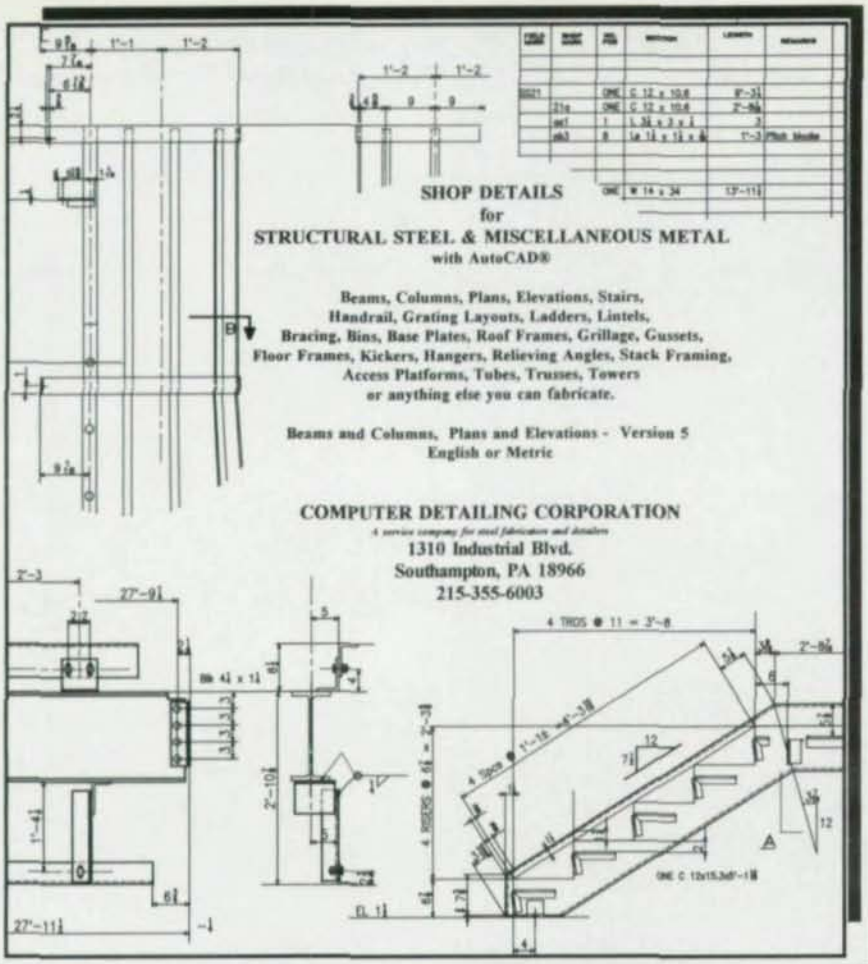
designated as having historical or architectural value under the Ontario Heritage Act. These include the only intact grouping of late 19th century commercial buildings to have survived the fire of 1904 and their facades have been meticulously restored. According to the project's architects, the public areas were designed to consolidate an entire downtown block into a single complex while maintaining the integrity of each of its parts. The master plan was developed by Bregman + Hamann, who also served as architects, along with Skidmore, Owings and Merrill, on the project's two large office towers. In addition, Bregman + Hamann worked on the historical restorations and the Garden Court.

The 350′-long Galleria utilizes traditional proportions and its 90′ height is slightly more than twice its 42′ width. At its east end, the Galleria terminates into the 100′ x



BCE Place Galleria Cross Section

The Galleria is part of the huge BCE Place complex, which includes more than 2.4 million sq. ft. of office space and 65,000 sq. ft. of retail space.



SLUGGER® by Jancy Engineering Co.
Manufacturer of Portable Magnetic Drilling Systems

2735 Hickory Grove Road, Davenport, Iowa, USA
Phone 319-391-1300 FAX 319-391-2323
Ask for Pat, Steve or Jeff

Call for a Demonstration Today

Lightweight-Accurate
Durable-Convenient
Affordable

Made in America's Heartland

IOWA

Available Exclusively Through the Best Stocking Distributors

100′ Heritage Square. In both the the Galleria and Heritage Square the glass roof is supported by large, tree-shaped columns.

Computers played a large role in the project, beginning with initial design drawings. Bregman + Hamann, using Calatrava's preliminary design, created a series of AutoCAD drawings to give the owner, Brookfield Development Corporation, a better feel for the project. And computers were crucial for the structural design of the project.

Structural Design

As might be expected, the project was incredibly complicated. "Without computers, it would be very, very difficult to design this structure," according to Alexander Czumaczenko, a partner with Yolles Partnership, Inc., a Toronto-based structural engineering firm. To handle the project's complexity, the designers relied extensively on an in-house 3D design and analysis program.

"The basic elements are trees, with one stem coming out of the ground, and then branching into two members, and then branching again," Czumaczenko said. "The architect wanted the tree cross-section to be a cruciform shape so we created it by fillet welding three steel plates together." The sizes of the 1½"-thick plates increased or decreased depending on stresses, with 16" x 16" plate at the bottom of the tree, 32" x 32" plate at the first branching, 12" x 12" at the second branching, and 8" x 8" above that. The top and bottom chords of the trusses are 8" x 8" tees, while the lacing members are 4" x 4" tees. "The architect wanted the built-up cruciform shape, despite its added expense," Czumaczenko said. "In Spain, labor is cheap and materials are expensive; here it's just the opposite." Steel fabricator for the project was AISC-member Canron Construction Corporation—Eastern Division.

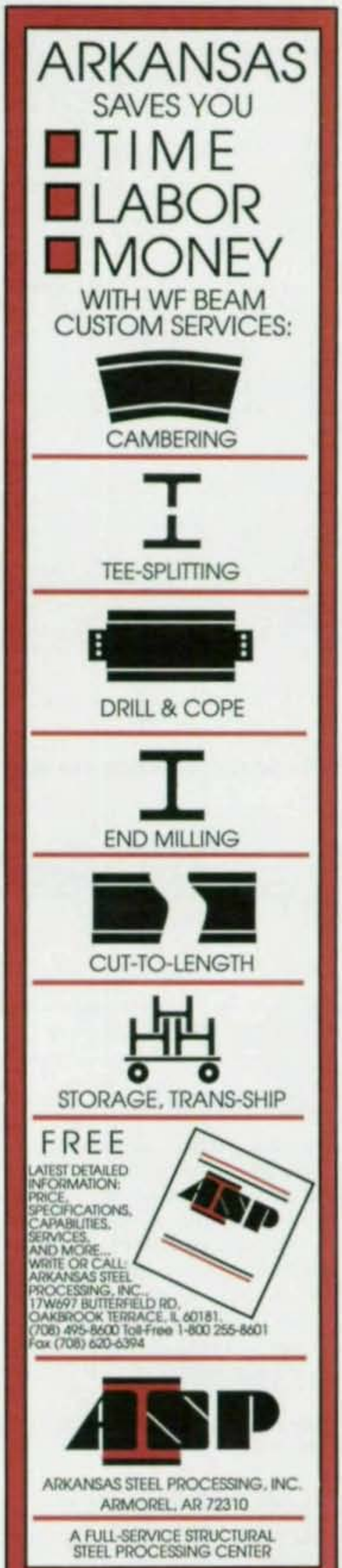
The tree columns are spaced every 45′ and primarily support the trellis-like space frame above. In addition, however, the top chords of the space-frame trusses

Separating the Galleria from Heritage Square is a large kinetic sculpture supported on a brick-clad steel beam. The large "windows", which pivot on a diagonal steel pipe, are framed with 6" x 6" hollow structural sections while steel tees are used for the horizontal elements.Photo by Robert Burley/Design Archive.

are tied into the surrounding buildings at one end. "The top chords are fixed at one end and free at the other to accommodate building movement," Czumaczenko said. Also, some of the columns have bracing elements attached to the surrounding buildings. "There's some minimal bracing where the trees first split. We could have increased the member size instead, but the architect said the bracing was acceptable."

Because of the variety of structures surrounding the Galleria—a 48-story office building, a six-story historical facade, a garden court, and a four-story building—four separate end conditions were required for the trusses. "We had to create four separate computer models to simulate the different restraint systems," Czumaczenko added. General contractor for the project was PCL Constructors Eastern Ltd.

Equally—or perhaps even more—complex is the framing system for Heritage Square. The 100' x 100' space is defined by 12 tree columns, each of which branch into two columns as they rise. The sloping perimeter columns are attached at their base to brick-clad risers



ROBOT V6

GRAPHICAL FULLY INTEGRATED STRUCTURAL ANALYSIS AND DESIGN SOFTWARE

NEW INCREMENTAL PRICING STRUCTURE. FROM $495.
Now you no longer have to switch to different programs when your problem gets larger, or you want to run special analysis. Starting with the identical program base, our $495 version, full featured version, and all those in between utilize the same easy to use yet sophisticated user interface as our full featured program. So you can buy the power you need now, and upgrade as your needs grow in the future. You won't have to learn another package. Large design firms can benefit by using ROBOT V6 packages with various capacities throughout the firm, each providing engineers with the same user interface and standardized printed output.

THE BEST TOOLS FOR STRUCTURAL ANALYSIS AND DESIGN
As a new generation software, ROBOT V6 is emerging as a new standard of excellence in structural analysis. Only ROBOT V6 provides you with unparalleled quality, reliability, calculating power, and ease of use. An investment of over 50 man-years of development effort has resulted in more than 400,000 lines of object oriented C and C++ code. Thanks to state-of-the-art programming techniques, ROBOT V6 is extremely fast and the most powerful structural analysis program running on the PC platform.

THE MOST EFFICIENT AND INNOVATIVE PROGRAM TODAY
ROBOT V6 will let you increase productivity of your design team, even if you use other programs now. ROBOT V6 capabilities leave the competition far behind. ROBOT V6 is especially geared for structural engineers, and supports various national codes for steel and concrete design using point-and-click, interactive design procedure.

metrosoft

OVER 1200 USERS WORLDWIDE. FOR MORE INFORMATION CALL 201-438-4915 OR FAX TO 201-438-7058

	UK	Germany	Italy	Belgium	Spain/Portugal	France	Luxembourg	Poland	Jordan	Morocco
Tel:	081 742 7724	(08557)410	011/6699345	(086)34 49 70	(3361) 27 00 68	76 41 80 82	25 03 60	(0 12)33 13 77	682483	26 89 43
Fax:	081 747 4663	(08557)550	011/6699375	(086)34 47 95	(3361) 27 10 90	76 41 97 03	25 03 63	(0 12)33 88 64	681600	26 09 99

STEEL BRIDGE DESIGN on your PC

Our steel bridge girder design software has been licensed by many of the largest ENR Top 500 Design Firms, as well as smaller firms and state DOTs. We now offer the following design and analysis features:

Integrated Grid Analysis & Girder Design

- ***Generates influence surfaces,*** *loads lanes or uses wheel load distribution*
- *Generates geometry for girders and bracing from a minimum of input*
- ***Plate girders and box girders w/ haunches, rolled shapes w/ cover plates***
- *12 continuous spans, variable horizontal curvature, skewed supports*
- *Powerful* ***nonprismatic girder optimization*** *processor (one that works!)*
- *Optimized girder designs satisfy user's preferences and the code*
- ***1992 AASHTO Specification, Allowable Stress Design, Load Factor Design***
- *Full control of composite action, slab pour sequencing analysis*
- ***Excellent for analyzing existing structures for specification compliance***
- *Comprehensive tabular output, graphical output of stresses and deflections*

For more information, or to request a free trial, contact:

MDX *software*

Phone	Also available:	Fax
(314) 446-3221	Screed Elevation Program	(314) 446-3278

Three pieces of steel plate are welded together to form the cruciform shape (opposite page) that the architect desired for the tree columns. The fabricator was allowed to use fillet welds, which reduced the project's cost compared with having to grind the welds smooth. Photo by Robert Burley/Design Archive.

that contain mechanical ductwork. In addition, the space frame roof also is supported by four interior columns that rise in four directions.

Rather than utilizing the cruciform shape of the columns in the Galleria, the columns in Heritage Square are square elements made up of four welded plates. Because the rain water leaders run through the columns, one plate was designed to be removable in case repairs to the leaders are necessary.

The space frame roof trusses consist of tees similar to those used in the Galleria. Snow loading was a critical issue. Because Heritage Square is surrounded by taller buildings, the Toronto Building Code required the engineers to account for a snow load of 120 psf. "Instead, we had special snow load studies conducted to obtain realistic requirements," Czumaczenko said. "The actual loads were 40 psf, except for some small areas that required 80 psf."

All of the plates—in both the Galleria and Heritage Square—are fillet welded. "We showed the architect some samples and he allowed us to leave visible welds, rather than requiring the welds to be ground smooth," Czumaczenko said.

Another interesting part of the project was a kinetic glass wall that separates the Galleria from Heritage Square. The moveable wall is located above an arched passage and its two sections each pivot on an inclined axis. The pivot point is a long hollow steel pipe set diagonally in the wall opening. The perimeter frame for these "windows" consists of 6" x 6" square tube, with tee members being used for the horizontal elements. The webs are non-uniform, with the widest point occurring where the tube extends through the web.

Irregular Structure Exposes Steel Frame

An exposed steel frame met the architectural requirements while also providing the needed tenant flexibility for the new Universal CityWalk Complex

Los Angeles' new CityWalk entertainment and retail complex was designed as a microcosm of the city's unique pop architecture. The architect used bright colors and oddly jutting buildings to create a visual feast.

By Tom Bouquet, P.E.

The new Universal CityWalk entertainment and retail complex adjacent to Universal Studios is one of the most ambitious and exciting new structures in Los Angeles today.

The complex, a four-acre microcosm of the city's unique pop architecture conceptually designed by the Jerde Partnership for MCA Development, consists of eight separate structures surrounding a system of pedestrian walkways. In project vocabulary, CityWalk consists of three major areas: "WestWalk," "Center Court," and "EastWalk."

The WestWalk portion creates a dramatic canyon of billboards, towers, awnings, hanging planters, fins, and other elements designed to give the complex a big-city feel reminiscent of the architecture of Hollywood in its heyday. It will house offices, specialty shops, a museum, restaurants and UCLA Extension classrooms, and sport an array of specialty lighting effects that will provide all the dazzle of Sunset Boulevard at night.

Center Court will form a ring of entertainment and dining venues, tied together by pedestrian bridges high above ground and covered by an exposed steel space frame.

And finally, EastWalk consists of three tiny buildings supporting exposed steel billboards rising 80' above the pedestrian walk.

The project's designers wanted the complex to look and feel as though it had been built and lived in over many years: on opening day, visitors will see pre-grown vines, specially aged facades, and variously dated architectural elements. The individual storefronts will appear to be crowded together at odd angles, bristling with signs, fins and architectural "afterthoughts." This unique and exciting design philosophy created numerous challenges for the project's executive architects, Daniel Mann, Johnson & Mendenhall (DMJM), which also provided architectural and engineering production services.

Structural Concept

CityWalk embodies the concept of the sculptured structural steel frame—a concept made possible by the revolution in computer-aided structural design and analysis techniques. The many unique applications of steel, including the large amounts of architecturally exposed structural steel, make the project a showcase for the possibilities that now exist using these techniques.

Almost every building is irregular in both the horizontal and vertical directions and has some discontinuity in the floor diaphragm; the plans were almost devoid of 90 de-

Steel was used on the project in order to achieve the tall forms and irregular shapes desired by the design team.

An Ordinary Moment Resisting Space Frame was used on this project for several reasons, including the high floor-to-floor heights and the many skewed connections and flying beams.

gree angles and were irregular to the extent that the engineers were forced to abandon a regular structural grid system in most areas. Yet all of the structural analyses of the CityWalk complex, from small vibration analyses to complex three-dimensional dynamic analyses, were performed on one PC at the Los Angeles office of DMJM. The primary lateral analysis program was SPACE-V from Digital Analysis Consultants.

The lateral force-resisting structural system is an Ordinary Moment Resisting Space Frame (OMRSF), which is anything but "ordinary" for this type of project in California. However, an OMRSF was selected for several reasons:

- To maintain desired frame stiffness for the expensive exterior wall assemblies;
- Because the many skewed connections and flying beam conditions made Ductile Special Moment Resisting Space Frame

WHEN YOU BUY ST. LOUIS, YOU BUY AMERICAN!

AND YOU GET: • FULL TRACEABILITY
• LOT CONTROL
• CERTIFICATIONS

Registered Head Markings on all structural and machine bolts:

Products from ½"—3" diameter include:

ST. LOUIS SCREW & BOLT COMPANY
6900 N. Broadway • St. Louis, MO 63147
(314) 389-7500 • 1-800-237-7059 • Fax (314) 389-7510

MEMBER INDUSTRIAL FASTENERS INSTITUTE

(SMRSF) detailing impractical;

- Because the high floor-to-floor heights and narrow building widths actually made the wind loads higher than Ductile Frame seismic forces in several transverse direction cases.

The steel moment frame system also was designed to give the owner and tenants maximum flexibility to change or expand the project, by adding mezzanines, changing tenant lease lines, or expanding on the structure. Many such changes were made during construction as tenantization progressed. One area even required that a concrete-framed basement be extended by about 5,000 sq. ft. below a four-level steel frame building that had already been fabricated. "We decided to frame the basement extension in steel," said Martin Lichtenstein, project structural engineer. "It was the only way to keep that area on track with the rest of the project." New steel column stubs were welded below the existing base plates to transfer seismic moment to concrete pedestals, and the floor framing was designed to transfer shear forces to both new and existing basement walls. Erection was finished only 2½ months after the design conception. Steel fabricator on the project was AISC-member The Palm Iron & Bridge Works. General contractor was Ray Wilson Company of Pasadena.

Unique Features

One unusual feature of City-Walk is the two-way sloped roof, or "CityRoof," which is faceted over several structures to give the illusion of a giant dome over the project. The top steel elevation for each column had to be calculated based on an algorithm for the shape of the dome, and each framing member had its ends cut at a slightly different angle. Vertical and horizontal control were coordinated with site data by the project civil engineers, IWA Engineering. Roof beams were skewed to provide a flat surface for the metal deck, which was warped to fit the curve. The imaginary dome peaks at about 60' above grade; only spe-

Access to various levels within the Center Court is provided by pedestrian bridges located at various heights (above). One of the interesting features in this project is the creation of large, free-standing billboards (right).

cial signs, fins, and towers extend above it. At 1½ times human scale, the structure below CityRoof is only three stories at most, with some single story areas rising more than 40′ above grade. Mechanical wells were provided in the CityRoof to ensure that no equipment protruded above the "dome."

The dome roof contributed significantly to the irregularity of the structural system, with each column required to be sized for its individual unbraced length, stiffness and stress characteristics. The high walls are supported by a tubular steel girt system, so perimeter W12 and W14 columns typically had to be checked for both strong-axis seismic forces and weak-axis wind forces. Flying moment frame beams, designed primarily for drift control, jog up and down the high exterior walls to follow the pattern of windows and storefront openings.

Another interesting example of unique steel framing applications is the square braced frame "stone donut" structure. Shaped like a picture frame, this structure is clad in translucent marble, which is illuminated from within at night. The supporting steel structure had to be invisible through the cladding as well as internally accessible for changing light fixtures from the inside. Due to the large size of this feature and the sensitivity of the marble finishes, the frame had to be very stiff, but dimensional requirements for "invisibility" held steel sizes to only 2". A three-dimensional space frame using 2" tube steel (ASTM A500 Grade C, F_y = 46 ksi) was designed to meet these requirements.

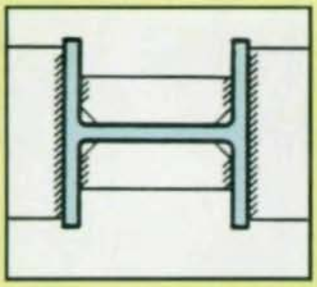
Throughout the project, engineers were encouraged to develop exposed steel framing systems consistent with the industrial, big-city image the designers wanted to convey. A major focus point of the project is a triangular courtyard surrounded by three exposed steel towers, rising 99′, 104′, and 132′ above grade. The taller two towers are partially clad in steel mesh, and illuminated by specialty lighting. The third supports an eccentric needle-like spire, similar to that of Hollywood's Capitol Records building. The spire is a vertical specialty lighting element supported on a sculpted tubular steel pedestal. The towers are purely architectural features, although the tallest encloses a spiral stair for maintenance purposes. Each was structurally designed to sit on open space frames (square, hexagonal, and circular), which in turn were integral with the building frames. Tubes, pipes, angles, channels, wide flange members and steel mesh were all used in these structures.

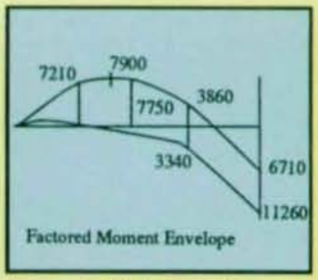
The Center Court structure also posed a special design challenge. In plan, the building consists of four unequal pie-shaped "wedges" set on a radial grid and enclosing a circular courtyard. These wedges are separated by large, radial pedestrian walkways at the ground level and interconnected by circumferential bridges of varying length at intermediate and roof levels. A 168′ diameter canted circular steel space frame covers the courtyard, providing a partial shade for the patios below. The space frame, designed by Pearce Structures of Chatsworth, CA, is supported by a built-up, canted steel ring beam, which in turn is supported by extensions of the building's seismic frame columns at each of the wedges. To support the space frame and ring beam without differential seismic deflections between the wedges, it was necessary to tie all of the wedges together, using the narrow pedestrian bridges to transfer lateral forces around the courtyard in a continuous ring. Thus, the entire Center Court complex was constructed without seismic expansion joints.

When completed in the summer of 1993, CityWalk will offer the essence of LA on a pedestrian scale, while serving to interconnect the existing Universal Cineplex, Amphitheater, and Studio Tours.

Tom Bouquet, P.E., is a structural engineer with Daniel, Mann, Johnson & Mendenhall, a leading international A/E firm headquartered in Los Angeles.

STRUCTURAL STEEL DESIGN SOFTWARE FROM AISC





CONXPRT

A knowledge-based, menu-driven PC software system for the design of connections in steel framed buildings. All strength limit states are checked and expert advice from long-time fabricator engineers is used to augment the design rules.

- Generates cope sizes, allows bolt stagger and permits different bolt diameters for shop and field use
- Designs can be stored on disk, allowing electronic communication between design parties.
- Generates complete reports showing details and strength for each limit state checked.

3-1/2" or 5-1/4" disk

MODULE I:
SHEAR CONNECTIONS
1st edition LRFD
Version 1.02 **$300**
9th edition ASD
Version 2.0 **$400**
MODULE II:
MOMENT CONNECTIONS
ASD format only **$400**

STEMFIRE

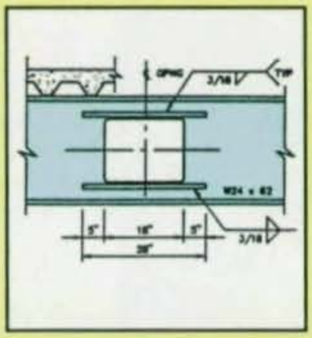
Determines safe and economical fire protection for steel beams, columns and trusses. Based on rational procedures developed by AISI which extend the published UL fire resistive designs to other possible rolled structural shapes and common protection material requirements.

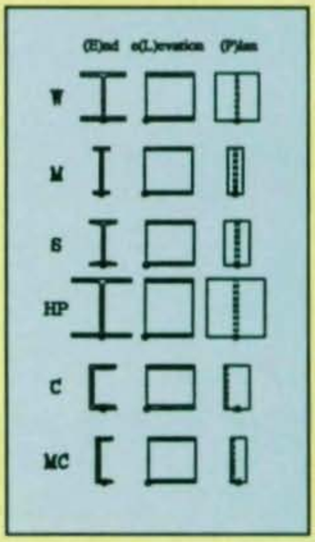
Two 5-1/4" disks & users manual **$96**
(sorry, no 3-1/2"

WEBOPEN

Designed to enable engineers to quickly and economically design beam web openings. Uses state of the art criteria and features a clear and logical data entry system with easy-to-use color coded input windows. Written by practicing engineers *for* engineers, incorporating expert design checks and warning messages which enhance the application of the AISC Design Guide—*Steel and Composite Beams with Web Openings*—to specific design problems.

3-1/2" or 5-1/4" disk. Includes AISC Design Guide **$495.00**





AISC FOR AUTOCAD

Saves time doing detail drawings of structural steel shapes in AutoCAD. Lists properties corresponding to data in the most recent LRFD and ASD manuals. Parametrically draws to scale the end, elevation and plan views of common shapes.

3-1/2" or 5-1/4" disk **$120**

ELRFD

A new sophisticated program for interactively checking structural steel building components for compliance with AISC specification. Checks whether member satisfies all limit states and limitation requirements set by the LRFD Specification and reports which sections are satisfied or violated.

- Review in detail the formulas and rules used in the evaluation and interactively assess any mathematical expression on the screen.
- Fully interactive MS Windows-based user interface.
- Disk includes ELRFD Check/Browser, AISC Structural Shapes Database and sample problems
- User Guide and Reference Manual.

3-1/2" disk only **$495**

AISC DATABASE

Contains the properties and dimensions of structural steel shapes, corresponding to data published in the most recent LRFD and ASD Manuals of Steel Construction. Presented in the ASCII format for W, S, M, HP and other common shapes and channels. Available in U.S. customary units or metric units. May be converted to Lotus 1-2-3 PRN format.

3-1/2" or 5-1/4" disk **$60**

VISA

ORDER YOUR AISC SOFTWARE PACKAGES TODAY

MASTERCARD

CALL (312) 670-2400

FOR FASTER SERVICE FAX YOUR ORDER (312) 670-5403

OR SEND MAIL ORDERS TO: AISC SOFTWARE, P.O. BOX 806276, CHICAGO, IL 60680-4124.

ALLOW 2-3 WEEKS FOR MAIL ORDERS; 7-10 DAYS ON PHONE, FAX ORDERS.

CREDIT CARDS ONLY ON PHONE, FAX ORDERS

Technology Yields Super-Fast Construction

Technology and teamwork helped 2,500 tons of steel go up—from detailing through erection—in only 10 weeks

In an extreme example of fast track construction, the project team for the American Home Products corporate office in Madison, NJ, expects to complete the 450,000-sq.-ft. building in only 18 months—including both design and construction.

"It was a super fast-track project," explained Todd Heacock, P.E., chief structural engineer with Paulus, Sokolowski & Sartor, Inc., Warren, NJ. "And the speed was client driven. They were moving out of their New York City offices and had a tight deadline."

If it had been a large warehouse project, 18 months might not seem unreasonable. But this was not a simple project.

The building features four office "pods" connected with a central atrium spine, with some of the structure sitting on top of below-grade parking. "Height limitations were a concern, so to maximize window space we designed a series of buildings," explained Bob Kady, project coordinator for The Hillier Group, Princeton, NJ, the project's architects. "The atrium then ties together the entire structure." To further complicate the project, the office pods are not set at right angles to the 60'-long spine; rather, they are skewed by 10 degrees.

Smart Planning

So how did the project team manage to meet the tight timetable? Primarily through smart planning. "The job was arranged from day one with constructability issues in mind," according to Paul

On June 10, 1992, the American Home Products building was merely a hole in the ground. By June 17, steel erection had begun. (opposite page). Steel erection proceeded very rapidly, as the pictures at right show on June 23, July 2, and July 25.

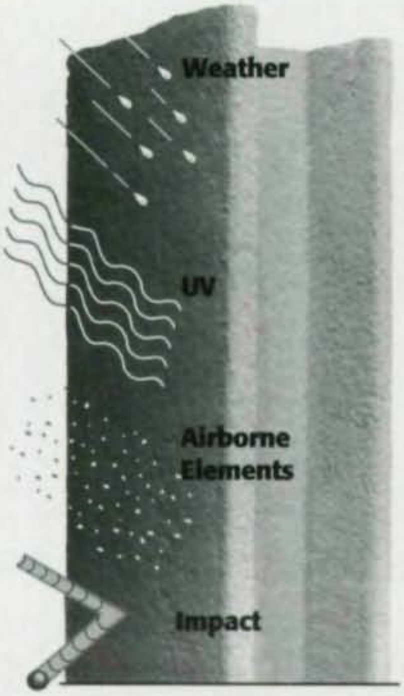
Anderson, project manager with Paulus, Sokolowski & Sartor, the project's general contractor. "The architect, general contractor and engineer were hired at the same time, and the subcontractors were selected very early in the process." And of paramount importance was getting the steel up as soon as possible. From the start of detailing to the completion of steel erection took only 10 weeks.

"The steel was competitively bid from less than 70% complete drawings," according to Robert G. Abramson, CEO of AISC-member Interstate Iron Works. But as part of the bid, the steel fabricator was required to give the structural engineer a job standards sheet including such items as connections and base plate details. This meant that throughout the job the engineer and fabricator were always on the same page. And it meant that the engineer would be designing a structure knowing how the fabricator preferred to work.

What also helped speed the steel portion of the project was the use of state-of-the-art technology by the fabricator.

"Initially, we hoped to import design drawings from the engineer's AutoCAD system to our CAD system," stated Abramson. Unfortunately, because almost every engineer uses different layering protocols, this data transfer was not feasible (for example, the way that Paulus, Sokolowski & Sartor defines a beam member on its CAD system is different from the way Interstate does). But this

When Proven Performance Counts...



Albi Fireproofing for Exposed Structural Steel

Albi fireproofing has proven its in-place performance longer than any other fireproofing available. Albi Clad is a thin, hammer-hard, smooth, durable, intumescent mastic fireproof coating for interior and exterior use. Albi Duraspray is a durable, cementitious, magnesium oxychloride fireproof coating for interior exposed steel in plants, garages and similar sites.

Albi combines superior in-plant appearance with the lowest cost-to-hardness ratio in the industry. Albi products may be applied without metal reinforcement, which eliminates potential corrosion. Albi's in-place weight is less than 1/2 to 1/20th that of cement-based products, so you can use lighter steel. And Albi's coefficient of thermal expansion/contraction is much closer to steel than epoxies or cements, so it stays on your steel.

With Albi, your steel can't look, nor your fireproofing work, any better.

Call for information and specifications: 203/828-0571

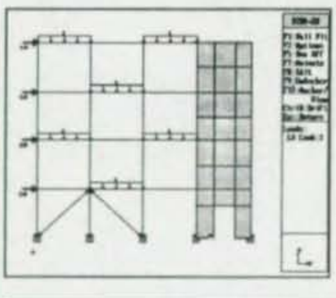
Albi
Division of StanChem, Inc.

401 Berlin Street, East Berlin, CT 06023 FAX: 203/828-3297 TWX: 710-430-9066

A Quick Quiz For Structural Engineers

The more a computer program costs, the better it is.	*TRUE*	*FALSE*
A program that solves complex, difficult problems must be complex and difficult to use.	*TRUE*	*FALSE*
Structural engineering software can never be fun to use.	*TRUE*	*FALSE*

If you answered *TRUE* to any of the above, or you would like to know more about a truly innovative software program, call us!



RISA-2D

Your complete solution for frames, trusses, beams, shear walls and much more!

RISA TECHNOLOGIES

26212 Dimension Drive, Suite 200
Lake Forest, CA 92630
1-800-332-7472

proved only a minor setback. Interstate began the project by entering all of the structural drawings onto their detailing system. Interstate uses a system from Geometric Dataflow, a now defunct company. Fortunately, Abramson explained, Interstate had earlier bought rights to the program's source code and has over the past few years substantially modified the system. "The beauty of a CAD system is that we were able to generate the basic frame very quickly," Abramson said.

Entering the frame into the system allowed the fabricator to quickly develop mill orders and to begin detailing the project. By working closely with Bethlehem Steel, the fabricator was able to obtain material in either cut-to-length or in multi-lengths as needed. Also, some of the material was available for immediate delivery from the Bethbeams depot, located in Bethlehem, PA.

As material was received by the fabricator, numerical information from the computerized detailing system was automatically downloaded to a sophisticated material tracking system and to automated fabrication equipment programs. This direct transfer of information saved time and eliminated the chance for error. "We're a fully automated shop," according to Abramson. "We do all our burning operations, hole making and cutting on CNC equipment."

In addition to doing their own detailing in-house, Interstate also does erection. The steel was primarily field bolted, and by using two cranes simultaneously, erection was fast and efficient. Main structural members were erected first, with detail pieces filled in later. This sequencing allowed other trades, such as mechanical, electrical, concrete, fireproofing, and waterproofing to proceed sooner.

Structural Design

"We tried to keep things as simple as possible," Heacock said. The three-to-five story office pods have mostly standard 30′ x 30′ steel bays, so there was a lot of repetition of elements. The columns and girders are A572 Grade 50 steel, while A36 steel was used for the infill purlins.

The structure is fully moment connected using Type 2 connections predominantly. The few exceptions occurred in the connections between the office pods and spine. Because the pods are off-center, the engineer specified bent plates. "Although it's a seismic zone 2, wind loads were slightly greater and governed the design," Heacock said.

Below-grade parking was constructed beneath a portion of the structure. To accommodate the parking structures 30′ x 60′ bay size, the engineer designed a 6′-deep transfer girder spanning 60′. A similar condition exists in one office pod containing a recreation area.

Lessons Learned

"Teamwork was essential in meeting the project schedule," according to Anderson. "There's a myth that quality and speed are inversely related. But we learned that if you emphasize quality, you'll automatically increase speed. If you do something right the first time, you'll save the time it takes to do something over.

"Productivity is a leadership, management and engineering problem, not a field worker problem. Make sure you start with a good design. And make sure you inspect work in the shop. If it's right there, then the field work will certainly go quicker and smoother."

For Abramson, there were two major factors involved in speeding this project. "The construction manager brought in the fabricator early, and made sure the fabricator was on the cutting edge of CAD and CNC technology," he stated. "And he chose a fabricator who does its own detailing and field erection."

Second, the fabricator had to provide a list of job standards. "A smart move that the CM made was that as part of our submitted proposal we had to include our standard details." And, of course, it helped that both the engineer and fabricator were willing to work closely with each other. "There was a lot of cooperation, a lot of phone calls, and a lot of faxes."

(At the 1992 National Steel Construction Conference, Robert Abramson moderated a session titled "Tieing It All Together." One of the papers presented at that session, by James P. Stevers with Globe Iron Works is contained in the 1992 NSCC Proceedings. The paper discusses the integration of data both within an organization and throughout an entire project team. "There is a revolution brewing in the structural steel industry. The revolutions called QUALITY," Stevers wrote. Copies of the 1992 Proceedings can be purchased for $20 by contacting AISC Publications at 312/670-5400 ext. 433.

How do you get a monster to shape up?

ROLLING SERVICES

	MAX		MIN.
Beam	24" x 76 lb./ft.	—	3" x 5.7 lb./ft.
Angle/Tee	8" x 8" x 1"	—	¾" x ¾" x ⅛"
Channel	15" x 50 lb./ft.	—	1" x ½" x ⅛"
Tubing/Pipe	6" O.D.	—	½" O.D.
Square	6" sq.	—	¼" sq.
Rail	132 lb./yd.	—	16 lb./yd.
Plate/Bar	4" thick	—	10 ga.

Rich-Con can do it. With our new Boldrini shape roll we can shape up monsters like 24" wide flange beams, 8" x 8" x 1" angles or 3" x 8" flat bars "the hard way."

For precision sawing and plate shearing, computer-aided design assistance or computer-driven multi-torch gas and plasma burning capability, count on Rich-Con for first-class, first-step processing.

A steel service center with a complete inventory of heavy carbon products, Rich-Con is dedicated to outstanding customer service. With a computerized inventory and order-entry system and our own fleet of trucks. Rich-Con can do it.

Kansas City's oldest business. Rich-Con was serving the Midwest before the Civil War. But our commitment's not to the past, it's to the Future. We're working hard to serve you better into the new century...and beyond.

Richards & Conover Steel Co.
Kansas City, MO
816-483-9100 • 1-800-727-0987
FAX 816-483-6983

Faeth Rich-Con
Kansas City, MO
816-221-7680

Springfield Steel Supply
Springfield, MO
417-866-6000 • 1-800-999-0987
FAX 417-869-6983

Richards & Conover Steel - Joplin Division
Joplin, MO
417-623-2222 • 1-800-666-0987
FAX 417-623-6983

RICH-CON can do it.

Leaders in heavy carbon steel for industry and construction since 1857

New Release, Lower Price

Metrosoft has announced a new pricing structure along with releasing Version 1.2 of its structural analysis and design software, ROBOT V6. New, lower pricing now starts at $495, which includes 2D and 3D linear static analysis capabilities for bar, truss and plate element models. The next step up is a package with a larger model size capacity, and the addition of shell elements. The-top-of-the-line version can handle 32,500 nodes, 32,500 elements and 32,500 loads and combinations. Other upgradeable features include: a moving load generator for loads along any 3D path with full animated graphic display of loads and influence lines; a steel module with a guided design process for the entire structure, groups, or individual elements; and an advanced analysis module for buckling, nonlinear, and dynamic analyses of mixed element models.

For more information, contact: Metrosoft, Inc., 322 Paterson Ave., East Rutherford, NJ 07073 (201) 438-4915.

Managing Materials Lists

A new version of E.J.E. Industries' Structural Material Manager includes a Production Control Module. Once a job is in production, this module lets the user produce both master shipping lists and shipping tickets. It automatically tracks which items have been shipped, the dates they were shipped, and which items have not been shipped. Another change is the incorporation of an External Data Interface (EDI), which allows users to import information from other software systems in an ASCII format. For example, a CAD program from CadVantage can export its bill of material directly to the Structural Material Manager's EDI format, eliminating the need to re-type material items.

For more information or a free demo kit of the software, contact: E.J.E. Industries, 287 Dewey Ave., Washington, PA 15301 (800) 321-3955.

Spray-On Fireproofing

Isolatek International has reformulated its spray-applied fireproofing product to achieve a higher density, greater bond and compressive strength, as well as a more uniform mix. A free eight-page brochure documents the physical properties and performance of CAFCO BLAZE-SHIELD II. The product is fast-drying and pneumatically applied with minimal clean-up requirements. Fire endurance tests in accordance with ASTM E119 have resulted in ratings of up to four hours. Because of its formulation, the product also is a highly efficient sound-absorbing material and also acts as a thermal insulator. It is noncombustible and certified 100% asbestos-free.

For more information or a copy of the free brochure, contact: Isolatek International, 41 Furnace St., Stanhope, NJ 07874 (201) 347-1200; fax 201/347-9170.

Squarewave Welding

The BURCO/CEBORA TIG STAR 16.P is a unique portable, "squarewave" TIG Welder—the first time this type of welder is available in a portable package. Squarewave technology is used primarily in the welding of aluminum where weld quality is important.

For more information, contact: BURCO, Box 2115, 530 Chapel Hill Road, Burlington, NC 27215 (919) 227-2737; fax 919/228-0760.

Steel Bridge Grid Analysis

A new steel bridge girder design program from MDX features integrated grid analysis and girder optimization. In addition to generating and loading influence surfaces for live load forces, this grid analysis program shares data with MDX's steel bridge girder design program. The scope of application for this package includes: Allowable Stress or Load Factor Design; variable horizontal curvature; skewed supports; plate girders; box girders; rolled shapes; web haunches; stiffeners; and cover plates.

For more information or a free trial version, contact: MDX Software (314) 446-3221; fax 314/446-3278.

Automated Steel Detailing

CadVantage has released Version 5.2 of its automated structural steel detailing system. While the program still allows individual input for maximum flexibility, it now also allows batch processing. Also, materials and sequencing information generated by the program can be assembled for direct import into external production software, such as EJE's Structural Material Manager. In addition, the new version incorporates a number of new connection types. On the way is a Windows version, which will allow users to take advantage of multi-tasking. Version 5.2 is available for $8,995.

For more information and a demo, please contact: CadVantage, Inc., 619 South Cedar St., Studio A, Charlotte, NC 28202 (704) 344-9644.

Finite Element Analysis

The AVANSSE program for the finite element analysis of 2D and 3D structures was developed using the new technology of Object Oriented Programming, which allows for high speed and accurate results for structures with up to 1,360 nodes, 4,080 elements, 8,160 degrees of freedom, 20 load cases, and 50 load combinations. Prices start at $250 and range up to $1,095 for a full version with many modules.

For more information or a free demo version, contact: Andrew Skwara, Engineering Bulletin Board Systems, 25439 Via Nautica, Valencia, CA 91355 (805) 259-6902; fax 805/255-7432.

Floor Design Program Adds Joist Capability

Version 3.0 of Ram Analysis' RAMSTEEL program offers several new features to the fully integrated floor framing and building design software. Now, in addition to composite and non-composite rolled or built-up shape, RAMSTEEL is capable of selecting and designating steel joist based on the S.J.I. joist designations or user defined tables. In addition, more than 30 performance or design enhancements have been added to this version, including fenced in area zoom, base plate design and support for the RAMSTEEL column module.

For more information, contact: Gus Bergsma, Ram Analysis, 5315 Avenida Encinas, Suite M, Carlsbad, CA 92008 (800) 726-7789; fax 619/431-5214.

STEEL MARKETPLACE

Help Wanted — Project Management/Estimating

Progressive and rapidly expanding Structural Steel Fabricator in Midwest is seeking motivated, aggressive individuals for Project Management/Estimating. Minimum of 10 years industry experience required. Duties include comprehensive, hands-on project coordination, cost allocation, and problem resolution. Proficient oral and written communication skills essential. Commensurate compensation and excellent benefits. Send resume with salary history to Sales Manager, P.O. Box 1066, Salina, KS 67402-1066.

STAAD-III/ISDS Design Training Seminar

Dallas, TX September 1993

Call CADVisions (214) 720-2023
(214) 720-0617 FAX

HELP—STRUCTURAL ENGINEER—WANTED

Departure of skilled P.E. has resulted in Steel Detailing Shop turning away business. Seeking a Structural Engineer, P.E. preferred, who cut his teeth in Steel Detailing, can draw if needed, and has the desire and ability to restart and run the business. Complete Detailing Operation with Steelcad II and AutoCAD on 3 stations. If you ever wanted to call the shots, this is your opportunity.

Contact: Emil Ruby, Topline Drafting, 1700 Universal Road, Pittsburgh, PA 15235
Phone: 412/793-6300; Fax: 412/795-8225

IMAGES—3D

Easy to learn
Shear & Moment Diagrams
AISC Code Check
Large Problems To 3,000 Joints
Automesh Generation
AISC Code Check
Enforced Displacements
P-δ Analysis
Static, Modal, Dynamic

Complete Static Package — Only $795
Celestial Software, 2125 Shattuck Ave., Suite 1200, Berkeley, CA 94704
Tel: 510-843-0977 / Fax: 510-848-9849
Fifty-node full function evaluation package for only $49.95

STEEL BEAMS AND PLATE FOR SALE

Excellent used steel beams, 12" @ 65 lb. and 1" steel plate used for bracing on construction project.

Like new condition — .10/lb., F.O.B. Michigan

Many other sizes available.

Call Curly at (313) 669-4103

MTD System 1

This third party software will eliminate the costly time required to assemble difficult masonry and steel component details.

60 Complete masonry and steel details are provided in isometric, plan and section for a total of 180 drawings. The details can be used as shown or simply modified to meet project specifications.

The MTD System is available for $225.00.

For a FREE DEMO, contact:
Masonry Technologies, Inc., 2000 Aldritch Place, Downers Grove, IL 60516 (708) 852-9122

2D Software

RISA-2D provides a fast, truly interactive environment for the solution of a wide range of structural design problems.
Use RISA-2D for frames, trusses, shear walls, continuous beams and much more.
Statics and dynamics are included, with full steel design.

For a free demo, contact:
RISA Technologies, 26212 Dimension Dr., Suite 200, Lake Forest, CA 92630 (800) 332-7472

GT STRUDL

New PC Version with Interactive Graphics and Links to CAD systems.

Static, Nonlinear & Dynamic Analyses and Integrated Steel Design

Curved Steel Girder Bridge Module

For information, contact: Alex Krimotat at SC Solutions
(415) 903-5050

Structural Steel & Miscellaneous Metal

Detailing software with AutoCAD for structural steel and miscellaneous metal detailers. Developed by a structural steel detailing company with over 30 years in the steel detailing business. Extensive AutoCAD training is not required. English or metric. ANYTHING that can be fabricated can be detailed with this system. Beams & Columns, Plans & Elevations, Bills of Material, Stairs, Bracing & Gusset Plates.

COMPUTER DETAILING CORPORATION
1310 Industrial Blvd., Southampton, PA 18966
phone: 215-355-6003 fax: 215-355-6210

Steel Inspection News: An Informational Digest

This bi-monthly newsletter keeps you informed on quality and inspection issues for steel-framed buildings. Specifications, codes, quality criteria, inspection and industry practices are discussed in a direct and practical manner for the fabricator, erector, inspector, engineer, code official, owner and contractor.

Subscription rates: $36 per year; $60 for two years

For more information or a sample issue:
Steel Structures Technology Center, Inc., 40612 Village Oaks, Novi, MI 48375 phone: (313) 344-2910; fax: (313) 344-2911

CLASSIFIED ADS

Reach 35,000 engineers, fabricators, architects, contractors, bridge officials and building owners inexpensively with a classified advertisement in Modern Steel Construction. It's fast and easy—we'll even do the typesetting for you at no charge.

For rate and placement information, call:
Greg Poland at (708) 679-1100.
Or fax him a note at (708) 679-5926.

GREAT NEWS FOR ESTIMATORS...

Now you can grind out a day's work in about 3 hours. No more tedious longhand calculations! The GRINDER™ software program accurately sorts and organizes your projects materials automatically. Optimizes ferrous and non-ferrous materials. Keeps track of hardware, bolts and assembled units. Includes cutting lists, pricing list, efficiency report and more.

GRINDER™ Software Company, 1774 Rose Vallet Road, P.O. Box 431, Kelso, Washington, 98626
800-677-4474; fax 206-577-4474

CBRIDGE — 3-D Bridge Analysis/Design Software
Straight Or Curved Bridges

CBRIDGE, the Syracuse University Bridge Design program is a full featured, 3-D bridge analysis and design system for straight or curved girder bridges. The rigorous 3-D analysis handles both simple and complex highway and rail bridges. Offering standard and custom loadings, vehicles up to 30 axles are automatically positioned on an influence surface. Multiple vehicle types may exist simulataneously. Automatic or user defined dead loads may be used. Mouse driven graphical interface allows rapid building and editing of design model. AASHTO code check performed during design sequence. In addition, Telos Technologies is an authorized dealer for STAAD III/ISDS, the world's most popular and widely used general purpose structural engineering software. **FREE DEMO DISK** and additional information is available on both products.

Telos Technologies, 1201 E. Fayette St., Syracuse, NY 13210
(315) 471-0113

Save $—BUY USED—ALL GUARANTEED

PEDDINGHAUS Angle Master (1983) GE Controls 6x6x½, 50' Conv.
FABRILINE FS 1010 Shear 10" Angle, 10" Channel, 14" Flats (1976)
VEMET Angle Line, 6x6x½"
KALTENBACH Saw HDM 1300 17¾" x 40" Cap (1975)
TRENNJAEGER LKH 450 Saw 18" x 40" Cap w/ Conv.
LAMINA Mag Base Drill 1½"
DOALL TF 245A Bandsaw, Vert., Tilt, w/25' Power Conv., 24" x 24" Cap.
EERTSH Roll ⅜ x 8" Initial Pinch w/ AIR Drop End
WHITNEY Beamline, 3-punch
CINCI 16'x400 Ton Hydraulic Brake
CINCI ½ x 10' Shear

Call or Fax for complete list of saws, ironworkers, shears & brakes
WESTBROOK ENGINEERING CO., 25301 Mound Rd., Warren, MI 48092
ph (313) 759-3100; fax (313) 759-3106; toll free: (800) 899-8182

CALIFORNIA STRUCTURAL ENGINEER
EXAM SOLUTION MANUAL 1987-1992

Complete problem statements and solutions for the last 6 years of California S.E. exam (except the alternate bridge problems). All solutions are based on the 1991 Uniform Building Code, 1989 AISC (ASD) manual and the 1989 ACI Code.

This 600-page manual is an excellent reference for engineers preparing for S.E. or P.E. exams and a major source of practical problems for educators in the field of structural engineering. Also, every structural engineering firm would benefit from having this reference available to their employees. Problems deal with types of building materials and strongly emphasize seismic design and analysis.

For more information, or to obtain an order form, contact: Ben Yousefi, S.E., at (619) 236-7368 or Mehrdad Maher, S.E., at (619) 236-7324.

FOR SALE

Very successful $3MM/Yr. Ohio Valley Structural and Misc. Fabricator and Erector w/$2MM backlog. Plant, property, equipment and backlog: $1.5MM.

Reply Box 6700-F, The Fabricator, 833 Featherstone Road, Rockford, IL 61107-6302.

INTERSTATE IRON WORKS CORPORATION
Servicing: New York, New Jersey, Pennsylvania
and the New England States
Steel fabrication, delivery & erection...one source for all
Our state of the art production facility of 140,000 sq. ft. built in 1986 is located on 40+ acres in Whitehouse, New Jersey.
For informative brochure please fax your request to:
Interstate Iron Works Corp., Whitehouse, NJ 08888
Tel: 908/534-6644; Fax: 908/534-4949
Celebrating our 75th year
IIW is proud to have been an integral part of the "The American Home Products Corporate Headquarters Project" featured in this issue.

FREE DEMO DISK
$250 Graphics Toolbox For Steel Detailers

Works from a bar type menu. All dimensions are displayed in true feet, inches, sixteenth. Developed by a steel detailer.

Oblique and right triangles, circles, rectangular bracing, stairs & connections, non-rectangular bracing, welded bracing, camber, feet-inch calculator, bracing end connections.

All onscreen graphics. No manual reference necessary. EGA monitor or better. Dos 3.0 or greater

Glen-Nevel Systems, 3599 Nina St., Oceanside, CA 92056
1-800-722-2945 (fax) 619-722-7365

Ram Analysis Steel Design Software

Now, get SBEAM by Ram Analysis for only $100. Full featured composite/non-composite single beam design and analysis software (LRFD or ASD). Easy-to-use with Windows graphical interface. Full 90 day money back guarantee. Also available, the RAMSTEEL Integrated Structural Software System. Fully integrated analysis, design and drafting of steel beams, joists, columns, and baseplates.

Ram Analysis
5315 Avenida Encinas, Suite M, Carlsbad, CA 92008
Phone: 800/726-7789
Fax orders: 619/431-5214
—30 Day Trial Available—

ADVERTISERS

Coming In September:
Residential & Hotel Construction
Bridge Expansion Systems & Bearings

Coming In October:
Institutional Buildings (education & judicial)
Machinery, Tools & Material Handling

Coming in November:
AISC Prize Bridge Awards
Metal Decks

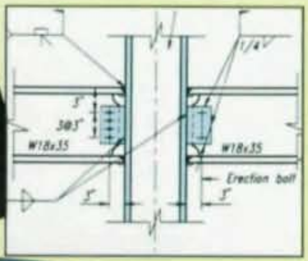
AISC ANNOUNCES

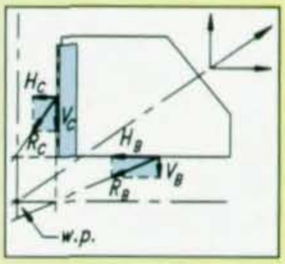
VOLUME II CONNECTIONS MANUAL

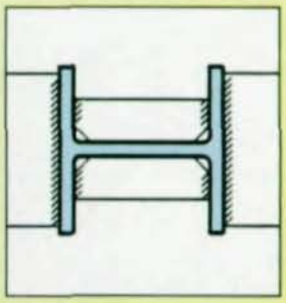
A S D / L R F D

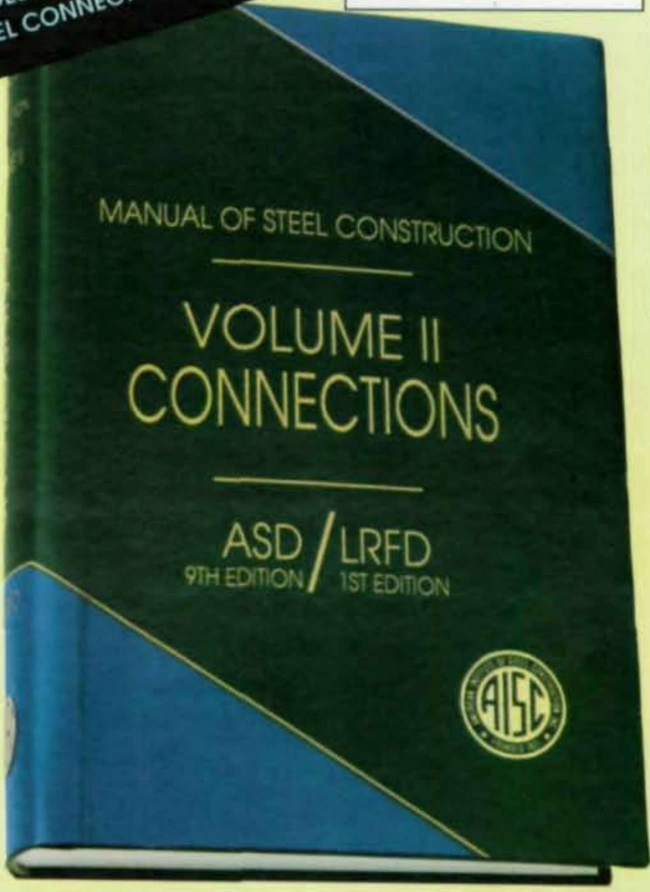
A 'MUST-HAVE' FOR ALL STRUCTURAL ENGINEERS, DETAILERS AND FABRICATORS...

ANYONE RESPONSIBLE FOR DESIGNING AND APPROVING STRUCTURAL STEEL CONNECTIONS.









▲ *Volume II Connections* is a companion and extension to the AISC *Manual of Steel Construction* (both LRFD, 1st Edition, and ASD, 9th Edition).

▲ **Contains examples and information on steel connections not published anywhere else.**

▲ Has practical and economical examples of complex connection designs in both LRFD and ASD.

▲ Based on the latest AISC LRFD and ASD specifications.

▲ Covers bolted and welded shear, moment, and bracing connections in applications not treated in either the ASD or LRFD *Manual of Steel Construction*.

▲ **FREE BONUS!** An updated copy of the AISC *Code of Standard Practice* will be sent with each book.

704 PAGES — ONLY $60.00 — ORDER YOUR COPY TODAY!

YES! I must have **Volume II Connections**.

Send me _____ copies at only $60 each.

Name/Title ____________________

Company ____________________

Address ____________________

City/State/Zip ____________________

Phone ____________________

☐ Check enclosed ☐ Charge my ☐ Visa ☐ MasterCard

Acct# ____________________ Expires ______

Signature ____________________

25% DISCOUNT FOR AISC MEMBERS

Return to:
AISC Connections Offer
PO Box 806276
Chicago, IL 60680-4124

Phone Orders
312/670-2400 X433
FAX Orders
312/670-5403

Please enclose remittance. No COD orders. Add $5 for UPS charge. Foreign orders: $10 mininum for shipping.

ETABS®
Building Analysis & Design

STATE OF THE ART

SAP90™
General Analysis & Design

STRUCTURAL STEEL DESIGN SOFTWARE

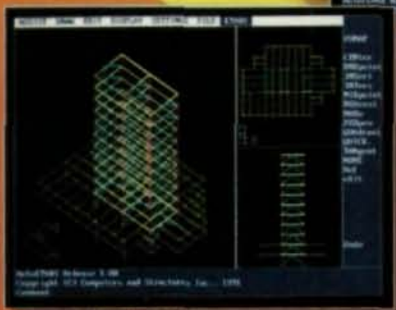
STRUCTURAL ENGINEERING ▪ EARTHQUAKE ENGINEERING

AISC ASD '89 ▪ AISC LRFD '86 ▪ UBC '91

INTEGRATED ANALYSIS & DESIGN SOFTWARE FOR STEEL STRUCTURES

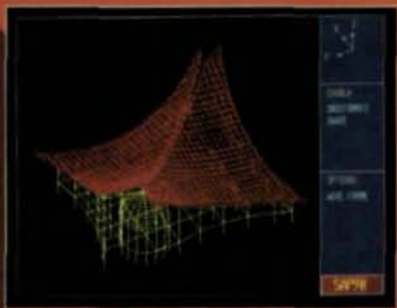
By: Ashraf Habibullah & Edward L. Wilson

Composite Floor Design

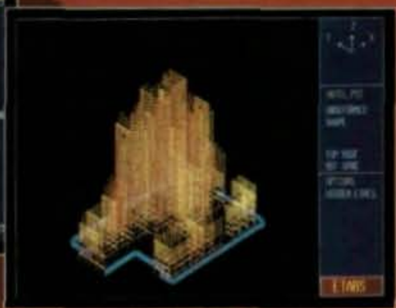


Integrated with CAD

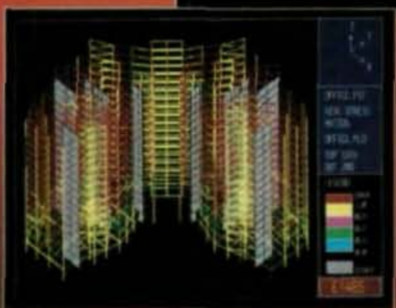
Eccentrically Braced Frames



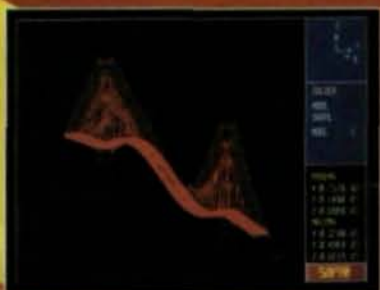
Complex Space Trusses



Highrise Moment Frames



Automated Stress Checks



Structural Dynamics

CSI

For more information:

Computers & Structures, Inc.
1995 University Avenue
Berkeley, California 94704

TEL: (510)845-2177
FAX: (510)845-4096

ETABS is a registered trademark of CSI.
SAP90 is a trademark of CSI.
©1992 Computers & Structures, Inc.