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MODERN STEEL CONSTRUCTION

May 1991

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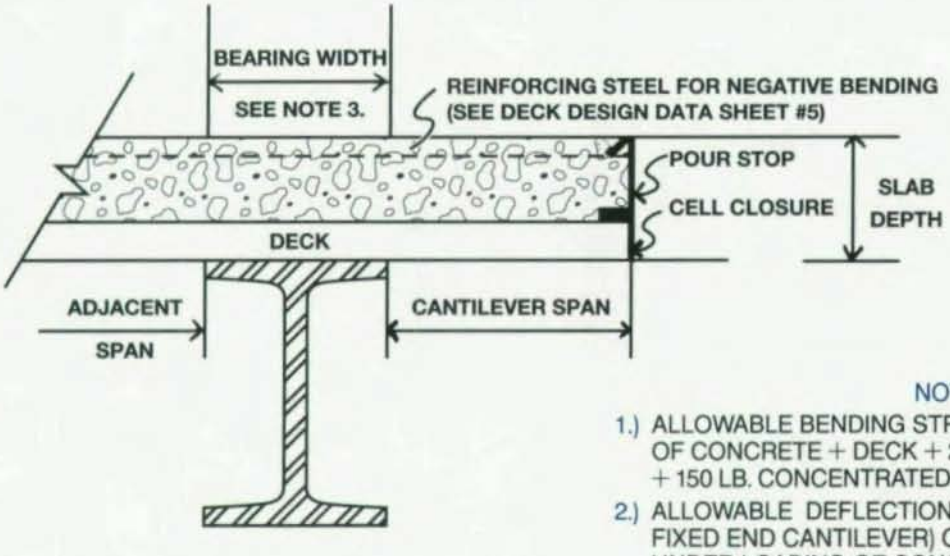
UNITED STEEL DECK, INC.

DECK DESIGN DATA SHEET

No. 7

MAXIMUM FLOOR DECK CANTILEVERS

FOR UNITED STEEL DECK, INC.



NOTES:

1.) ALLOWABLE BENDING STRESS OF 20 KSI WITH LOADING OF CONCRETE + DECK + 20 PSF OR CONCRETE + DECK + 150 LB. CONCENTRATED LOAD, WHICHEVER IS WORSE.

2.) ALLOWABLE DEFLECTION OF FREE EDGE (BASED ON FIXED END CANTILEVER) OF 1/120 OF CANTILEVER SPAN UNDER LOADING OF CONCRETE + DECK.

3.) BEARING WIDTH OF 3½" ASSUMED FOR WEB CRIPPLING CHECK — CONCRETE + DECK + 20 PSF OVER CANTILEVER AND ADJACENT SPAN: IF WIDTH IS LESS THAN 3½"; CHECK WITH SUMMIT, NEW JERSEY OFFICE.

4.) CALL NICHOLAS J. BOURAS, INC. ANYTIME YOU NEED DECK INFORMATION.

FLOOR DECK CANTILEVERS

NORMAL WEIGHT CONCRETE (150 PCF)

	UNITED STEEL DECK, INC. DECK PROFILE															
	1.5 IN B-LOK				1.5 IN LOK-FLOOR				2.0 IN LOK-FLOOR				3.0 IN LOK-FLOOR			
Slab Depth	22	20	18	16	22	20	18	16	22	20	18	16	22	20	18	16
4.00"	1' 11"	2' 3"	2' 10"	3' 4"	1' 11"	2' 4"	3' 0"	3' 6"								
4.50"	1' 10"	2' 2"	2' 9"	3' 3"	1' 10"	2' 3"	2' 10"	3' 4"	2' 6"	2' 11"	3' 8"	4' 3"				
5.00"	1' 10"	2' 2"	2' 8"	3' 2"	1' 10"	2' 3"	2' 9"	3' 3"	2' 5"	2' 10"	3' 6"	4' 1"	3' 8"	4' 3"	5' 3"	6' 0"
5.50"	1' 9"	2' 1"	2' 7"	3' 0"	1' 9"	2' 2"	2' 9"	3' 2"	2' 4"	2' 9"	3' 5"	4' 0"	3' 7"	4' 1"	5' 0"	5' 9"
6.00"	1' 9"	2' 0"	2' 6"	2' 11"	1' 9"	2' 1"	2' 8"	3' 1"	2' 3"	2' 8"	3' 4"	3' 10"	3' 5"	3' 11"	4' 10"	5' 7"
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8.00"	1' 7"	1' 11"	2' 4"	2' 8"	1' 7"	1' 11"	2' 5"	2' 10"	2' 1"	2' 5"	3' 0"	3' 6"	3' 1"	3' 6"	4' 3"	4' 11"

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MEMBER STEEL DECK INSTITUTE sdi

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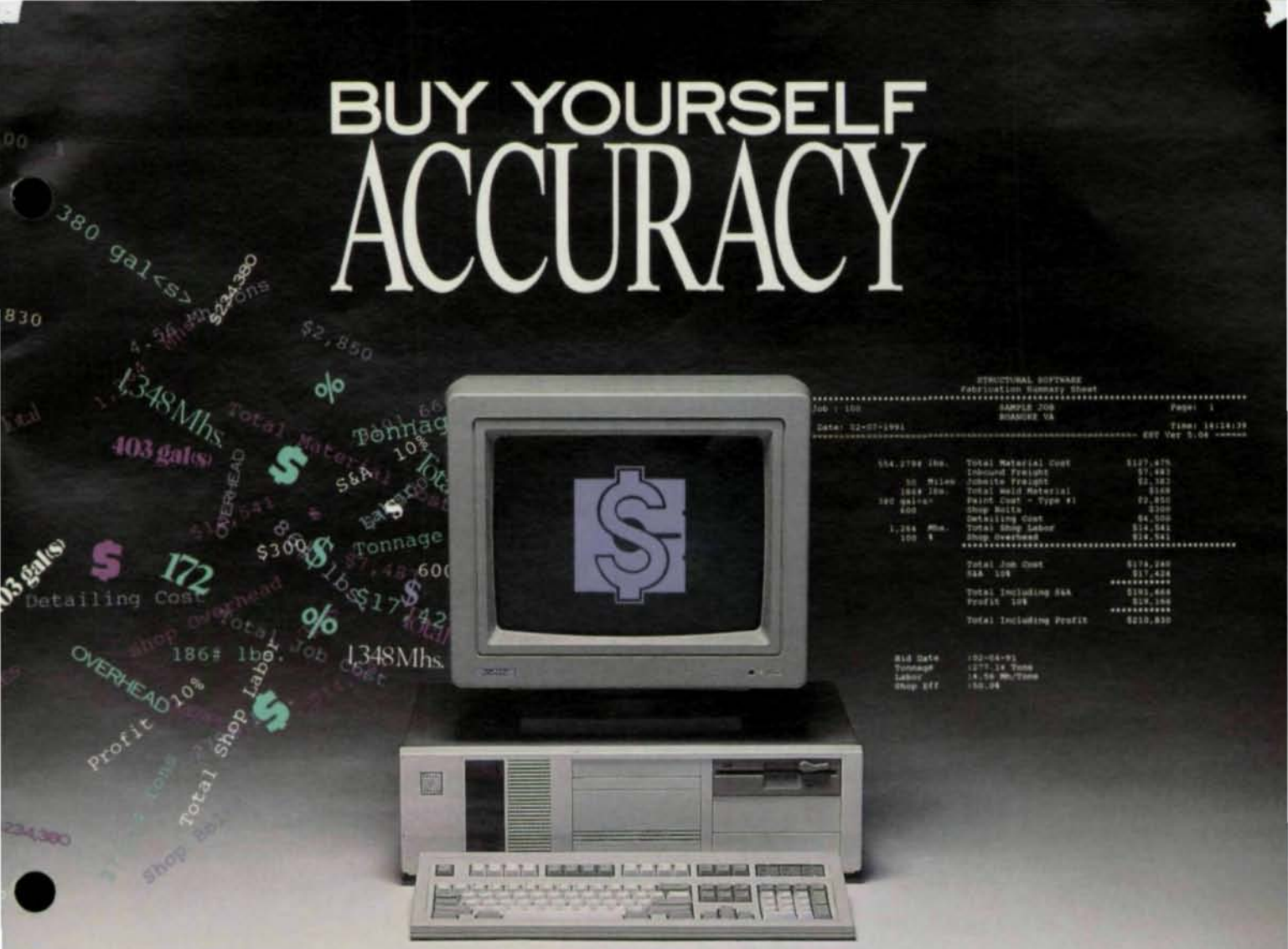

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MODERN STEEL CONSTRUCTION

Volume 31, Number 5 May 1991

The wide-open expanses of glass which created such a stupendous view from anywhere inside this vacation home were only possible with a steel-framed structure. The story behind this magnificent home begins on page 46. Photo by Dann Coffey Photography

FEATURES

NEWS AND DEPARTMENTS

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Don't Ignore Marketing Needs

During lunch a few weeks ago, a vice president from a large New York City-based design firm commented that his firm's work load was slowing down. I nodded, and mentioned that a lot of firm's were experiencing the same problem, particularly in over-built cities such as New York and Boston.

When I asked him about his plans, he spoke hopefully of expanding into some new areas—such as education, health care, and renovation work. I nodded again. It seemed like an appropriate strategy, since no slowdown is expected in those areas.

He also mentioned his firm was going to try and reduce some operating costs, though they were doing their best not to cut staff. I nodded a third time. The design field is people-driven, and it's important to maintain a quality workforce.

And then he added that his firm was slashing its marketing budget. I stopped nodding, though the comment was expected.

It seems that whenever the building cycle begins to flatten, the reaction of design firms is to pull back on their marketing. It's almost reflexive, probably because marketing is a non-traditional activity for design firms, especially those involved in engineering. But even firms known for their top-notch marketing have a tendency to cut their marketing staff whenever work slows down.

But it's also the wrong reaction. When times are hard, it's even more important to be out there pushing and soliciting new business. And if your company is expanding into new areas, marketing is crucial. How can you expect to attract clients if nobody knows you're now offering those services?

Architects are beginning to appreciate the need for marketing. Go to an AIA Convention and you're almost inundated with marketing seminars.

Engineers can't afford to lag behind. **SM**

(For another viewpoint on marketing, see Joan Capelin's article "The Dearth of Marketing" beginning on page 11.)

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Jurors Named For AISC Prize Bridge Competition

The chairman of the Steel Bridge Committee of the Transportation Research Board, an academic, a practicing engineer, and two state transportation officials were named to the 1991 Prize Bridge Competition jury by the American Institute of Steel Construction.

The biennial Prize Bridge Competition honors structural steel bridges completed and opened to traffic from July 1, 1986 through May 1, 1991. Winners have ranged from prominent mega-structures such as San Francisco's Golden Gate Bridge to smaller projects such as the Trinity Church Pedestrian Bridge in New York City. Deadline for entering this year's competition is May 24, 1991.

This year's jury members are: Charles W. Roeder, chairman, Steel Bridge Committee of the Transportation Research Board of the National Research Council and a professor at the University of Washington in Seattle; Arun M. Shirole, P.E., director of structures & deputy chief engineer of the NYDOT; Donald J. Flemming, P.E., a state bridge engineer in St. Paul; Robert C. Flory, P.E., chairman and CEO of Booker Associates in St. Louis; and Dr. David Billington, Director of the Program in Architecture and Engineering Department of Civil Engineering at Princeton University.

Award Categories

There are 10 award categories:

- Long Span—One or more spans over 400′ in length.
- Medium Span, High Clearance—Vertical clearance of 35′ or more with longest span between 125′ and 400′.
- Medium Span, Low Clearance—Vertical clearance less than 35′ with longest span between 125′ and 400′.
- Short Span—No single span greater than 125′ in length.
- Grade Separation—Basic purpose is grade separation.
- Elevated Highway or Viaduct—Five or more spans, crossing one or more traffic lanes.
- Movable Span—Having a movable span.
- Railroad—Principal purpose of carrying a railroad, may be combination, but non-movable.
- Special Purpose—Bridge not identifiable in one of the above categories, including pedestrian, pipeline and airplane.
- Reconstructed—Having undergone major rebuilding.

The Trinity Church Pedestrian Bridge in New York City was one of the 22 projects honored in the 1989 Prize Bridge Competition. Structural designer was Ammann & Whitney and architectural designer was Lee Harris Pomeroy Associates, both of New York City. Steel fabricator was Reynolds Manufacturing Co., Avonmore, PA.

Winning projects will be published in the September issue of *Modern Steel Construction.*

All entries must contain an entry form, photographs, and a written description of the project. To receive an entry form, contact: Christy Depkon, American Institute of Steel Construction, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001; phone: (312) 670-5432; fax: (312) 670-5403.

Base Isolation Addendum

The January issue's listing of suppliers of base isolation systems inadvertently omitted Watson Bowman Acme Corp. For information on this company, contact: Watson Bowman Acme Corp., 95 Pineview Dr., Amherst, NY 14228 (716) 691-7566.

If any readers are aware of other base isolation system suppliers, please contact Modern Steel Construction so these companies can be added to future listings.

Also, one of the companies included in the list, Fyfe Associates, Inc., cannot offer its product or services in the base isolation market during 1991.

Correspondence

Dear Editor:

Mr. [Richard A.] Huber's article on page 46 of the March issue ["Session Touts Certified Welder Program"] demands clarification and additional thought.

Huber says that the American Welding Society's welder certification program will save the industry money by ALLOWING certified testing laboratories to test to the D1.1 Structural Welding Code. This is not quite the whole story.

Anyone who has the knowledge to read the D1.1 Code is allowed to conduct welder qualification tests and certify that these welders passed the tests. There are many thousands of such people, including, but not limited to, certified welding inspectors.

The economical benefit to the industry is highly suspect. I seriously doubt that fabricators and other employers of welders who either test their own welders or pay for third party testing of these welders will be magnanimous enough to allow the names of these welders to be placed in an AWS registry to be available to whomever would be willing to purchase a list of names from AWS.

It is also contrary to the Ironworkers Union policy to allow another party to control a roster of names which would affect the hiring of Union members.

The remaining category of potential customers for the AWS program would be independent contractor welders who will probably think more than twice before the AWS registration and renewal of registration fees plus costs of needless eye exams can be financially justified.

The AWS program has a long way to go before it becomes financially beneficial to anyone except the AWS.

A.J. Julicher, P.E.
Gaithersburg, MD
(Welding consultant and member of the D1.1 Committee)

Welded Bridge Awards

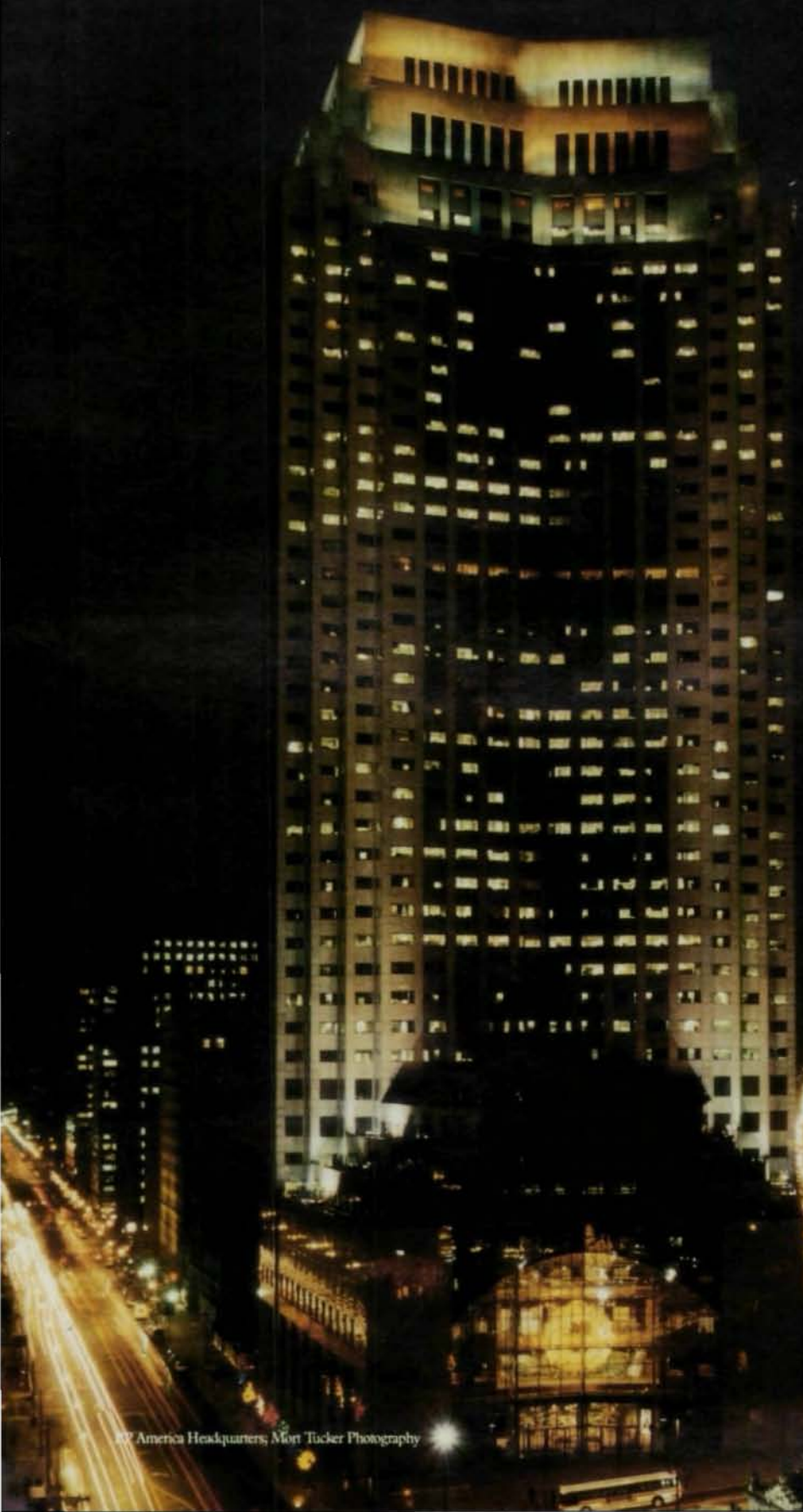
Entries are now being accepted for the Awards for Excellence in the Design and Construction of Arc Welded Short Span Bridges sponsored by The James F. Lincoln Arc Welding Foundation.

Both new construction and renovation projects completed after Jan. 1, 1989 on bridges with spans of up to 100' in length are eligible. Projects will be judged on the basis of the use of arc welding to provide design innovation, enhance structural integrity, and reduce the cost of maintaining short span bridges.

Prizes of $5,000, $2,000 and $1,000 will be presented. Entries must be received by July 1, 1991.

For more information, contact: Richard S. Sabo, Executive Director, The James F. Lincoln Arc Welding Foundation, P.O. Box 17035, Cleveland, OH 44117-0035 (216) 481-4300.

OUR WELDING PRODUCTS ARE UNSEEN IN ALL THE RIGHT PLACES.



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BP America Headquarters; Mort Tucker Photography

The Dearth Of Marketing

In this time of flat revenues, a solid marketing plan assumes even greater importance

Joan Capelin heads Capelin Communications, a New York City-based public relations firm that exclusively consults to design and building professionals. Prior to forming her own consulting firm, Capelin spent nearly 10 years with the marketing departments of several New York City architectural/engineering firms. In 1990, she received the Marketing Achievement Award of the Society for Marketing Professional Services, its highest honor.

By Joan Capelin, APR

It's doubtful that Samuel Johnson was thinking about marketing when, more than two centuries ago, he wrote: "Depend upon it, Sir, when a man knows he is to be hanged in a fortnight, it concentrates his mind wonderfully."

Although hanging is out of style these days, the current recession has caused professionals to "concentrate wonderfully" on their design business. As a result, many are re-examining whether—and how—marketing and public relations fit into their practice.

A year ago, I would have written that this was a moot question. The answer was that of course there should be an active marketing program—or at the very least, a marketing awareness—in a professional design firm. Indeed, a number of surveys in the late 1980s by ACEC, AIA and private sources indicated that marketing had become a permanent part of design practice, long since factored into the way and cost of doing business.

From my own experience during the 20+ years I've worked with design service firms, I could observe how very far this growing zest for business development had spread across the country, from the single practitioner all the way to the three- and four-letter giants.

How quickly things change.

Starting with the latter months of 1990, marketing staffs have been cut back or eliminated, budgets decimated, and public relations projects put on hold. I've seen partnerships that embraced marketing and public relations in the halcyon '80s become confused, turn on their heels, and flee from such endeavors. Some course correction may have been needed, but still, much of this is disastrously shortsighted.

Still, some good may come from all this. As a result of the cutbacks, many partners who were previously disinterested in their firm's marketing and unaccustomed to this kind of activity are making daily cold calls, writing proposals, speaking to the press, and doing stand-up presentations.

> I've seen partnerships that embraced marketing in the halcyon '80s become confused, turn on their heels, and flee from such endeavors

They are now personally faced with the sobering reality that few new assignments exist, and their traditional client base is being wooed actively by their competitors. In fact, the *ACEC 1991 Business Health Survey* found that the area in which CEOs felt they most need expertise is in marketing. To them, Dr. Johnson's adage is particularly relevant.

> You should never take the wrong type of work, even if it's all that remains between you and despair

And so, ever so painfully, they have wonderfully come to contemplate some BASIC TRUTHS.

- If it is to succeed, marketing must involve planning and long-term goal setting.
- Marketing is a commitment by the firm at the highest level, and preferably *an attitude* of the entire office.
- Marketing is not the same as selling; however, they are both essential and interrelated.
- Marketing never stops, even when the client has signed the contract and/or the firm is at full capacity.
- You should never take the wrong type of work, even if it's all that remains between you and despair.
- Similarly, going after work in a specialty totally different from your expertise—no matter how "hot" the market—is, at best, a dangerous venture.
- The marketing budget must be regarded as inviolate; no other claim should touch it.
- A few tactics—a brochure, an occasional article, an ad in some journal, membership in the "right" organization—do not constitute a marketing strategy.
- The firms that get the work, attract the best people, and have the biggest lines of credit are those that remain visible and work constantly at maintaining their credibility.

Up to this point, much of what I've written could be marked with exclamation points for emphasis. But for what follows, the most useful punctuation is the question mark.

Shedding Light On The Subject

What is the difference between marketing and selling? A few definitions might help.

Marketing basically is deciding what you want to do and where; for what type of people; for what kind of payment; and at what level of effort. *Sales* is going out after the work that this thought process, backed up by marketing research, identifies.

Public relations is the communications arm of marketing. Anything having to do with telling or showing anyone else who you are and what you do falls within the spectrum of public relations activities.

Some people confuse public relations and advertising. *Advertising* is bought space in a publication or on radio or television. When you advertise, you pay for a specific amount of space and time, and you directly control the message.

What kind of work will yield you the satisfaction you want without unduly penalizing you?

The people who act as your agents are paid a percentage of the advertising cost. *Public relations* is providing, at no cost, information which the media then decides whether to use editorially. You pay for the time of the person who is your representative.

In a comprehensive marketing plan, all of these are involved, though finding the right balance is up to you.

How Do You Find The Best Balance?

It's a lot easier than most people think. You know the answers; it just requires concentration to bring them out into the open. Or you can hire someone to help.

Start with a solid business plan.

What do you want to accomplish professionally and personally: Pride and satisfaction? A big bank account? Collaboration or independence? Expanded knowledge? Security? Endless challenges? Travel? How much money do you need to get to that point? And how will you get it?

A marketing plan emerges from the decisions to these questions: What kind of work will yield the satisfactions you listed above without unduly penalizing you? What kind of client will provide them? What kind of colleagues and surroundings will make your job enjoyable? How close is this to where you are now?

How Much Effort Does Marketing Require?

Are you willing to pay for the right level of competent support if you can't put in your own time and effort to formulate and implement a marketing plan? In my office, we speak about a client's "matching grant." If he or she doesn't care enough to get involved, why should we?

In the same vein, do you want such support to be in-house, outside, or both? Either way, you are going to pay for the assistance. I have worked both ways, so I know first-hand that in-house marketing people don't have the time to do the long-range projects or specialty work that require extended efforts, and often they don't have the experience or contacts. However, they do have the advantage of day-to-day presence in the office and the confidence of their colleagues and other members of the firm.

Timing Is Of The Essence

What is your timetable for results: Overnight or over a year? How much patience and flexibility do you have if a marketing pro-

gram must stretch into the future?

Like football players, good marketing and public relations people have to know where the goal line is and have a plan for getting there. They have to factor in elements such as style and image, know where other people are at any time and keep on moving—not only forward but around any obstacles in their path within a set amount of time.

Donald Trump (not that he's everyone's role model) wrote in *The Art of the Deal*: "I never get too attached to one deal or one approach." And with his current circumstances, he has certainly proven the need to be flexible about obstacles in his path.

> Most important for good marketing are the desire and ability to change

Most important for good marketing are the desire and ability to change. Do you enjoy change? How much change can your firm absorb? How able will it be to use new concepts, words, and materials, and to benefit from the visibility generated? How quickly?

Not everyone welcomes change. One of the most exciting marketing and public relations campaigns I ever initiated was ultimately put aside, despite its being the pride and joy of the firm's president and his marketing manager. We redirected the way his firm was described, we rewrote his brochures, and we sent him out into the world to proselytize. But the effort collapsed and the needed changes never occurred. Why? Because he was unable to convince his partners and staff members that there would be a payoff for the shift in vision and approach. He was ready for change, but his firm wasn't.

What's The Hardest Part Of Marketing?

Answer: Keeping the program moving consistently and with the same high level of commitment. Performance can only be judged at the finish line: You have to know what it is; where it is; and what is needed to get there.

It's been my experience that a firm does best when it confines itself to one single-minded (but not simple-minded) effort, conveying as few messages as possible. You may think that repeating the same message over-and-over is designed not to confuse your audience—but actually it's so the people transmitting the message can keep things straight and moving forward.

Similarly, when Charles-Edouard Jeanneret (Le Corbusier) said: "Creation is a patient search," he could just as easily have been talking about public relations for design professionals like himself.

Creating or changing someone's opinion, attitude, or behavior can, according to sociologists, take two years or more.

The changes you want won't happen unless you stay determinedly with your marketing campaign. People who go start-stop, start-stop through a marketing or public relations effort do themselves a tremendous disservice. The rules of physics make it abundantly clear: It takes a lot less energy to keep an object in motion than to stop and restart it.

How Will You Know If Your Marketing Is Succeeding?

Structure the marketing plan so your goals and objectives are clear and quantified. How many leads do you expect to generate? How many doors do you want to open? How many new clients do you expect to bring in?

(But don't ask your public relations consultant to promise a specific number of articles published; it's considered unethical behavior by the Public Relations Society of America.)

Let me step gingerly into the area of the intangible. The brochure itself is not what's important; rather its importance lies in the decisions about the firm's direction that developing a brochure will force you to make.

Likewise, a news release is important only as it reflects your decision to target your efforts to a specific audience where your research indicates there is an opportunity.

Just as in design, the decision making *process* is often more valuable than what results. Being successful does not necessarily mean a shelf full of materials. It does mean being able to move ahead with the utmost confidence.

Of course, you have to build accountability into your marketing efforts. That way, if you don't reach your objectives you'll have a way to assess why it didn't go as planned. In most cases you'll have to report to others on what happened, or didn't happen, and why; this is not the moment for guessing.

Finally, most professional design firms will list satisfaction with the quality of their design work as the single most significant measure of the success of their practice. In that case, the purpose of marketing is clear: It enables a firm to do the kinds of projects it *wants* to do, rather than the projects is *has* to do to stay in business.

And that goal, Dr. Johnson, is something wonderful on which to concentrate. ■

Just as in design, the decision making process is often more valuable than the results

Custom-Designed Steel Joists from Canam Steel Play Supporting Role in Unique Structures.

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Leaning High-Rise Buildings

What nature accidentally did to a famous tower in Italy, engineers are doing intentionally to create a new visual dimension in architecture

Puerta de Europa

This article is adapted from a paper by Leslie E. Robertson, P.E., Saw-Teen See, P.E., Monica V. Svoljsik, P.E., and Richard Zottola, P.E.

Why construct a building that leans from the vertical?

When architect Gunnar Birkerts of Birmingham, MI, recently designed a sloping building, he explained that he sought to "free the building from the vertical," to "surpass the traditional role of functional accommodation, visual complacency and the general attitudes of generic high-rise structures."

Stephen Achilles, a partner with John Burgee Architects, the designer of another sloping building, explained that when his firm received the commission for the Puerta de Europa building in Madrid, the planning approval stage was already in process with two towers contemplated, each on widely separated footprints.

"The separation was necessary to avoid three subway stations, related underground pedestrian passageways, and the right-of-way of an unbuilt street. The heights and plan dimensions of the towers were so separated that they failed to work together as a pair or to define the edges of Paseo de la Castellana. Instead, they threatened to give the appearance of simple repetitiveness, as so often happens in the case of housing blocks," he stated.

"We solved the problem by sloping the towers toward each other. A relationship was immediately established between the two, and a major gateway was formed. As the towers are situated on a major traffic rotary, the Plaza de Castilla, which forms the northern limit of the Madrid business district, the gateway image seems entirely appropriate."

The firm of Leslie E. Robertson Associates has been retained to provide the structural engineering for several leaning high-rise buildings. Two projects, with a total of five such buildings, are now under construction, including the sloping towers of Puerta de Europa.

Project owner/developer is Urbanor S.A. (Madrid) and architects are John Burgee Architects

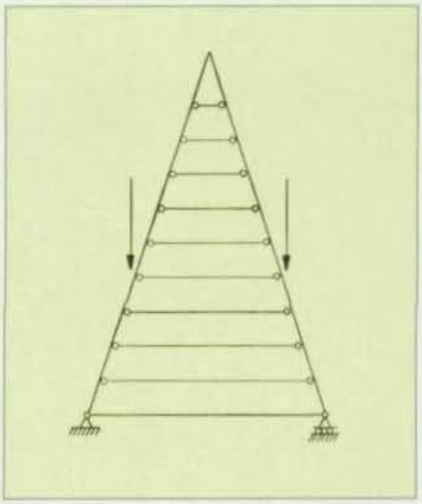


Figure 1: The Basic Building Block

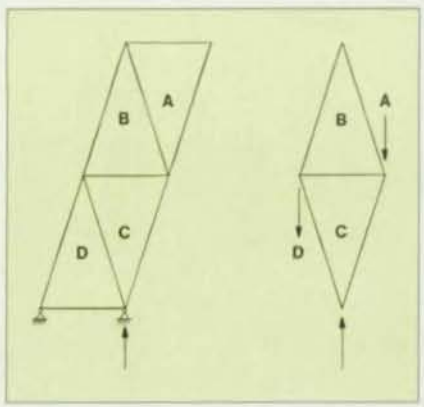


Figure 2: Balancing Gravity-Induced Stress Levels

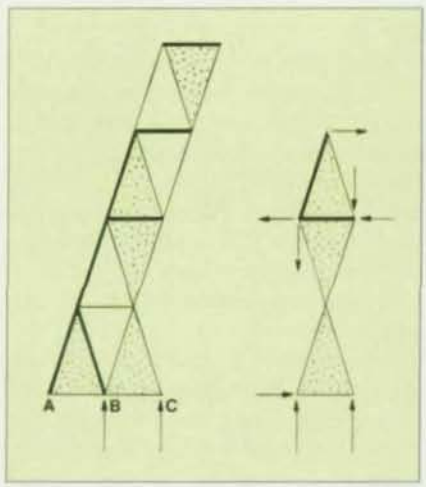


Figure 3: A More Complex System

(New York) with Pedro Sentieri Cardillo (Valencia).

The 25-story buildings have a height above the plaza of nearly 375' and have a slope of 14.3°. While alternative designs were considered and priced, the final design makes use of a reinforced concrete core and structural steel frame, both of which are post-tensioned.

Sloping Theory

Beyond the needs of a "normal" building, a leaning building requires an enhanced lateral-force system in the direction of the cantilever and an enhanced torsional system on account of the eccentricity of transverse lateral forces. It is important to realize that the cantilever creates a substantial gravity-induced overturning moment but that the gravity-induced shearing force is zero.

While all building systems must incorporate an adequate level of lateral stiffness and strength, a leaning building must have significantly increased stiffness in the direction of the cantilever. That is, in addition to the need to resist the normal lateral forces from wind and earthquake, the system also must resist the gravity-induced overturning moment—and must do so at very low levels of lateral deflection. This enhanced requirement is particularly severe in that gravity induced lateral deflection may not be recoverable; i.e., such deflection may remain permanently in the structure, and, in concrete structures, may increase with time on account of the long-term (creep) properties of concrete.

Prior to beginning work on the Puerta de Europa project, Leslie E. Robertson Associates had considered several structural concepts for leaning buildings. Much of this work was done in association with the architectural firm of Gunnar Birkerts And Associates, Inc.

In order to obtain the high level of lateral stiffness cited earlier, a triangulated structure offers unique advantages in terms of both stiffness and strength. Additionally, it may offer opportunities to incorporate the structural system into the visual expression of the building.

Figure 1 shows the basic triangular building block. Where carrying symmetrical vertical loads, the system acts as a vertical cantilever, carrying the symmetrical loads without bending.

Secondary lateral system

Under unsymmetrical loading, as is required for live loads and for the lateral loads from wind and earthquake, a secondary lateral force system is required. This secondary system must span between the nodes (corners) of the basic building block. By combining two of the basic building blocks to create a parallelogram shape, it is possible to create a more complex system with gravity loads distributed to the nodes for later distribution to other building blocks in the overall system.

The cantilever creates a substantial gravity-induced overturning moment but the gravity-induced shearing force is zero

Note that both symmetrical and unsymmetrical loads induce compressive (or tensile) loads into the floor construction. Due consideration of these loads, with particular attention to secondary stresses, is essential.

When the building blocks are composed of isosceles triangles (figure 2), each is capable of carrying its own gravity loads to the foundations without uplift in the foundations. By balancing gravity-induced stress levels in the vertical and horizontal members of the combined parallelogram shape,

sidesway can be minimized and each of the floors remains level. However, some kind of secondary lateral force system is required to deal with unbalanced lateral forces and with lateral loads introduced between the bases of each triangular shape.

A more complex system can be achieved by combining four or more of the basic triangular building blocks (figure 3). Again, the structure more-or-less balances on one lower corner. Under lateral forces from wind or earthquake and as a result of unbalanced live loads, some form of tie-down is required in the other lower corner, however. This tie-down can be composed of rock or earth anchors, tension piling, or a ballast (concrete mass).

Balanced Structure

To remain in equilibrium, the weight of the lowest building block must be carried up to its apex so as to balance the weight of the uppermost triangular building block. The extra weight of the structure over that of a conventional building is found largely in this requirement. Additional unique structural requirements are associated with the slope of the column and with the gravity-induced forces in the floor system.

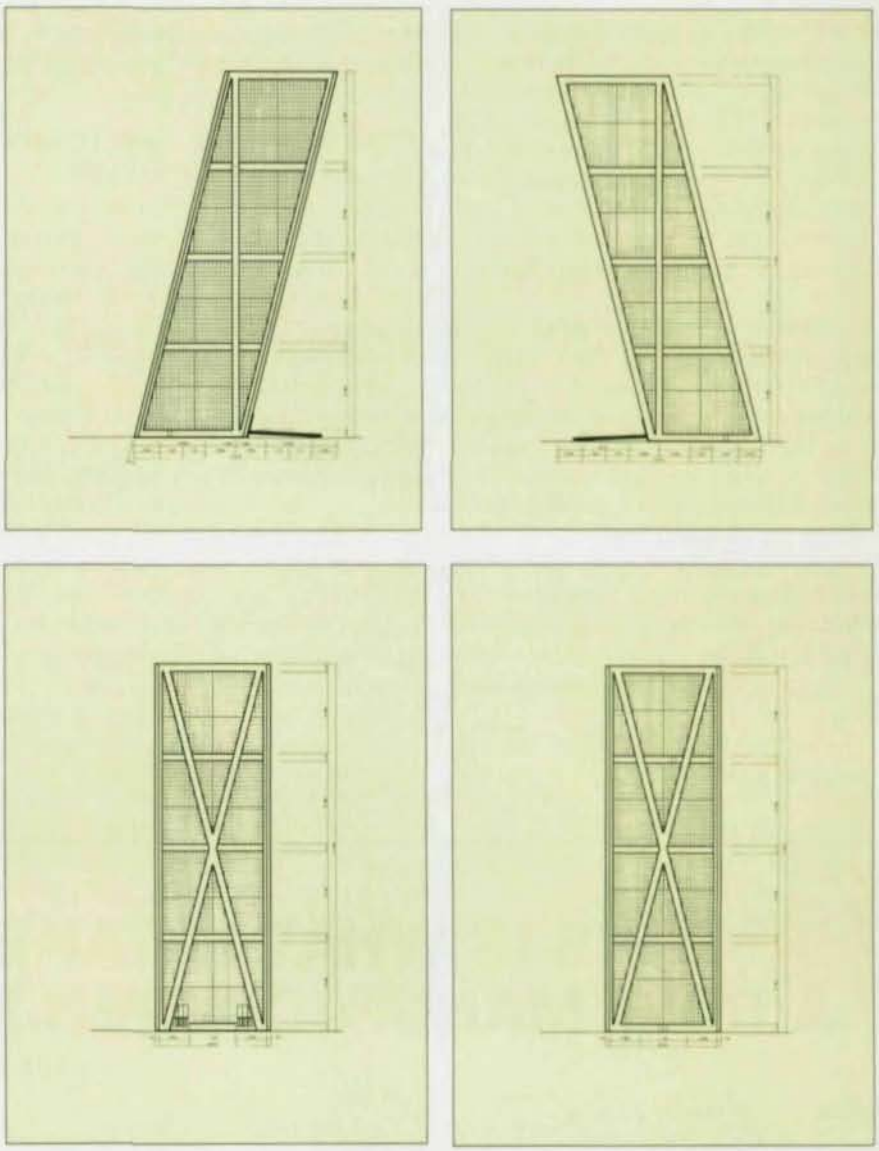
Ever increasing levels of complexity and drama can be developed. Omitting considerations of wind, earthquake, and lateral stiffness, the amount of material required in a complex sloping building for columns and diagonals would exceed that of a standard structure by 60%. However, since the floor framing is unaffected, the total increased weight of the structural materials on the project would be considerably less than 160% of a standard structure. Also, post-tensioning of those members of the structure in gravity-load tension would reduce the gravity-required strength and thus the weight of the framing materials.

Deflection Compensation

While many techniques are available to compensate for most of the gravity-induced lateral deflection, this issue remains the dominant factor that drives the structural design of a leaning high-rise building. Approaches, any of which can be combined, include: cambering the structure; increasing stiffness; and post-tensioning so as to make equal to zero some portion of the gravity-induced lateral deflections.

Several factors must be considered in choosing a deflection-compensating system. The deflection due to the live load may be twice that due to wind or earthquake and the deflection due to dead load my be perhaps four times as large. The total gravity-induced lateral deflection, then, may be five to 10 times larger than the lateral deflection due to wind or earthquake. As a result, the exclusive use of cambering could be a problem. Stiffness alone also is impractical because the level of stiffness would have to be five to 10 times that of a normal building, which would be very expensive.

Another factor is that most of the overturning moment is associ-



The two sloping towers of Puerta de Europa have a mixed structural system featuring steel columns and beams and a concrete service core. The steel is post-tensioned to increase the efficiency of the structural system by reducing the required stiffness.

ated with the upper floors of the building—and occurs after much of the structural system has been completed, which again argues against the exclusive use of cambering. In developing the system of deflection compensation, it is important both to recognize and exploit this vertical distribution of overturning moment.

Clearly, post-tensioning is a proven technique for the control of gravity-induced deflections. In concept, post-tensioning is introduced into those elements of the structural system that are under gravity-induced tension so as to place these members in compression. By placing the post-tensioning system in the outer (tension) wall of the building, it is possible to compensate for all or a part of the lateral deflection induced by gravity loading.

Post-tensioning creates an increased efficiency of the structural system by allowing a reduction in required stiffness, thus reducing cost.

Case Study: The Twin Towers Of Puerta De Europa

The structural system for the Puerta de Europa project was selected in response to cost, construction time, exterior aesthetic, and anticipated interior layout considerations.

The building's columns are of structural steel with yield points ranging from 36 ksi to 65 ksi, with some columns in below-grade areas encased in concrete. Composite steel/concrete columns were considered for the four corners of the tower, but the concept was discarded during the construction documents phase to help reduce construction time.

Beams and girders are of structural steel with yield points ranging from 36 ksi to 50 ksi. With a floor-to-floor height of just over 13', an electrified raised floor of 5.2", and a 5.8" slab/deck assembly, the depths of the beams are necessarily heavily constrained. Accordingly, nearly all the beams and girders are located on the architectural module so as to allow light fixtures to nestle between the floor framing. Even so, most of the floor beams are notched to allow passage of ductwork and the flange width of girders is severely restricted.

The service core is of reinforced concrete and the structural design allowed for slip forming, sliding forms, jumped forms and the like. The design does, however, presume that the service core is constructed so as to be 10 floors or more ahead of the structural steel.

Tie-down ballast of reinforced concrete is used to provide an adequate factor safety against overturning. The ballast is 165' long,

41′ wide and 31.7′ deep, and weighs 15,400 tons.

The post-tensioning used on the steel for this project is a conventional system, albeit one manufactured for use in post-tensioned concrete construction. For physical protection, the post-tension is carried in steel-pipes, not post-tensioning ducts. The system is anchored in the concrete ballast at the base of the building and anchored again at the top of the parapet. The basic deflection-control operation takes place at the parapet level.

Lateral Force System

Unlike the relatively simple geometric forms described earlier, more complex geometries were required to meet the functional and aesthetic limitations imposed by the Puerta de Europa project.

Transverse to the direction of the cantilever, the system is fairly straightforward. In the direction of the cantilever, however, the system is more complex.

Structural steel frames were placed in each of the two exterior walls. To mobilize the stiffening influence of the intrinsic triangulation of the facade, 25′-deep roof-top stiffening trusses frame the depth of the plant room space. The deflection-control system is provided by post-tensioning, which is anchored at the parapet and dead-ended in the ballast and spliced at the point where the slope begins. The facade is not cambered.

Post-tensioning creates an increased efficiency of the structural system by allowing a reduction in required stiffness, thus reducing cost

Two interior frames are provided, both making use of the concrete service core. These frames have three essentially independent components:

- A triangulation consisting of a vertical steel column and the structural steel diagonal;
- A triangulation consisting of the vertical concrete service core and the structural steel diagonal; and
- The cantilever stiffness of the service core.

All systems are post-tensioned. Prior to post-tensioning, the total overturning moment is distributed to the service core and to the various frames in a manner dependent on the sequence of the construction and on the relative stiffness of the various elements.

For the towers of Puerta de Europa, the service core remains the

dominant lateral force element until such time as the steel-to-concrete connections are completed at the roof.

As those connections are completed, the stiffness of the construction increases markedly. The introduction of post-tensioning, then, brings the concrete service core back to the true and plumb position so as to reduce to almost zero the overturning moment carried by the service core and the steel frames.

Long-Term Effects

Since the service core and its foundations must carry a significant overturning moment until the time of post-tensioning in order to allow construction, the concrete core must be designed for this temporary loading.

The creep deflection of concrete can add significantly to the gravity-induced lateral deflections. However, it is possible to use the long-term effects of concrete to offset other long-term effects, such as imposed live loads.

For example, the long-term shortening of the concrete member can be used to offset the bending moments of the concrete to produce a net sway equal or close to zero.

Alternate Designs

A variety of alternate designs were considered for the Puerta de Europa project.

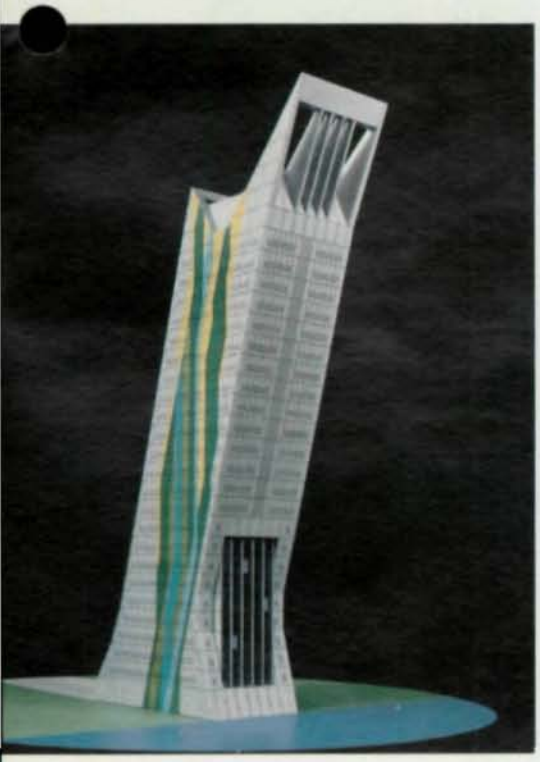
In one alternative, the post-tensioning is contained solely within the service core. Because the lever arm of the post-tensioning is greatly reduced, the amount of post-tensioning is increased proportionally.

In order to control deflections, it is essential that the post-tensioning system be load-balanced, which requires a significant increase in concrete strength. And even with an increase, the core wall thicknesses need to be increased throughout the height of the tower and particularly at the anchorages of the post-tensioning.

Also, the effect of the long-term axial deformation produces a near-fatal long term creep deflection. It is not feasible to compensate for this deflection by over post-tensioning. Likewise, there is a significant increase in the overturning moment on the services core that results in a significant increase in the cost of piling, which is only partially compensated by a reduction in the size of the ballast.

The system's major advantage, a modest simplification of the steel work is offset in part by an increased requirement on the part of the floor diaphragms.

A second alternative involves placing a portion of the post-tensioning in the service core, while the remainder is located in the outer wall. The principal advantage of this system is that the de-



Domino's Farms Tower, Ann Arbor, MI

According to architect Gunnar Birkerts: "The Domino's Farms Tower exhibits a dynamic interaction between a structure and its surrounding landscape. As it has been freed from urban contextual considerations, it enjoys the freedom of movement in a rural setting. There are no restrictions or rules governing its physical appearance. This allows for a kinetic interaction with nature.

"The building structure is a cantilever; a fifteen degree incline off the vertical (a modest one by comparison to Frank Lloyd Wright's Falling Water, which is a ninety degree cantilever off the vertical).

"The architecture of the Tower is expressive and compelling. It is intended to invoke an emotional response to it. It is intended to be memorable with an image that is verbally easily conveyed.

"The architecture of this building has surpassed the traditional role of functional accomodation, visual complacency and the general attitudes of generic high-rise structures. It is destined to excite, compell and deliver a new facet in architecture."

flection control operations can take place early in the construction process. This alternative allows the start of curtain wall construction earlier, thus leading to an earlier occupancy.

Compared to the first alternative, this system reduces substantially the over-turning moment capacity required of the service core.

A major disadvantage is the reduction of the amount of rentable area due to the increased size of the structural connection between the outside wall and the service core. In addition, two separate post-tensioning systems are required and the construction time of the service core is increased.

Leslie E. Robertson, P.E., FASCE, C.E., S.E., D.Sc., and D.Eng.; Saw-Teen See, P.E., C.E., M.Eng., MASCE; and Richard Zottola, P.E., M.Eng., MASCE, are partners with the firm of Leslie E. Robertson Associates, a New York City-based consulting structural engineering firm with a world-wide reputation for innovative design. Monica V. Svojsik, P.E., M.S. and M.Eng., MASCE is an associate with the firm. □

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Airport Hotel Grows Up

A multi-phase renovation project culminated with an eighth floor expansion

After more than three decades, the Hotel MIA at Miami's International Airport could not compare with facilities offered in other major cities. Comfortable and soundproof rooms, restaurants, lounges, meeting rooms and health clubs are all derigueur today, and the old 1950s hotel lacked many of these features.

However, its location inside one of the nation's 10 busiest airports complicated the renovation/expansion. An airport never sleeps, and an airport hotel can never be shut down. As a result, a long-term, phased project was planned.

While the final construction work finished just one year ago, the initial phases began in the mid-1980s. This early work included gutting and rebuilding the guest rooms and expanding the lobby. In addition, a new mezzanine for administrative offices was added to the existing connected terminal. To provide headroom for a new lobby bar below the administrative space, composite steel deck was used with fully encased steel beams.

Conference Center

Perhaps the most interesting part of the early work was the creation of hotel meeting rooms in an office structure adjacent to the hotel and connected to it with expansion joints. "We wanted to create large, open spaces, so we had to remove the existing interior columns," explained Bart Wallis, P.E., vice president and chief engineer with Bliss & Nyitray, Inc., Miami.

Steel trusses were installed to span 42', from exterior column to exterior column. Two columns were removed from three bays to create the open meeting rooms.

Because the existing office struc-

The new eighth floor of the Hotel MIA in Miami features a lounge and swimming pool. The glass-heavy addition was designed as a modern complement to the original 1957 facade.

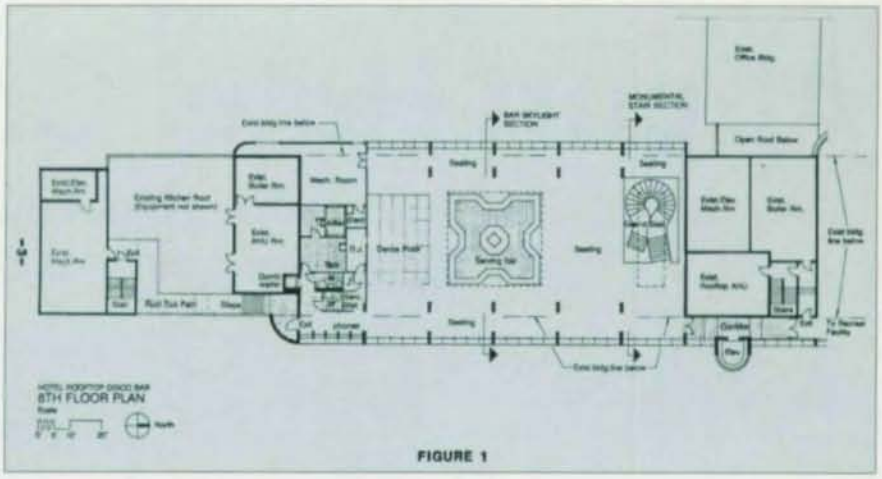

FIGURE 1

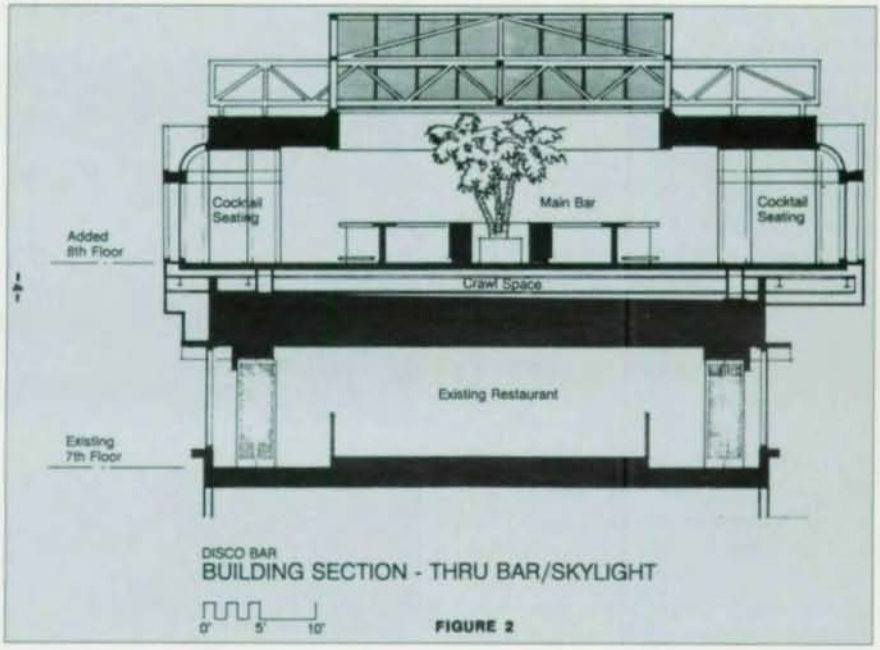

FIGURE 2

ture was steel framed, the 4'-deep trusses could be installed on top of the existing beams, with the beams acting as the bottom flange of the truss. Gussets were welded to the tops to connect new web members. A combination of high-strength bolts and field welding was used for the connections.

Since access was limited, steel was fabricated in 10' sections and hand-carried using the building's stairs and elevators.

Rooftop Expansion

The last phase was the construction of a new lounge and recreation center. "The challenge was to add new space—but since the Terminal is all built-in, the only place to go was up," explained David Wong, field project administrator with Robert B. Browne Architects, Coral Gables, FL.

Since weight was a prime consideration in adding a new floor, steel framing was specified even though the rest of the hotel was concrete.

The new recreation area is built over hotel guest rooms. "The existing bay spacing was approximately 21', with a girder framing across the length of the building approximately 50'," Wallis said. "The new construction is built with the new steel columns bolted with epoxy anchors on top of the existing concrete columns." Both the new columns and new girders are W18 sec-

tions. The new frame is welded to form a rigid frame to resist lateral wind loads and hurricane force winds. Steel fabricator was AISC-member Richmond Steel, Inc., Houston, and steel erector was Poston Bridge & Iron, Fort Lauderdale, FL.

The old roof was left intact, and the new eighth floor was built "floating" 4' above it to provide space for utility lines.

Access to the site was severely limited. To solve hoisting problems, a tower crane was erected in the median strip of the Terminal's departure and arrival drives—the only location that would not restrict traffic.

Stainless-Steel Pool

The recreation area includes a stainless steel swimming pool supported on a steel frame. "Wide flange steel sections were suspended down to form a "bed" for the stainless steel pool," Wallis explained. "One bay of girders were removed to provide a 42'-long open space and the pool was supported on the existing columns."

Rather than being built over guest rooms, the new eighth floor lounge extends over a column-free restaurant. The existing structure in that area was inadequate to carry the 100 psf live load of the new construction, and available depth for new floor construction was limited. The solution was to create a new composite girder using the existing roof beam, and then adding vertical plates to allow installation of a new upper beam section. In turn, the upper beam section supported a 4½" composite steel deck. The new "Vierendeel" girder permitted using the web openings to run the many plumbing, telephone, electrical and central beverage dispensers lines required to serve a lounge facility.

Steel was essential for this project for several reasons. "A lightweight steel structure meant that we didn't need to reinforce existing columns," Wallis said. Steel's light weight also simplified hoist-

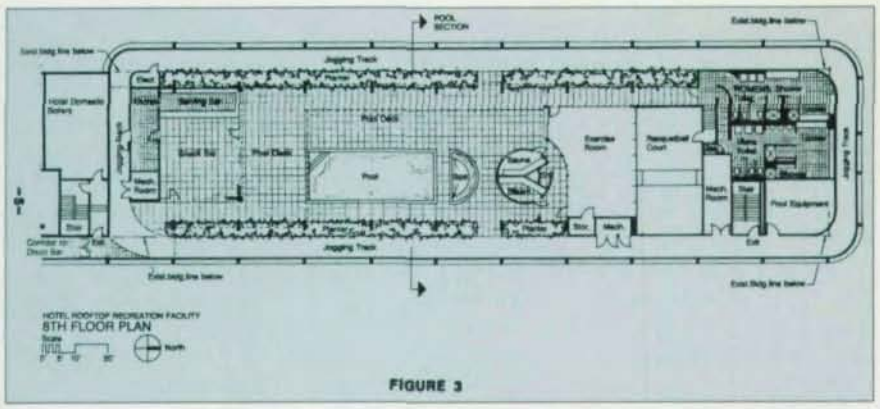

FIGURE 3

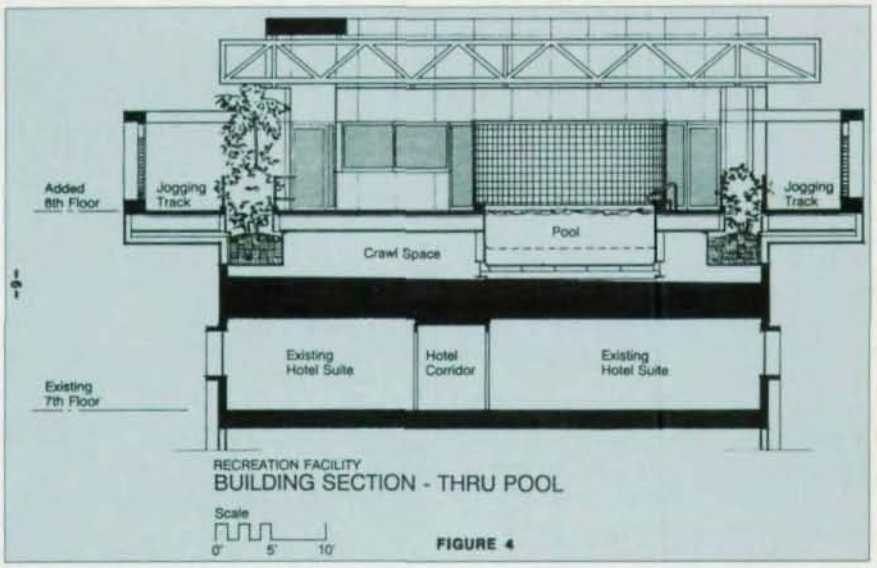

FIGURE 4

ing. "We were working in a busy airport in operation 24 hours a day. We could only hoist during specified hours. With steel, we could quickly hoist a full-day's load and stockpile it on top of the roof."

Also, steel construction can be framed without being shored. "Since we were working on an existing roof with occupied space below, it was important that we keep the existing roof intact," Wallis said. "With steel, we could open space around an individual existing column, attach the new steel column, and immediately seal the area. And the steel frame and metal deck provided its own working platform."

While the concrete columns didn't need reinforcing, adding 20' to the structure's height did mean accommodating increased wind loads. Analysis revealed that moment reversals due to wind loads could not be accommodated by the building frame, yet do to space constraints, no new shearwalls could be added. The solution was to infill half-story openings in various locations to create new shear diaphragms.

The new roof over the main bar area consists of a large skylight. "The glazing is double-insulated for sound protection and maximum tinting was specified for glare control," Wong said. In addition, a motorized shade is used to block the sun during mid-day hours. Likewise, fabric curtains cover the bar's windows.

While most of the eighth floor is enclosed, the part over the pool was left exposed.

Construction of the final phase began in August 1988. The recreation area opened in February 1990, while the lounge portion opened three months later. □

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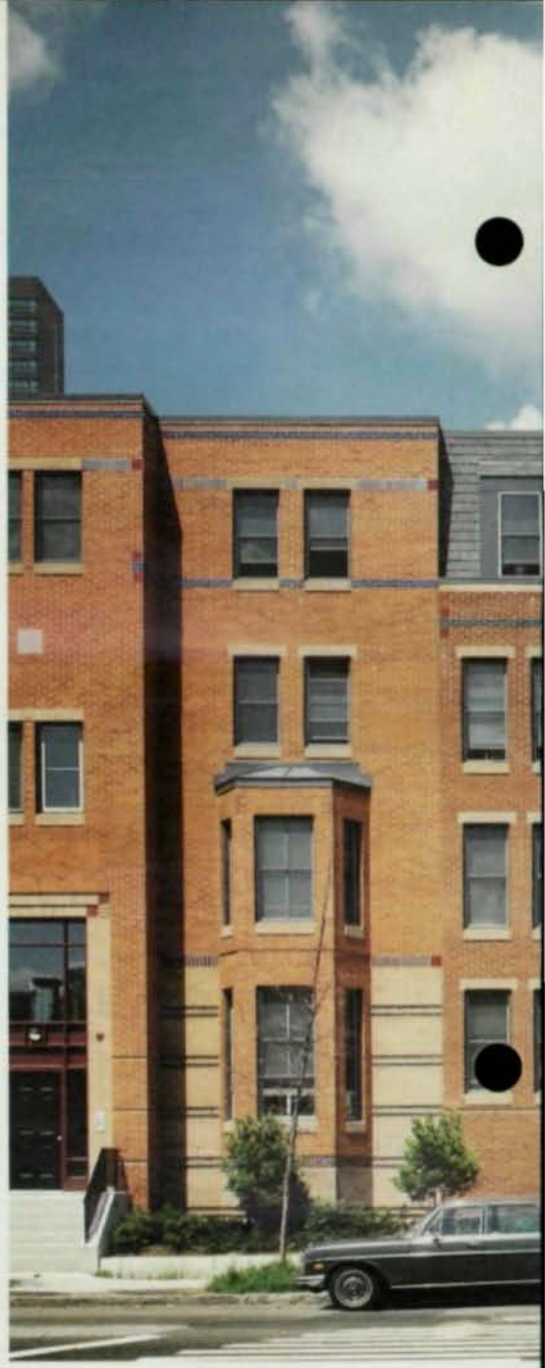
Transitional Design

A Boston residential project succeeds in gracefully bridging the gap between a 19th century residential neighborhood and a modern commercial center



The designers of Tent City, a 269-unit, mixed-income residential community in the heart of Boston's Back Bay/South End faced two major challenges: the need to architecturally make the transition between two radically different neighborhoods and to structurally provide both housing and parking on one site.

One side of the development borders the South End Historic District—one of the largest extant examples of 1850s residential architecture, while on the other side is the Copley Place commercial district.

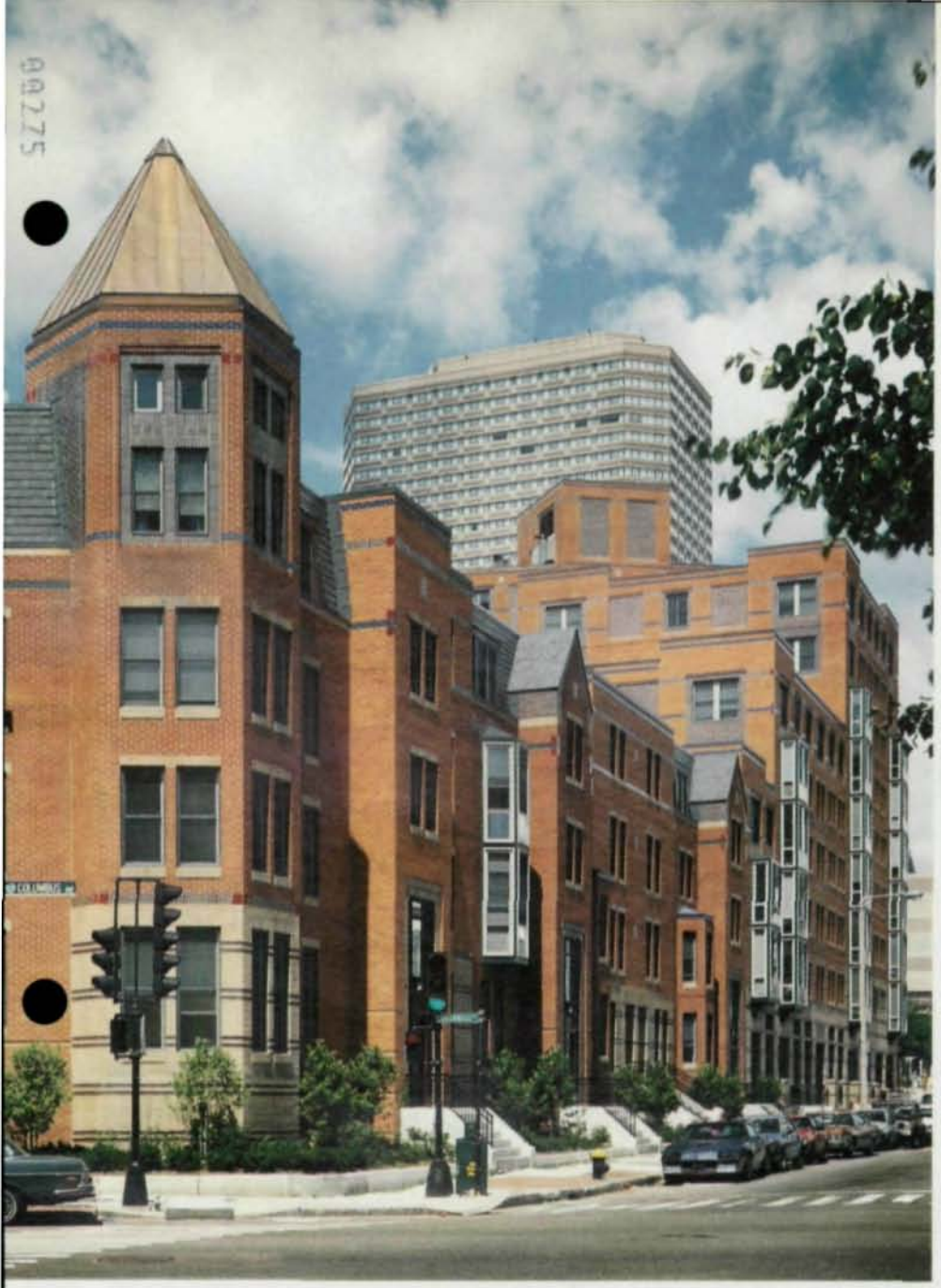
The architectural solution was to combine low-rise townhouses with mid-rise apartments. In addition, there is a limited amount of retail space incorporated into the project. "The development makes a graceful transition from historic Copley Square with its Churches, Boston Public Library and Copley Place to the traditional 19th century Victorian townhouses of the South End," explained John M. Clancy, FAIA, principal with Goody, Clancy & Associates, Inc., Boston. "A 12-story mid-rise building matches the height of its neighbor, Copley Place, then gradually steps down across the site to meet the four-story townhouse height of its South End neighbors."

The structural solution was to bury a two-level, 698-car garage beneath the site—and to use the garage's roof as the foundation for the low-rise portion of the project. Because of landscaping and vehicle requirements, the roof of the structure had to be designed to support 500 lb. loads.

Structural Platform

Since the garage was already being designed to accommodate such a high load, it was possible to use its roof as a platform for the low-rise townhouses, explained Michael Jolliffe, P.E., a principal with Zaldastani Associates, Boston, the project's structural engineer.

"The low-rise columns simply sit



The low-rise townhouse portion of Tent City is designed to meld into Boston's old South End neighborhood. The use of red and tan brick and large windows ws contextual, while the brightly colored glazed brick and precast lintels were used to add richness and interest. As in traditional architecture, the structure is clearly divided into a distinct base, middle and top. Photos by Steve Rosenthal

on the roof of the garage, which allows for a very efficient and very cost effective garage layout," Jolliffe said.

Because of the much greater loads, the columns in the mid-rise portion of the project were designed to correspond to the location of the garage columns.

Moment-Resisting Frames

Both the low-rise and mid-rise portions have moment-resisting steel frames with steel beams and girders on the column lines and steel bar joists supporting a concrete floor slab on metal decking. "From the second floor on up we have 3" concrete on 9/16" galvanized steel decking," said Anand Lele, P.E., a senior associate with Zaldastani. An exception to this floor system occurs on the first level of the mid-rise portion where the floor consists of 6¾" lightweight concrete over a 2" metal deck supported on steel beam and girder construction. "In that area of the building we needed to provide a fire separation between the floor and the garage," Lele explained.

Bracing was added in the transverse direction of the mid-rise portion for lateral stability. "Bracing is less expensive than a moment connection, and we could locate the bracing in the walls between the units in the transverse direction," Lele said. Bracing couldn't be used in the longitudinal direction, however, because the only possible locations were in the exterior walls and that would have limited window space. In the low-rise portion, lateral stability is provided by transferring loads from the moment frame to the plaza level.

1,789 Tons Of Steel

The project used 1,324 tons of A36 steel and 465 tons of A572 Grade 50 steel. "We used A36 steel for the columns and most of the girders, except where there was a restriction in depth," Lele said. Construction cost for the above grade portion was $26 million,

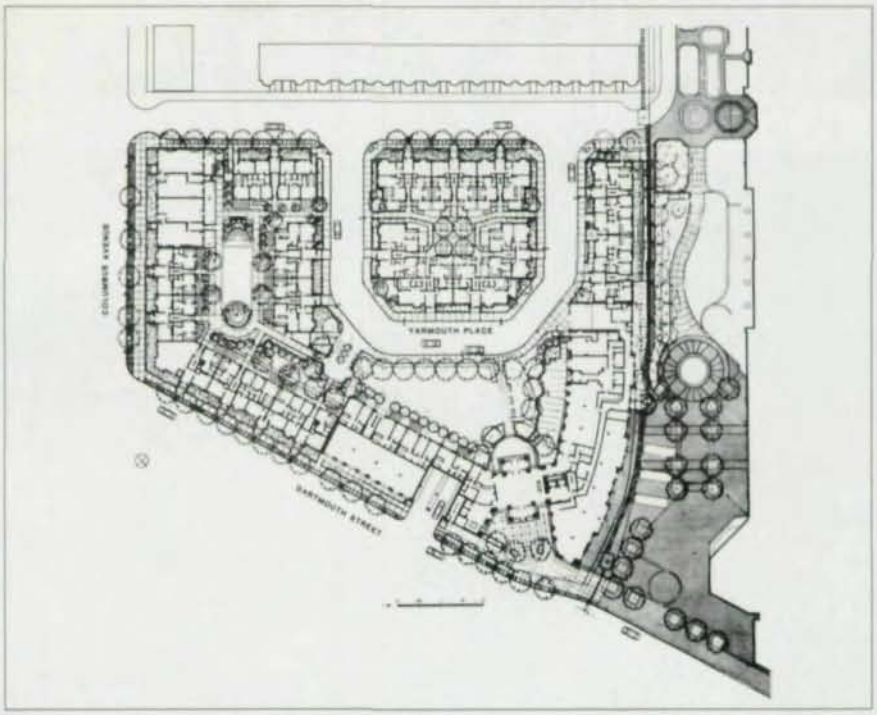
while the parking structure cost $12 million. Structural steel fabricator and erector was AISC-member Novel Iron Works, Inc. Contractor on the project was the Boston office of Turner Construction Co.

Economical Decision

Steel was the obvious choice for the project because of its light weight, which enabled the low-rise portion to sit on the parking structure roof. "We looked at concrete, but steel was more economical," Lele said. In addition, the structure's peculiar geometry, which involved very little repetition of form, more readily lent itself to steel construction.

The plan was dictated by street locations, a curved boundary on one side, and the architectural needs to make the transition between the two neighborhoods.

"The four-story townhome units have the same relationship to the street as the nearby historic buildings—they're set back and have ele-



The residential development is built on top of a two-level, 698-car below-grade parking garage. The low-rise portion uses the garage's roof as a foundation, while the mid-rise portion's columns extend through the garage. The entire development forms a transition between Boston's South End and a neighboring commercial development.

vated front stoops," Clancy said. "A curve on the northern side of the project reflects the location of a former rail line, which is now a park. We wanted to get the maximum space out of the site while also reflecting the historic importance of the curve."

All of the buildings are clad in varying shades of red and tan brick, accented by brightly colored glazed brick and precast concrete lintels. Changes in the brick color were used to add interest and richness, and, as is common in traditional architecture, to indicate a distinct base, middle and top to the buildings. The one and two bedroom units in the midrise portion feature oversized bay windows with striking views of the city.

"We chose our materials to reflect, without copying, the architecture of the nearby historic district," Clancy said. The overriding architectural and planning goals were to create a human-scaled, urban living environment. □

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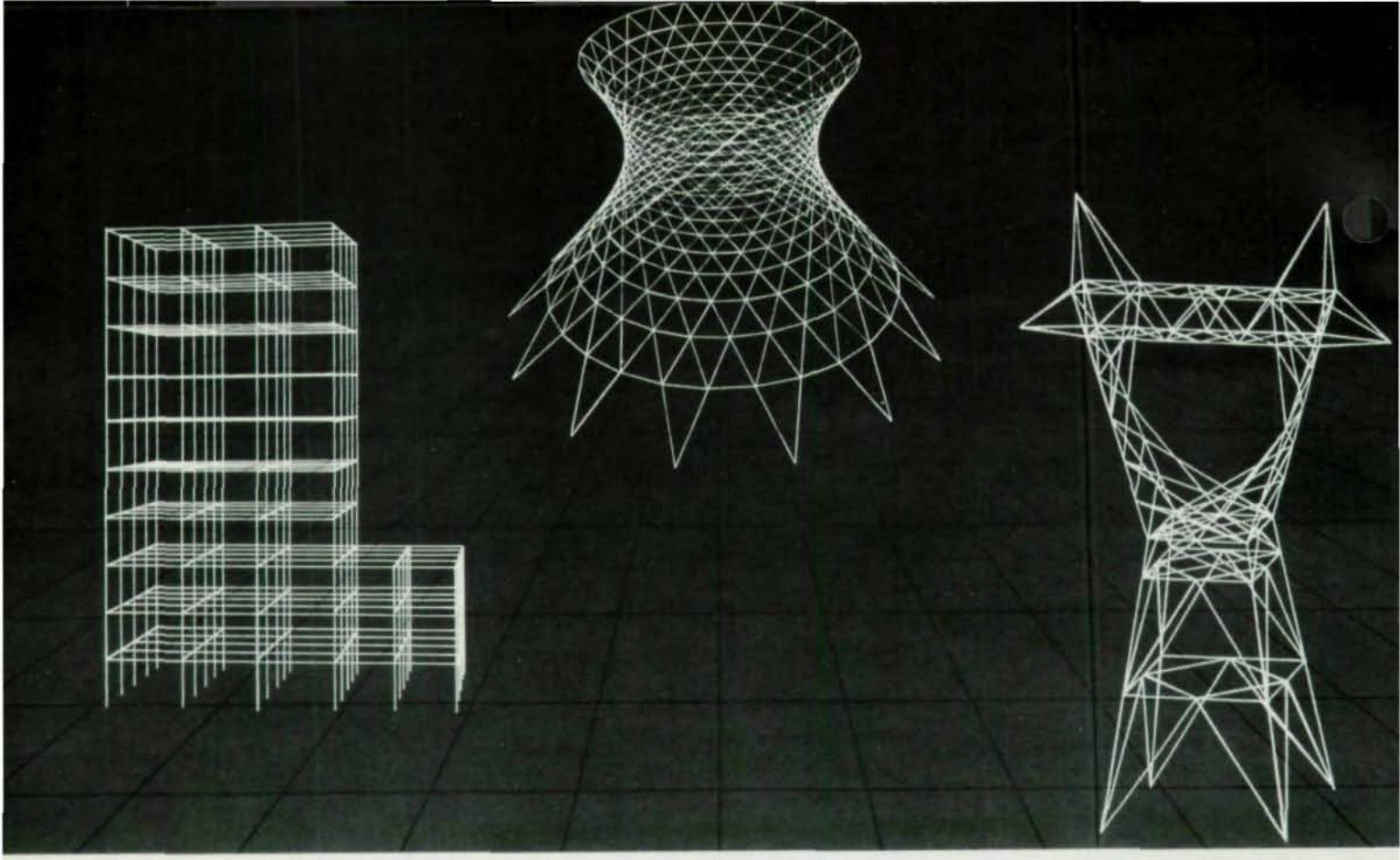

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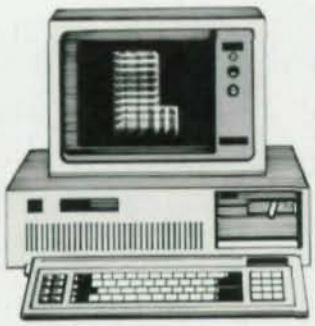

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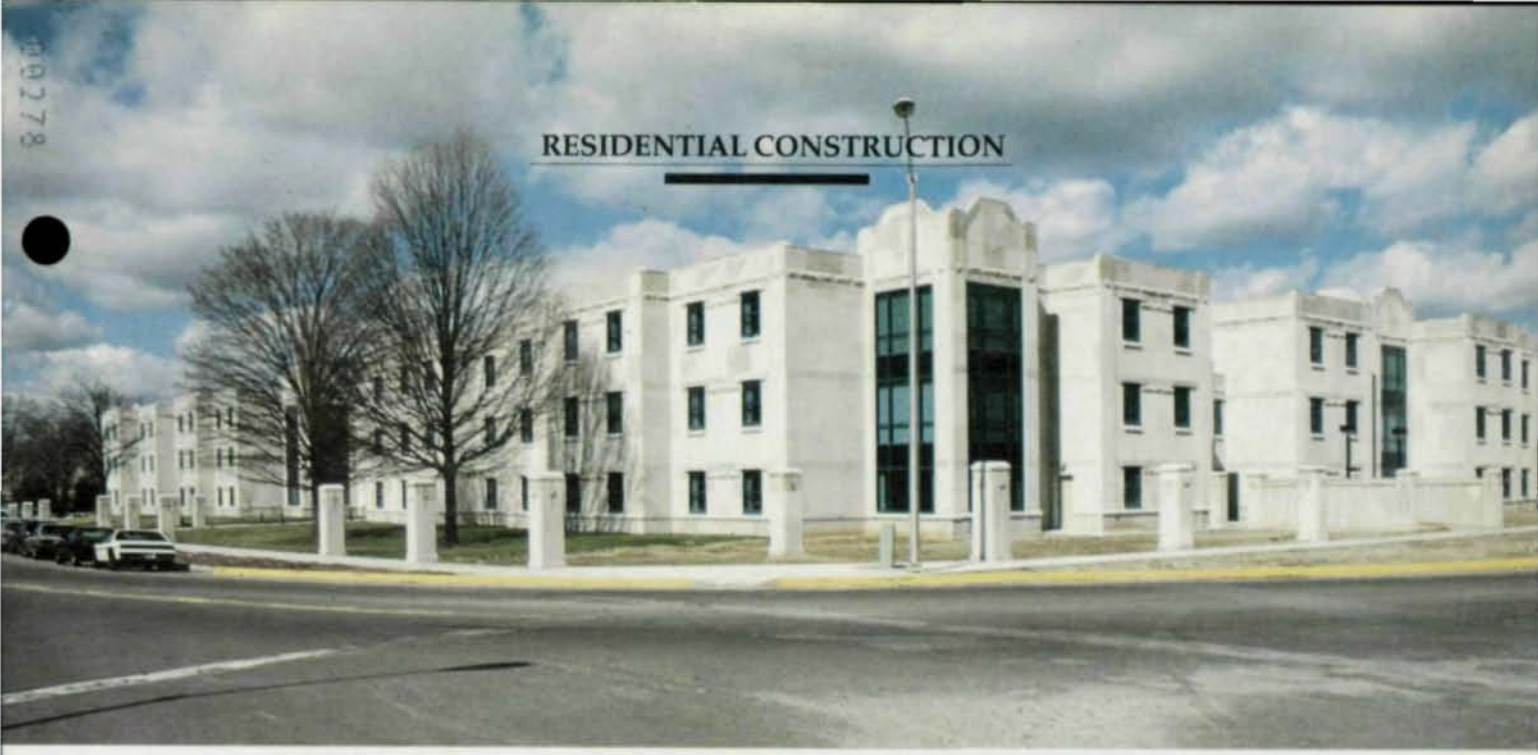

Fast-Track To Success

When Butler University needed a new Residential College in a hurry, the building team turned to steel construction

The educational program requirements for a new Residential College at Butler University in Indianapolis posed a monumental challenge: The university needed to occupy half of the desired 480 rooms in just 16 months, and the rest six months later.

In addition, the university wanted a building that would be more aesthetically inviting than the typical college dorm—yet one that would be in keeping with the collegiate Gothic character of the school while still meeting a $16.6 million budget. And, of course, the facility had to provide barrier-free access for handicapped students.

"From an architectural standpoint, the project was fast-tracked," explained C. Andrew McNeilly, AIA, senior project architect with James Architects & Engineers, Indianapolis, the project's architect and structural engineer. "The design began in the Spring of 1988, and we had the foundations underway before the contract documents were complete. Occupancy of the first half was in the Fall of 1989, with only 10 months for construction."

The concept for the Residential College is a series of clustered "neighborhoods", including student suites, study lounges, kitchenettes, and faculty-in-residence quarters. In order to provide a transitional experience between dorm room and an apartment, the student rooms were designed as computer-networked suites with shared bath facilities.

Front-door identity

The suites were organized to create neighborhoods with winding paths so that each suite has a front door identity. The neighborhoods are grouped around the main lobby/lounge, a dining room, T.V./video room, and weight room. To provide the maximum number of students with access to individual temperature controls, a variable air volume HVAC system was designed with zones comprising three student suites. In addition, each room is wired with one "clean" receptacle for computer power. The building also is air conditioned, which makes it ideal for summer conferences.

Structurally, the 165,578-sq.-ft. dormitory is designed as a steel moment frame using bolted angle connections. "We used simple steel framing with an angle on the top and bottom of the steel beams to

The residential college is designed as two wings of double-loaded corridors, each wrapped around a central courtyard.

take the moment created by the wind loads," said McNeilly. The angles at the second floor are 4" x 4" x ¾", while the angles at the third floor are 4" x 4" x ⅝". The structure used 575 tons of A36 steel. Steel fabricator was AISC-member Geiger & Peters, Inc., Indianapolis.

Economical Framing

"We considered using concrete construction, but the configuration of the building made that difficult and expensive," explained A.R. Baker, Jr., construction manager with Huber, Hunt & Nichols, Inc., Indianapolis. "There are a lot of ins and outs and external corners, and a steel frame with a lightweight metal deck proved to be the most economical."

Because the architectural design called for minimizing the size of structural members, the structural engineer opted for 6" steel tubes for the columns. "We wanted to maxi-

mize the window sizes, and even 12" columns, which would have been about the minimum with concrete, would have been too large," McNeilly said.

The square tube columns extend the height of one floor, with beams cantilevered on top. Bolted connections were used between the beams and columns. A column is then extended the height of another floor, with a beam again cantilevered on top. This process is repeated for the full three stories, with the roof beam cantilevered on top.

In addition to the steel's small dimensions, speed of fabrication and erection was crucial to the project's success. The schedule was based on a fast-track design being completed as shop drawings were being prepared, according to Donald Peterson, vice president of sales and project manager with Geiger & Peters. Shop drawings for fabrication were completed in 16 weeks

The main lobby is designed as a large open space where students can gather.

and all of the steel and deck work were completed in eight weeks. While the project had a 16 month deadline for Phase I and a 22 month deadline for Phase II, both phases were completed two months ahead of schedule.

Aesthetic Concerns

The project is designed with two wings of student rooms on either side of a central cafeteria. To enable the creation of a double-loaded corridor while still giving each room an exterior window, the architect placed a courtyard in each wing. "Because of the floor plan layout using the same framing in four units of the structure, the framing had duplication in the steel details that expedited the drafting and the fabrication," Peterson said. The drafting was done on an SDS computer system.

To meet the university's aesthetic concerns, the architect cloaked the structure in panels of tooled, smooth, and rock face Indiana limestone sculpted into vertical towers, bridges, portals to interior courtyards and arched entrances. The exterior wall system is hung from metal studs and the steel frame. A galvanized steel enclosure membrane permitted completion of interior finishes prior to installation of the limestone panels. □

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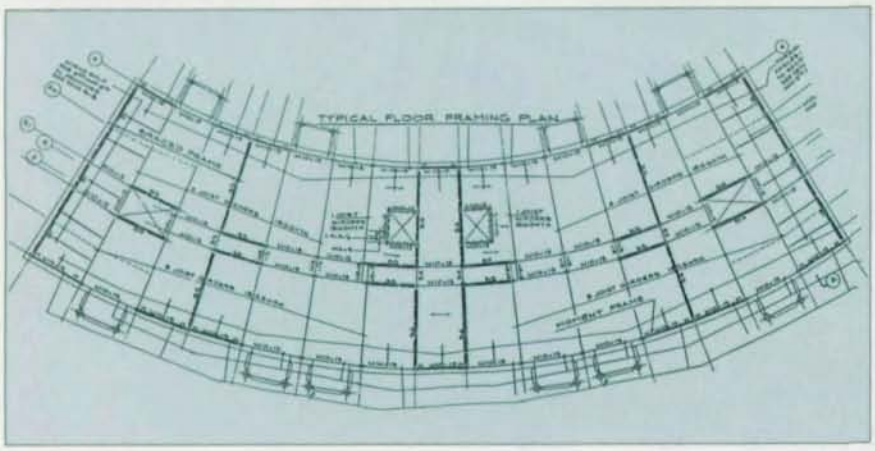

While the project's curved shape was dictated by site constraints, it also provided exceptional views. In addition, by fixing the main corridor off-center, it allowed for the creation of a wide variety of room sizes and configurations. To break down the large scale of the building, the architect created a distinct base, middle and top.

A steel frame met the project's site, height, and time requirements

By Zareh Gregorian, P.E., and Garen Gregorian

Location, location, location may be the battle cry for realtors, but for designers, it can mean a big headache.

The Crescent Park residential development in Woburn, MA, has a prime location in an abandoned quarry just 10 miles north of Boston. Unfortunately, in addition to its great location, the site features wetland and unbuildable stone hillsides, leaving little of the 25 acre site for construction.

The solution was to build a series of four curved buildings in an S configuration. Each seven-story, 80,000-sq.-ft. building has 66 units. In addition to fitting the buildings to the site, the curved shape also maximized views. The curve has a large enough radius that the radial walls are not abrupt and provide an element of variety in the rooms. The curved corridor sweeps away as you move along it and adds an unusual aspect to an otherwise ordinary experience. The corridor is off-centered to provide a variety in the dimensions of the units.

The architect, Lawrence A. Linder Architects, Inc., Boston, chose to clad the building in brick with bands of different colors, which served to break down the scale of the building. The bottom two stories are more playfully striped and combine as a base scaled to pedestrians. The middle zone—floors three through six—are alternately

striped with buff and light brown brick, while the top floor is light-colored and set back. Large sections are used for the balconies, again in an attempt to modulate the scale of the building. Project designer was L.A. Linder, AIA, and project architect was Candy Gander, AIA.

Project Constraints

In order to meet the developers need for a total number of units, the buildings needed to be seven stories. However, city code requirements limited the building height to 70'. As a result, 8' ceiling heights were designed. Also, large column spacing was specified in the short direction of the plan to provide column-free spaces for flexible unit plans, which varied in size and shape on each floor.

Time also was of utmost importance and the project was fast-tracked.

A variety of structural systems were reviewed for the project, all of which also considered the architectural requirements.

Concrete block bearing wall systems, though economical, could not meet the open and flexible plan requirements of the project. Cast-in-place concrete was rejected as too heavy, expensive due to the form work costs of the curved members, and unsuitable due to the height limitations. Likewise, precast concrete was not feasible due to the building's curved shape. And the lift-slab method was rejected due to its complicated erection procedures.

After analysis, a steel frame was selected as the most economical method of achieving the desired crescent shape. The chosen structural system provides a lightweight structure, adequate clear spans, and small members that could meet the height restrictions.

The collector girders span 27' and 23' in the short direction and are 18" deep. A composite floor system from Hambro, a division of AISC-member Canam Steel, was used to span the 15'-17' between girders.

The selected system was versatile, easy to install, and provided reduced depth and adequate rigidity for the spans. It also allowed adequate space in the floor structure for passage of mechanical utilities through web openings in joists and girders. In addition, it allowed the project to be erected on its fast-track schedule.

Lateral Stability

The lateral stability of the building is provided by a combination of braced and moment resisting steel frames. To provide open spaces for exterior windows and access to balcony areas, moment frames were used on the two main elevations of the building.

K-braced frames are used in the long direction inside corridor walls, and in the short direction in unit separation walls.

For uniformity of details, the moment frame girder sizes are kept to 10" deep throughout the structure. To facilitate the connection of the collector girders to the inside web of the columns and to skew connection of the moment frame girders to the flange of the columns, H-shape columns are used with the web facing the exterior of the building.

For the first building, the skew moment connection was provided by installation of top and bottom flange plates on girders. The detail was modified for the second building to omit the flange plates and instead used full-penetration welds. While this change required precision cutting of girders edges to the skew shape with a slope of ½ to 12, no major construction problems were encountered and the change resulted in a more simple and economical solution to the moment connections. General contractor on the project was Suffolk Construction Co., Inc., Boston. Steel fabricator was AISC-member Canam Steel Corp., Needham, MA.

Steel tubes with an outside dimension of 3½" were used for the K-braced members in order to fit inside the 4"-thick wall partitions.

To meet Massachusetts code requirements for wind and earthquake loads, shear connectors were welded to the top of the steel girders, enabling the concrete slab to act as a floor diaphragm and transfer the lateral forces to the moment and braced frames.

Member sizes of the lateral load resisting frames were selected to produce equal deflections and avoid destabilizing conditions in the structure due to application of lateral forces. These frames also act as stabilizers for columns with simple connections that are not in the moment or braced frame systems. The governing drift in the short direction is less than H/500 (1.7") as required for similar buildings. Staad III and SAI Frame programs were used to analyze the structural system.

Zareh Gregorian is a principal and Garen Gregorian, MSME, MSCE, is a project engineer with Gregorian Engineers, Belmont, MA. □

Located just 10 miles north of Boston, the Crescent Park residential development is located in a heavily-wooded abandoned quarry. The project's curved S-shape emerged from the need to preserve wetlands and work around unbuildable stone hillsides.

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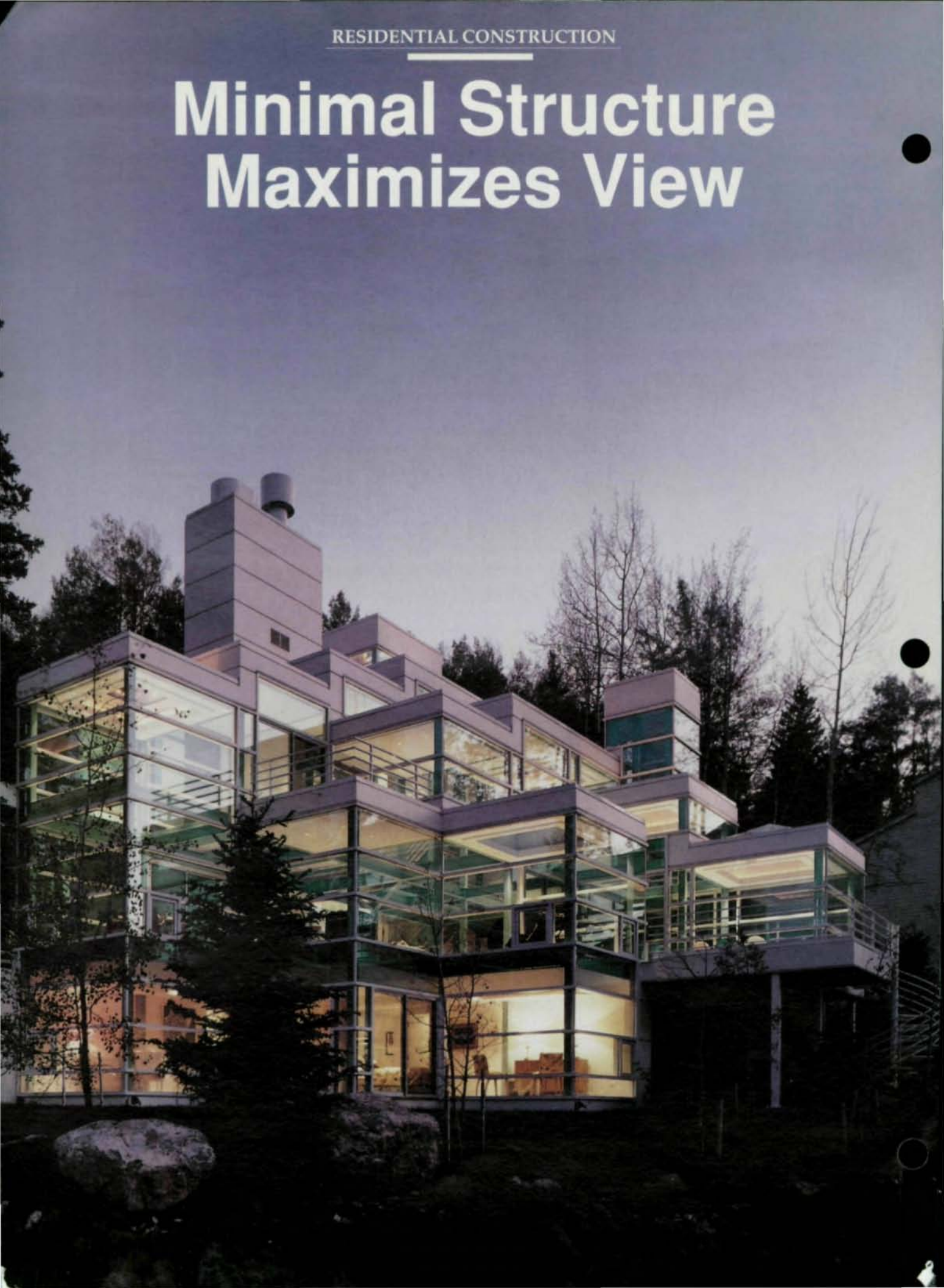


A slender steel frame, combined with expansive sheets of glazing, created a one-of-a-kind view for this Vail vacation home

Rather than create a house to be *looked at*, the architect of the Tennenbaum Residence in Vail, CO, opted for a house that can be *looked through*. The extensive use of glazing created a home that is nearly transparent and as a result affords spectacular views of the surrounding mountains.

"The client wanted a home where they could view the site and not feel closed in, especially in the winter when there's very little sun," explained Edward Niles, FAIA, of Edward R. Niles Architects, Malibu, CA.

In response to his client's desires, Niles created a series of glass boxes cascading down the hillside. "It has a skeletal framework that allows sunlight and the view to enter. But a big box would have been out of scale. Instead we designed a series of smaller boxes that knit the home into the fabric of the hill."

Once the basic design was created, steel was the logical choice for the structural system. "The structure had to take up the least amount of space possible," Niles said. "We wanted a structure of points and lines, not one of planar surfaces." When the house is viewed in profile, the steel forms a series of almost two-dimensional lines, while when it is viewed in plan, all that is visible are the terminal points of the steel members.

Minimal Structure

To minimize the size of the framing, 6" x 6" steel tubes were used for the columns, according to Stanley G. Neujahr, P.E., president of Neujahr & Gorman, Inc. In addition, the structure uses moment connections instead of a braced frame, which would have disrupted the open window space. "We used clip angles with weld plates on the top and bottom to take the shear," Neu-

A steel frame was crucial to the success of the Tennenbaum residence in Vail, CO. In order to maximize the glazing, it was important to minimize the size of the structural framing.

Steel was left exposed on the inside in order to give visitors an understanding about the methodology and construction of the home.

jahr explained.

Another advantage in using steel tubes is that roof drains could be run inside of the tubes. "Because of the extensive skylights, we needed a lot of drainage," said Ray Story, a project administrator with Pierce Segerberg & Spaeh, a Vail architectural firm that supervised the construction. "We put heated gutters around the skylights and ran PVC pipe down the inside of the tubes. We considered filling the pipe with

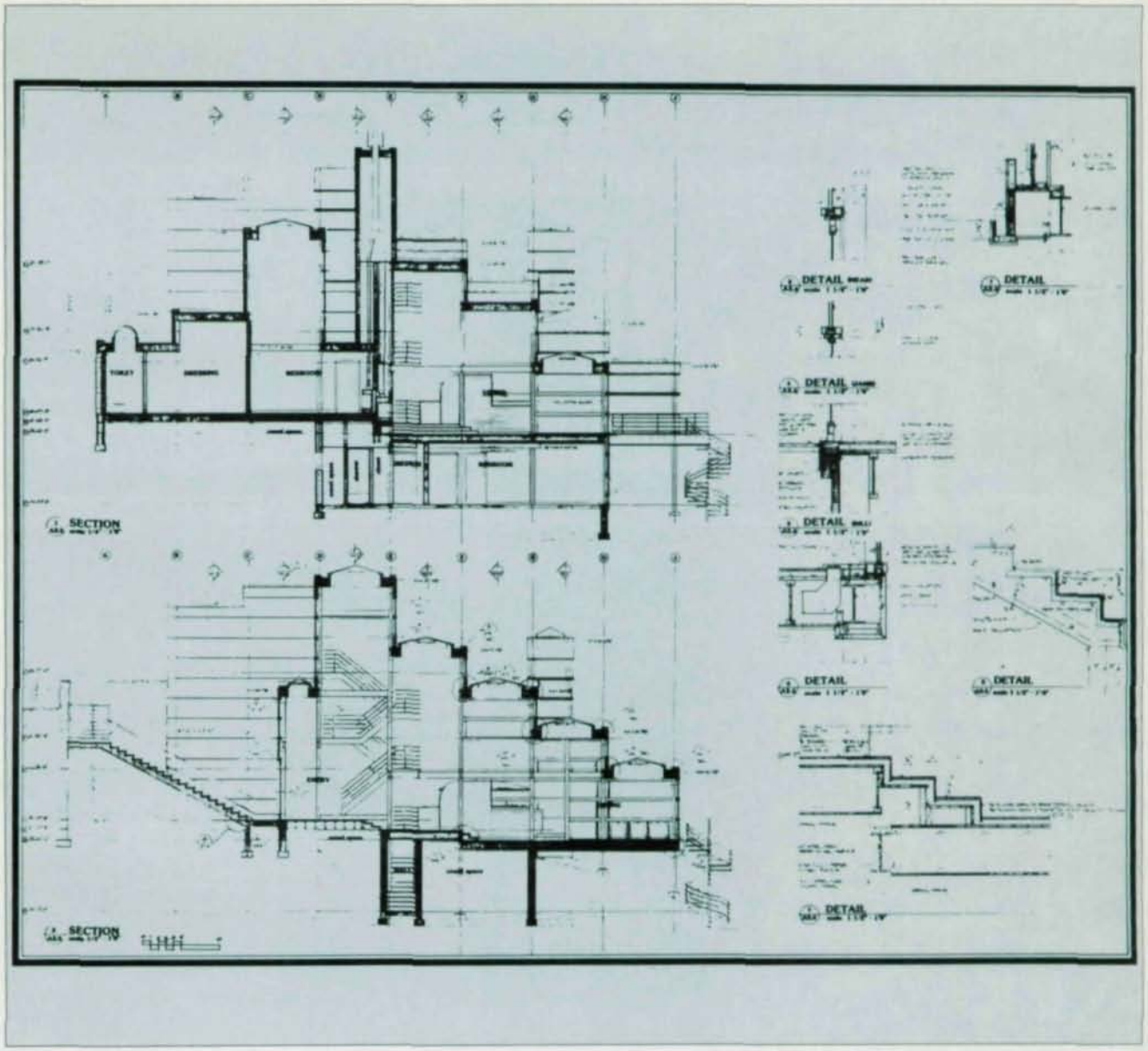
"When people care about workmanship, there's nothing the matter with leaving steel exposed."

perlite beads to reduce noise, but it turned out to be unnecessary."

Excessive heat gain was controlled partially by man and partially by nature. The home is situated on the south side of the valley, which means it is shaded most of the time. Also, a Low-E coating was specified on solar tinted insulated glass.

W10x22 beams were used on a 9'6" square grid. "The beams are oversized so we could put a plate on top," Neujahr said. The plate supports a hanger for a wood joist for the flooring. In some areas where larger rooms were required, grids were combined to create 19' spans. In those areas, W12 x 30 beams were used. However, to keep the total structural depth the same throughout, instead of welding a hanger to a plate attached to the beam, the hanger was welded directly to the beam. Steel fabricator was AISC-member Meyers & Company Architectural Metals, Basalt, CO, and steel erector was Pinnacle Steel Erectors, Grand Junction, CO.

Another reason for using steel was to aid the construction process. "We could bring the steel up the mountain in small sections," Niles said. "And it can be erected during

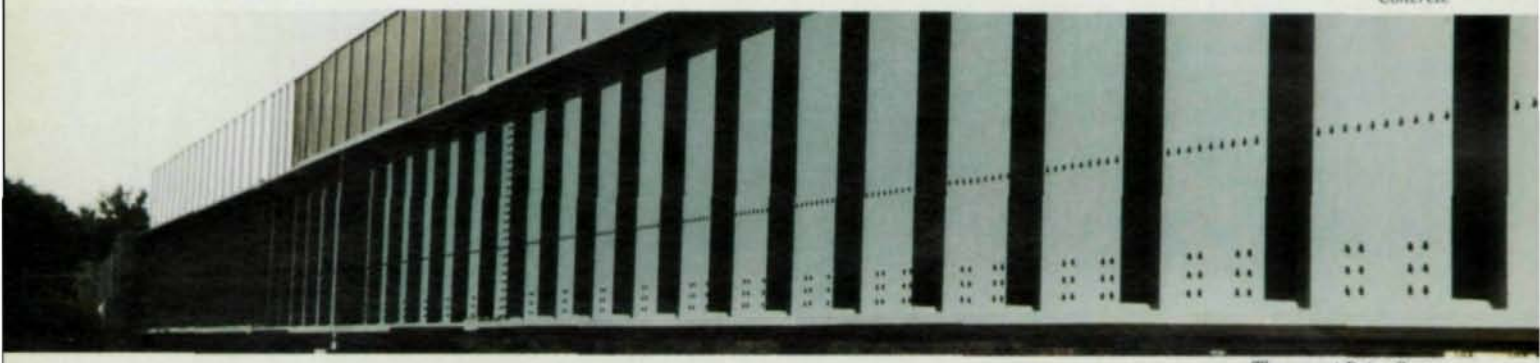


the winter," Story added.

Most of the steel was left exposed, with drywall partitions extending only to a beam's top or bottom flange. "When people care about workmanship, there's nothing the matter with leaving steel exposed," Niles said. "Steel can be inherently beautiful."

While some people consider exposed steel as too industrial in appearance, Niles prefers to view it as an intellectual aesthetic. "Leaving the steel exposed allows you to trail through the methodology and construction of the home. It creates an understanding of how things are made." □

Concrete



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Steel Box Girders Create Clean Appearance

The shear size and visibility of an interchange near downtown Shreveport, LA, made aesthetics a prime consideration

Located just seven miles south of downtown Shreveport, LA, the I-49 and LA 3132 interchange dominates the horizon of an established residential/industrial neighborhood.

The $65 million interchange is part of the $1.4 billion Interstate 49 project extending 210 miles and connecting Lafayette in the south to Shreveport in the northwest. Rural stretches totaling some 190 miles are now complete, and approximately 20 miles of urban projects in Shreveport and Alexandria are underway. State officials anticipate all urban gaps will be closed by 1994.

Howard Needles Tammen & Bergendoff (HNTB), a multi-discipline firm headquartered in Kansas City, is the primary consultant to the Louisiana Department of Transportation and Development (LDOTD) for the Inner interchange and the I-49 projects.

Approaching Shreveport from the south, the I-49 mainline bridge crosses east-west LA 3132 between Linwood Avenue and LA Hwy. 523. The mainline bridge consists of

A massive tree pier rises 80′ at the heart of the interchange.

twin type IV AASHTO girder structures, each 60′ gutter-to-gutter and approximately 1,300′ in length. Inverted tee capbeams supported by rectangular columns and drilled shaft footings carry the north and south ramp structures.

Eight-Ramp Interchange

The eight-ramp interchange configuration is comprised of four inner and four outer ramp structures, with the superstructures being supported by 410 steel and concrete curved trapezoidal box girders. The box girders sit on top of 92 single-column, architecturally-flared piers and a center tree pier positioned in the median of the Inner Loop.

The massive, $900,000 tree pier, surrounded by four levels of ramps and highways, rises to a height of 80′ at the center of the interchange. The top strut of the delta is post-tensioned with steel rods to transfer

compressive forces into the concrete base.

The shaft of the pier broadens toward the base and is anchored with a drilled shaft foundation to support a vertical load of 8.5 million lbs. from the four ramp structures. "The pier footing is 42' x 54' x 10' deep, and is founded on 24 48"-round drilled shafts, each capable of supporting 375 tons," explained Jack Shortess, P.E., HNTB project manager.

Unique Tree Structure

The tree pier is uniquely designed to accommodate the multi-level, multi-directional inner ramps. It's delta portion elevates the South-to-West and North-to-East inner ramps 89' and is orthogonal to the cantilevered beam extensions in the midsection of the pier. The beam extensions are positioned at a 45198 angle to the I-49 mainline bridge and shoulder the West-to-North and East-to-South ramps at 62' above ground level. I-49 cross over LA 3132 at 26' above ground level.

3,090 Tons Of Steel

The superstructure at the core of the interchange required 3,090 tons of structural steel. Construction contractor was T.L. James & Company, Inc., Shreveport, and steel erector was AISC-member John F. Beasley, Dallas.

The four curved inner-ramp structures are comprised of four four-span and one three-span continuous steel units (A572 50 ksi). Transversely supporting the longitudinal steel box girders at the tree pier are framed-in steel cap beams.

"At the core, the longer steel spans are uninterrupted by piers," explained Rudy McLellan, P.E., HNTB principal structural engineer for the interchange design. Steel girder spans range from 166' to 228'. Total length of the 19 steel spans is 3,500'.

Because the interchange is visible for miles and located near industrial and residential areas, the LDOTD and HNTB placed particular emphasis on the appearance of the structure. Horizontally curved trapezoidal box girders and architecturally flared piers were used to satisfy the horizontal and vertical curvature, structural depth and span length criteria.

Trapezoidal Box Girders

Each core interchange ramp is supported by two or three horizontally curved steel trapezoidal box girders. All of the box girders are single cell trapezoidal shaped. To satisfy exacting horizontal curvature requirements, "none of the steel box span units are identical," according to Shortess.

Girder depths, however, are constant, rather than stepped, for the

entire length of each ramp unit, and vary from 62" to 76" for individual ramps. "The constant structure depth and the slope of the web of the steel boxes creates a very clean type of structural line," McLellan noted. "Looking at the underdeck, you don't see a lot of branching members. The boxes look very smooth."

Flared Piers

The architecturally flared piers also are uniquely designed. "The shape and configuration of the piers was done for aesthetic reasons," McLellan said. "And the face of the piers are rusticated for interest." Piers vary in height from 20' to 83' to accommodate the rise and fall of the ramp units.

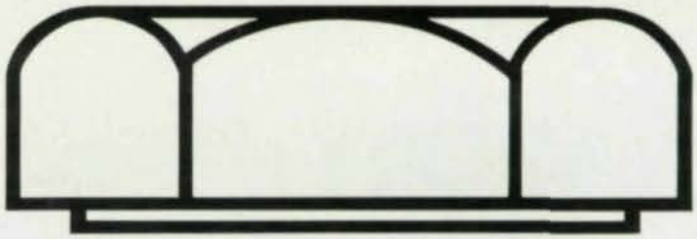
Attention to detail at the superstructure-substructure junctures contributes to the overall "simple, graceful appearance of the interchange," McLellan said.

The upward slope of the flared piers and the similar slope on the box girders visually forms a smooth line at the top of the pier. "The upward and inward slope of the top of the pier was set to meet the downward and inward slope of the steel box girder, giving the appearance of the superstructure flowing into the substructure," Shortess explained.

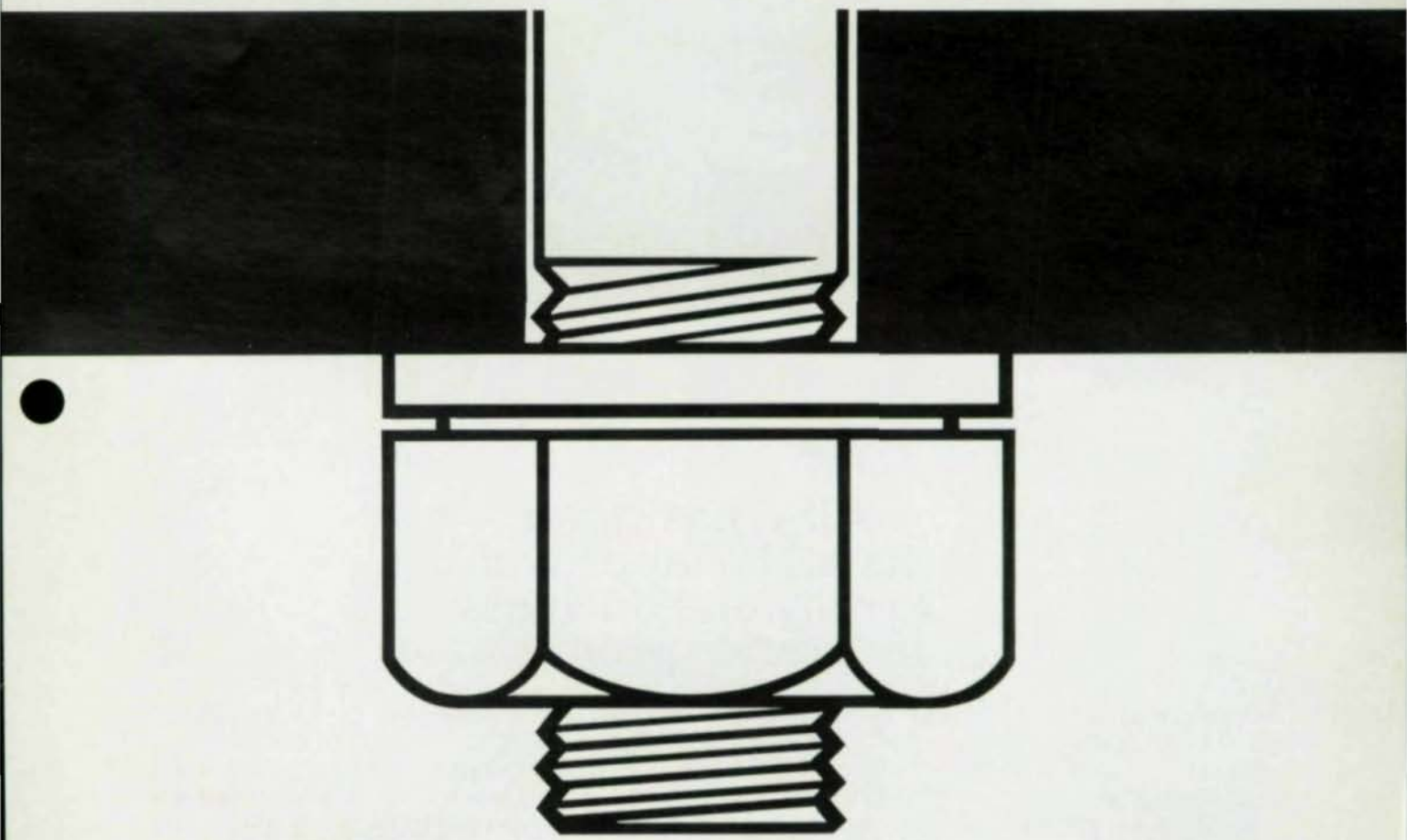
Moving out from the core of the interchange to the transition piers, facial walls are used to mask the transition to the concrete box girder approach spans. Facial walls extend vertically from the top of the deltas to camouflage the difference in structural depth of the steel and concrete units.

Future Project

The LDOTD also selected architecturally flared piers and trapezoidal box girders to join the I-49 and I-20 highways just north of the Inner Loop interchange. The look-alike structure, located in downtown Shreveport, is currently under construction. Plans call for approximately 8,000 tons of structural steel in the $23 million project. □



If you're not using Direct Tension Indicators here, you're just guessing.



If you're inspecting bolted connections with torque wrenches, the only thing you can be certain of is being uncertain.

You see, it's tension that maintains the high clamping force critical in preventing connections from slipping or separating. And while torque is a fine indicator of turning force, it's just not accurate when it comes to measuring tension.

So how can you be sure your bolts are properly tightened?

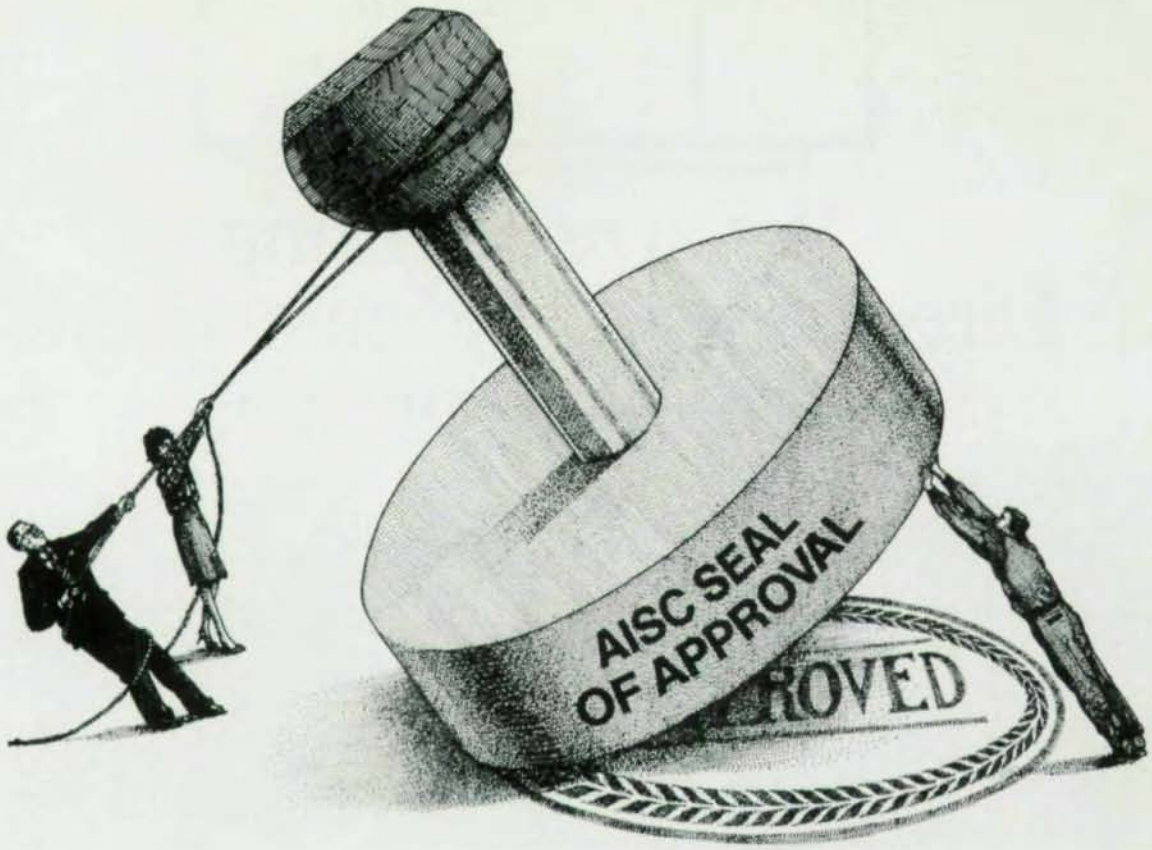
Begin with Direct Tension Indicators (DTIs) to ASTM F959 from J&M Turner. Because you install DTIs right along with your bolts, you're assured of reaching the correct level of tension with every assembly.

Plus, you're ensured of saving money by avoiding costly, imprecise torque and turn inspections.

For more information plus a copy of our new videotape that explains the benefits of using DTIs, write us at J&M Turner, Inc. 1310 Industrial Blvd., Southampton, PA 18966.
Or call 1-800-525-7193.

And stop guessing.

J&M Turner Inc.



AISC has given its seal of approval to only one business insurance program.

The American Institute of Steel Construction has given its seal of approval to the business insurance program from the CNA Insurance Companies. The reason is our proven ability to respond to the specialized insurance needs you have because of the specialized nature of the work you do.

This business insurance program provides a comprehensive package that can meet virtually all your business insurance needs, including commercial property, commercial liability, commercial auto, workers' compensation and commercial umbrella. The program also offers you the opportunity to be eligible for a safety group dividend* based on the efficient control of losses.

With the program's comprehensive approach to coverage—plus specialized loss control services and responsive claims handling—you can be assured of receiving the best value an association-endorsed program can offer. You can be confident about the stability of your program, too. It's backed by the experience and financial strength of one of the nation's largest and most respected insurance organizations.

For more information, call 1-800-CNA-6241.

*Safety group dividends, available in most states, are declared by CNA's Board of Directors and cannot be guaranteed.

CNA

For All the Commitments You Make®

The CNA Insurance Companies underwriting CAM programs will vary according to the coverage. These companies include: Transportation Insurance Company, Valley Forge Insurance Company, Continental Casualty Company, National Fire Insurance Company of Hartford, American Casualty Company of Reading, Pennsylvania or Transcontinental Insurance Company. CNA Plaza, Chicago, IL 60685.

National Steel Construction Conference (NSCC)

Washington, DC June 5-7

Advance Program and Registration

Tuesday, June 4

11:30 a.m. - 4:30 p.m.
Welcome to Washington Tour
(optional event)

8:00 - 11:00 p.m.
Washington After Dark
(optional event)

Wednesday, June 5

8:30 - 10:30 a.m.
Professional Member Forum

9:00 a.m. - noon
Experience Capitol Hill
(Spouses optional event)

1:00 - 5:00 p.m.
Corcoran Gallery of Art, Embassy Row & the National Cathedral
(Spouses optional event)

1:00 - 1:15 p.m.
Welcome and Introductions

1:15 - 2:00 p.m.
General Session: T.R. Higgins Lecture: *Building Floor Vibrations*
Prof. Thomas M. Murray, Virginia Polytech Institute and State University

2:00 - 3:00 p.m.
Keynote Address: *Motivating Your Staff and Work Force*
Dorman Conklin, Principal, Employee Development Services, Jackson, MS

3:00 - 5:00 p.m.
Exhibits Open
No technical sessions are offered at this time, giving attendees an opportunity to visit the 100-plus exhibit booths.

5:15 - 6:00 p.m.
Exhibitor Workshops
Specialized sessions introducing the latest in new products and techniques

6:30 - 8:00 p.m.
AISC Welcome Cocktail Party
All conference attendees and their spouses are invited

Thursday, June 6

8:30 - 9:15 a.m.
General Session: *Building for Earthquake Survival*
Peter I. Yanev, EQE Engineering, San Francisco

9:15 - 10:15 a.m.
General Session: *Troubleshooting Structural Steel: BASIC Offers Practical Solutions*
Dr. Reidar Bjorhovde, BASIC, University of Pittsburgh

10:00 a.m. - 3 p.m.
Exhibits Open

10:00 a.m. - 3:00 p.m.
George Washington Slept Here
(Spouses optional event)

11:00 a.m. - 12:30 p.m.
Technical Seminars
1. *Troubleshooting Structural Steel: BASIC offers Practical Solutions*
2. *Practical Engineering in Shop Fabrication*
3. *Simple Connections in Tubular Construction*
11. *Economic Comparison ASD and LRFD for Buildings*
12. *Seismic Building Design Specificatoins*
13. *Rehabilitation of Existing Buildings*

Noon - 1:45 p.m.
Lunch Service Provided In Exhibit Hall

2:30 - 4:00 p.m.
Technical Seminars
4. *Plant Automation*
5. *How to Get Shop Drawings Approved—On Time*
6. *Undeisrable Clauses in Contracts*
14. *Recent Research Results—I*
15. *Recent Research Results—II*
16. *Recent Developments in Steel Fabrication and Material Selection: Electroslag Welding & Weathering Steel Structures*

4:10 - 5:30 p.m.
Technical Seminars
7. *EPA—Right to Know Legislation SARA, Title III, Section 313*
8. *Advances in Welding for the Steel Fabrication Industry*
9. *Application of Multiple Shop Coatings*
17. *Innovations in Bridge Design*
18. *Seismic Connection Design*
19. *Innovations in Fire Protection*

5:30 - 6:15 p.m.
Exhibitor Workshops

7:00 - 7:45 p.m.
Reception (Cash Bar)

7:45 - 10:00 p.m.
Dinner & Entertainment
Capital Steps and Dancing
(Optional event)

Friday, June 7

7:30 - 8:15 a.m.
Exhibitor Workshops

8:30 - 9:15 a.m.
General Session: *Steel Construction System for Low-Rise Commercial and Residential Building*
P.O. Thomasson, Swedish Institute of Steel Construction, Stockholm, Sweden
Session highlights a special construction system that minimizes floor-to-floor height.

9:15 - 10:00 a.m.
General Session: *The Great American Pyramid: Ancient Shape, Modern Design*
Lawrence G. Griffis, Walter P. Moore & Associates, Houston

10:00 a.m. - 2:30 p.m.
Exhibits Open

10:30 a.m. - 4:00 p.m.
A Special Tour
(Spouses optional event)

10:45 a.m - 12:15 p.m.
Technical Seminars
20. *Codes & Ethics*
(1, 4, 7, 14, and 15 repeat)

Noon - 1:45 p.m.
Lunch Service Provided In Exhibit Hall

2:30 - 4:00 p.m.
Technical Seminars
(2, 5, 8, 11, 12, and 13 repeat)

4:10 - 5:30 p.m.
Technical Seminars
(3, 6, 9, 16, 17 and 18 repeat)

8:00 - 11:00 p.m.
Washington After Dark Tour
(Optional event)

T.B.A.
The Phantom of the Opera
(Optional Event)

Saturday, June 8

Optional Tours:
Tour of Bridge Shop (8:00 - 11:30 a.m. and 9:00 a.m. - 12:30 p.m.)
Arlington Cemetery and Mt. Vernon (10:00 a.m. - 4:00 p.m.)
Air and Space/American History Museum (1:00 p.m. - 5:00 p.m.)

NSCC REGISTRATION FORM

Registration Fee: (Please circle appropriate fees)

AISC Member Fee: $290.00 (before April 19)
$335.00 (after April 19)
(Includes AISC Active Associate & Professional Members)

Non-Member Fee: $340.00 (before April 19)
$385.00 (after April 19)

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

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

Exhibitor, in Booth (no charge)

Added Exhibitor: $75.00

Spouse's Fee: $100.00

Registration Fees Include all General and Plenary Sessions, workshops, seminars, coffee breaks, luncheons Thursday and Friday, the Get-acquainted Cocktail Reception Wednesday evening and a printed, bound copy of the Proceedings. Exhibitors are entitled to one registration for each 8 ft x 10 ft or 10 ft x 10 ft exhibit space reserved. "Added Exhibitor" fee is payable **ONLY** if in excess of one person per 8 ft x 10 ft or 10 ft x 10 ft.

Registration Cancellation Policy: Cancellations received before May 22, 1991, 100% of pre-paid registration fees will be refunded; after May 22, 50% will be refunded. (Those cancelling after May 22 will receive their copy of the Conference Proceedings.)

Partial Registration Fees

(You may also pre-register for one day or half day.
Circle your choice below.)

Half Day Sessions: (Lunch not included)	
Wednesday Afternoon	$ 55.00
Thursday Morning	$ 70.00
Thursday Afternoon	$ 70.00
Friday Morning	$ 70.00
Friday Afternoon	$ 70.00
One Day Sessions:	
Thursday (includes Lunch)	$160.00
Friday (includes Lunch)	$160.00
Exhibit Floor Pass	
(included in full & partial registrations)	$ 5.00
Total Partial Registration Fees	$ _____

Registration for Optional Events

Event	No Tickets	Total Price
#1—Welcome To Washington (Tues. 11:30am)	___ @24.00	$ _____
#2—Washington After Dark (Tues. 8:00pm)	___ @22.00	$ _____
#3—Washington After Dark (Fri. 8:00pm)	___ @22.00	$ _____
#4—A State Dinner/Capitol Steps (Thurs. 7:45pm)	___ @65.00	$ _____
#5—Phantom of the Opera (Fri. TBA/pm)	___ @65.00	$ _____
#6—Tour Bridge Shop (Sat. 8:00am)	___ No Fee	
#7—Tour Bridge Shop (Sat. 9:00am)	___ No Fee	
#8—Arlington Cemetery/Mt. Vernon (Sat. 10:00am)	___ @34.00	$ _____
#9—Air & Space/American History Museums (Sat. 1:00-5:00pm)	___ @24.00	$ _____
#A—Experience Capitol Hill (Wed. 9:00am)	___ @22.00	$ _____
#B—Corcoran Gallery/National Cathedral (Wed. 1:00pm)	___ @22.00	$ _____
#C—George Washington Slept Here Tour (Thurs. 10:00am)	___ @30.00	$ _____
#D—A Special Tour (Fri. 10:30am)	___ @34.00	$ _____
Total Optional Event Fees		$ _____

PLEASE REGISTER (Type or Print)

Name _____ Nickname (for badge) _____

Company _____ Title _____

Mailing Address _____

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

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

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

Conference Fees Payable:

Registration Fee	$ _____
Spouse's Fee	$ _____
Partial Registration Fees	$ _____
Optional Events	$ _____
Total Registration Fees:	$ _____

MAIL COMPLETED FORM AND CONFERENCE FEES TO:

American Institute of Steel Construction, Inc.
1991 National Steel Construction Conference
P.O. Box 806286
Chicago, Illinois 60680-4124

Phone inquiries and information: 312/670-5422 Fax 312/670-5403

_____ I enclose check (U.S. funds) payable to AISC in amount of total fees.
_____ Please charge my credit card – Visa or MasterCard Only

_____
Circle one VISA MasterCard

Expiration Date (Month and Year) _____

Signature (if any credit card charges): _____

Name on Card: _____

NSCC HOTEL RESERVATION FORM

NOTE: MAIL COMPLETE FORM TO THE SHERATON HOTEL.

RESERVATIONS MUST BE ACCOMPANIED BY ONE NIGHT'S ROOM DEPOSIT INCLUDING 11% TAX AND $1.50 OCCUPANCY TAX. THE HOTEL ACCEPTS CHECKS, MONEY ORDERS, AMERICAN EXPRESS, VISA, MASTER CARD, DINERS CLUB, CARTE BLANCHE, & DISCOVER.

If reserving rooms by phone, advise hotel you are attending the **AISC National Steel Construction Conference** and wish the conference rate.

All Conference activities take place at the historic Sheraton Washington Hotel, 2660 Woodley Road at Connecticut Ave. NW (near the National Zoo) Washington, D.C. 20008 Phone: (202) 328-2000.

Circle room rate requested: Rooms vary in price based on location and size of room. If rate selected is not available, next available rate will be confirmed. The Wardman Tower Rooms are elegant rooms in the historic Wardman Tower.

Single Room Rates:

$109* **$119*** **$129***

Wardman Tower Rate: $140*

Special Requirements: _____

Note: *Rate quoted is for single occupancy, if additional person in room, add $20.00. Rates do not include room tax of 11% or $1.50 per day occupancy tax.

The hotel will honor and guarantee reservations received by May 1, 1991. Reservations received after this date will be on a space available basis. So mail this form promptly.—Reservations are subject to cancellation at 4:00pm if not guaranteed.—Failure to cancel your reservation 72 hours prior to arrival will result in forfeiture of your one night's deposit. Please reserve the accommodations indicated above for:

Guest Name: _____ # Adults _____ # Children _____

OR sharing room (dividing bill) with: _____

Organization or company: _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

Phone Office: ( ) _____ Home ( ) _____

Arrival Date: _____ Approx. Arrival Time: _____ Departure Date: _____
(Check-in time is 3:00pm. Check-out time is 1:00pm)

I enclose check for $ _____ **payable to the Sheraton Washington Hotel. OR**

Please charge one night's deposit including tax & $1.50 occupancy tax to my

Credit Card # _____
(Circle card used:) American Express Visa MasterCard Diners
Discover Carte Blanche

Expiration Date: _____ Signature: _____

(For information only, call David G. Wiley, Phone: 312/670-5422)

National Steel Construction Conference
Product Exhibitors

Nucor Fastener
Booths 2005/2006

With the passage of H.R. 3000, Congress has mandated that fasteners must conform to the specifications to which they are represented to be manufactured and that they have the inspection, testing and certification to prove it.

Nucor Fastener has been adhering to these standards since it opened in 1986. Nucor uses 100% domestically melted and rolled raw material. All fasteners are identified with a lot number on each container that allows traceability to materials, dimensions, processing and testing.

For more information, contact: Nucor Fastener, P.O. Box 6100, St. Joe, IN 46785 (800) 955-6826.

American Punch
Booth 307

The American Punch Co. offers a wide range of punches, dies and shear blades for angleline, beamline and portable punches. In addition, the company offers a variety of shear blades, coupling nuts and punch stems.

For more information, contact: The American Punch Co., 685 S. Green Road, Cleveland, OH 44121 (800) 243-1492.

American Institute of Hollow Structural Sections
Booth 2003

This non-profit group is committed to advancing and improving the use of hollow structural sections/structural steel tubing in building, bridge and special structure applications. The institute offers technical data, seminars, and is involved in research and development and specifications and standards activities. Among its publications are "HSS/Structural Steel Tubing—Dimensions and Section Properties" and "Column Load Tables."

For more information, contact: Frederick J. Palmer, Director, 929 McLaughlin Run Road, Suite 8, Pittsburgh, PA 15017 (412) 221-8880.

Tnemec Company
Booth 206

At this year's National Steel Construction Conference, the company will be featuring corrosion-resistant primers for steel and compatible high-performance finishes for specialized architectural and industrial use.

Included are zinc-rich primers recommended for bolted connections that have been tested and rated for slip coefficient and creep, primers that cure quickly in the ship for expedient handling, VOC-compliant aliphatic polyurethanes and coatings that cure in cool temperatures. Applications include: structural steel; space frames and trusses; bridges; tanks; pipes; and equipment.

For more information, contact: Tnemec Co., Inc., 6800 Corporate Dr., Kansas City, MO 64120-1372 (816) 483-3400.

Kaltenbach/Behringer
Booth 109

Kaltenbach, the world's largest manufacturer of circular cold saws, announces the addition of two models. The all new HDM-1000 and HDM-1400 structural saws are designed for use in a "tandem system" with our structural CNC drill.

Unique design includes a traveling saw arm and fixed datum fence to include miter cutting, optifeed, and vertical clamp. Popular options include CNC control for 89 cutting angles and FABCUT software package for fabricators.

Kaltenbach saws have a wide range of available options, including mitering bases, patented optifeed, vertical bundle clamps, length measuring devices and material handling systems.

For more information, contact: Joseph A. Dick, executive vice president, Kaltenbach, Inc., 6775 Inwood Dr., Columbus, IN 47201 (812) 342-4471.

Steel Solutions
Booth 313D

Steel Solutions will be exhibiting its new Release 2.0 of *Steel 2000 Integrated Management Software* at this year's National Steel Construction Conference.

Included will be enhanced versions of its popular *Estimate* and *Fabricator* programs. New handling techniques for *Inventory* tracking and *Purchasing* will be demonstrated along with the integrated *Job Cost* and *Accounting* modules.

A new *Steel Service Center* program also will be released at the Conference.

For more information, contact: Steel Solutions, Inc., P.O. Box 1128, Jackson, MS 39215 (601) 932-2760.

Structural Software Company
Booth 103-105

Structural Software Co. will be demonstrating several programs at this year's National Steel Construction Conference, including: *Estimating; FabriCAD II; Material Allocation*; and *Order Entry*. The Estimating program prices all of the items that go into a job, from mill to warehouse. FabriCAD II is a detailing program that emphasizes speed and accuracy. The Materials Allocation program has modules for: inventory control; production control; and purchase orders. And the Order Entry program is designed to help a fabricator develop a quick quote for a client on the phone or over the counter.

For more information, contact: Structural Software Co., 5012 Plantation Road, P.O. Box 19220, Roanoke, VA 24019 (800) 776-9118.

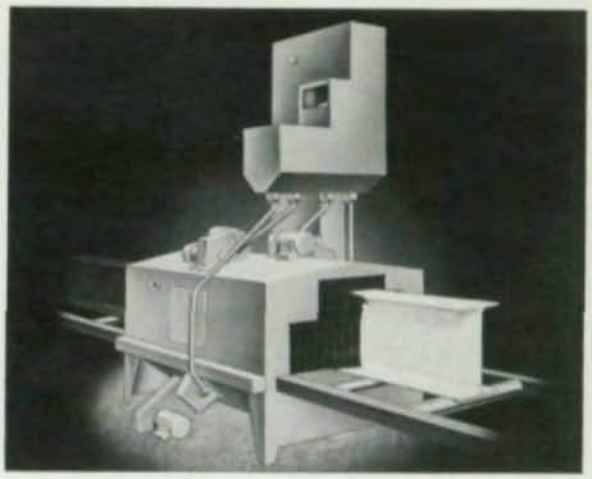
Peddinghaus Corporation
Booth 707C

Peddinghaus has introduced the Fabriline 2000 Model BPL 1000/5 is an innovative machine for automatically punching steel sections. It features a patented flange press configuration that punches opposing flange holes simultaneously and automatic mechanisms to adjust the die height of the web press.

Also newly introduced is a machine with the capability of punching up to three different hole diameters through 1¼"-thick material using a 154 ton hydraulic punch. Also, the machine has plasma cutting for cut-to-length shapes. This unique combination affords the user the capability of quick machine setup as well as enhanced production capabilities iwth little changeover time.

For more information, contact: John J. Holland, vice president, system sales, Peddinghaus Corp., 300 North Washington Ave., Bradley, IL 60915 (815) 937-3800.

Pangborn Corporation
Booth 501B



At this year's National Steel Construction Conference, Pangborn will feature various blast cleaning systems for descaling plate, rolled shapes, weldments and fabrications, for both pre- and post-blast descaling. Scale models and visual aids will be used to depict a wide variety of blast cleaning systems used in surface preparation of materials for burning, welding and applications of coatings.

For more information, contact: Pangborn Corp., P.O. Box 380, Hagerstown, MD 21741-0380 (301) 739-3500.

Arkansas Steel Processing, Inc.
Booth 204

This newly formed company offers services to steel fabricators including: drill and cope; cambering; cutting to length; tee splitting; storage; and trans-shipping of wide-flange beams. The firm's plant will be located in Armorel, AR.

For more information, contact: Bob Bronson, Arkansas Steel Processing, 17W697 Butterfield Road, Oak Brook Terrace, IL 60181 (708) 495-8600.

Ridge Erection
Booth 615

In addition to its erection service, the company operates a decking service and a crane rental and rigging company with a fleet of cranes ranging from 9 tons to 140 tons with up to 300' of boom. The company's projects have ranged from big-city high-rises to rural bridges.

For more information, contact: Ridge Erection Co., 6015 W. 56th Ave., Arvada, CO 80002 (303) 422-0578.

Insco Saw Division
Booth 607D

Insco's display at the National Steel Construction Conference will feature segmental saw blades, bandsaw blades and ICAS—a computer program for the structural steel industry. ICAS selects the proper blade, correct feeds and speeds to maximize beam cutting efficiency. The company's segmental saw blades range in diameter from 10" to 108" and the bandsaws are offered in three types of bi-metallic bandsaw material to provide a durable yet relatively low-cost tool.

For more information, contact: Insco Saw Division, 320 International Circle, Summerville, SC 29483 (803) 873-7850.

NEA
Booth 3023

The NEA promotes innovative labor-management programs and provides members with an opportunity to exchange information and develop relationships with their peers. Publications include: *NEA Notes; I-Beam; Labor Update*; and *Safety Spotlight*.

For more information, contact: Noel C. Borck, exec. vice president; 1501 Lee Highway, Suite 202, Arlington, VA 22209 (703) 524-3336.

NSCC Product Exhibitors

TradeARBED, Inc.
Both 207

The company is best known for its standard and "Tailor-Made" wide-flange beams up to 44" in depth and with foot-weights up to 920 lbs. per ft.

Recently introduced products are the standard and "Tailor-Made" HISTAR shapes. These High Strength, Low Alloy steel sections have a yield strength of 50, 65 or 70 ksi and are produced by the revolutionary Quenching and Self-Tempering process that results in a high yield strength, outstanding low temperature toughness, and excellent weldability (as featured in a recent report by the American Welding Institute).

For more information, contact: TradeARBED, Inc., 825 Third Ave., New York, NY 10022 (212) 486-9890.

Welded Tube Co.
Booth 2002

Welded Tube Co. has introduced RedKote, a manufacturing process utilizing PalmerKote. In the process, the steel tube is descaled and degreased while it's being formed. Then it's coated with a primer paint and dried before being cut into finished lengths.

For more information, contact: Welded Tube Co. Of America, 1855 East 122nd St., Chicago, IL 60633 (312) 646-4500.

ITW Buildex
Booth 514

The Autotraxx ICH Deck Fastening System is used to attach steel deck in a stitch or structural steel application. The system has two components: a stand-up tool that includes a screwgun, special fastener guidance system, depth sensitive nosepiece and unique drive socket; and Traxx fasteners with an ICH (Internal Cone Head) design.

The fasteners have either a Traxx/1 point for stitch applications or a Traxx/5 point for structural attachments. The design allows the tool drive pin to engage securely with the fastener for consistent drilling.

For more information, contact: ITW Buildex, 1349 West Bryn Mawr Ave., Itasca, IL 60143 (708) 595-3549.

Inorganic Coatings
Booth 807B

Inorganic Coatings offers a wide variety of coatings for the structural steel industry, including IC 531 zinc silitate. The coating is a combination of high-ratio liquid glass and pure zinc that chemically bonds to the steel and seals off to become a permanent barrier to moisture, oxygen, deicing salts and ultra-violet rays.

For information, contact: Inorganic Coatings, Inc., 500 Lapp Road, Malvern, PA 19355 (215) 640-2880.

Haydon Bolts, Inc.
Booth 2011

The company offers: plain or galvanized foundation anchors; threaded rod; tie rods; hanger rods; swage bolts; hex bolts; U and eye bolts; crane rail; tension control bolts; lag screws; washer; threaded rebar; B7 studs; turnbuckle assemblies; nuts of all types; plates; coupling nuts; masonry anchors; A325 Type 1 & 3 + A490 structural bolts; A307 A & B; A36; A588; 4140-B7; and up to 4" diameter carbon and stainless steels.

For more information, contact: Haydon Bolts, Inc., Adams Ave. & Unity St., Philadelphia, PA 19124-3196 (215) 537-8700.

Lohr Structural Fasteners, Inc.
Booth 2000/2001

Lohr offers a wide range of domestic bolts. The product line is mill certified, fully assembled and tested, and of the highest quality available.

Contact: Lohr Structural Fasteners, Inc., P.O. Box 1387, Humble, TX 77347 (800) 782-4544.

Design Data Corporation
Booths 300/302/304/306

DesignLINK, Design Data's newest member in its software family, can be seen along with the rest of the company's innovative software and hardware products for steel fabrication at the National Steel Construction Conference. This software family makes up the SDS/2 Steel Fabrication system, consisting of: Engineering, Analysis and Design; DesignLINK; Estimating; Detailing; Production Control; and CNC Interface Modules. Each of these modules can be installed as a stand alone package or integrated with one or more of the other modules to provide numerous advantages.

For more information, contact: Design Data, 1033 O St., Suite 324, Lincoln, NE 68508 (402) 476-8278.

NSCC Product Exhibitors

Dogwood Technologies, Inc.
Booths 211/213/310/312

Dogwood's Procedural Detailing System offers a state-of-the-art computerized steel detailing system. While other companies are just adding stair or bracing, Dogwood is already working on the next generation of detailing systems.

For more information, contact: Dogwood Technologies, Inc., P.O. Box 52831, Knoxville, TN 37950-9928 (800) 346-0706.

Lincoln Electric Company
Booth 1010

The Lincoln Electric Company will be showing two new products at the National Steel Construction Conference. Idealarc SP-100 is ideally suited for individuals with access to 115 volt AC input power and who want the ease of use, quality and dependability of both the Innershield (FCAW Flux-Cored Arc Welding) process and the MIG (GMAW Gas Metal Arc Welding) process. Idealarc SP-250 is a complete semiautomatic constant voltage DC arc welding machine. It combines a constant speed wire feeder with a microcomputer-based controller.

For more information, contact: The Lincoln Electric Co., 22801 St., Clair Ave., Cleveland, OH 44117-1199 (216) 383-2162.

MetalMizer
Booth 407D

MetalMizer's tilting head vertical bandsaws offer: 18" x 20" capacity; 45198 tilting cutting head; 0-175 lb. cutting pressure; infinitely variable blade speeds; high-effiency drive system; and counter-balanced cutting head.

For more information, contact: MetalMizer, 8180 W. 10th St., Dept. FW1-MM, Indianapolis, IN 46214 (800) 553-0182.

NSS Industries
Booth 415

American-made Rapid Tension structural bolts from NSS Industries meet the highest industry standards and have the lot identification stamped on each and every bolt for complete traceability.

For more information, contact: NSS Industries, 9075 General Dr., Plymouth, MI 48170 (313) 459-9500.

National Institute of Steel Detailing
Booth 201

The NISD offers its members a quality procedures program, health insurance, newsletter and meetings in all parts of the U.S. The Institute has 11 chapters in 28 states.

For more information, contact: L.N. Ross, National Institute of Steel Detailing, 1791 Tullie Circle, N.E., Atlanta, GA 30329 (404) 634-8424.

Valmont Tulsa
Booth 2004

Valmont Tulsa offers tubular sections manufactured to meet an engineer's or fabricator's specific shape and size requirements. The sections are available in large sizes from 14" to 30" and in squares, rectangles, and tapered shapes.

For more information, contact: Valmont Tulsa, P.O. Box 2620, Tulsa, OK 74101 (800) 331-3002.

Steelcad
Booth 301B

Steelcad offers a fabricating program designed by fabricators. The program increases drawing productivity through the use of computers, but is simple enough that the operator doesn't need an engineering degree or a huge amount of experience with steel detailing.

For more information, contact: Steelcad International, 200 East Robinson, Suite 250, Orlando, FL 32801 (800) 456-7875.

CONXPRT
Booth T.B.A.

Steel Connection Design Software (CONXPRT) is a knowledge-based PC software system for the design of steel building connections. Three basic types of connections are availabel in Version 1.0: double framing angles; shear end-plates; and single-plate shear connections. Attendees at the National Steel Construction Conference will be able to view a hands-on demonstration of the software.

For more information, contact: AISC Software, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001 (312) 670-2400.

WEBOPEN
Booth T.B.A.

This state-of-the-art software package is based on and includes the new AISC *Design of Steel and Composite Beams with Web Openings*. The program, which was written by practicing engineers, is designed to enable engineers to quickly and economically design beam web openings. The easy-to-use color-coded input windows provide a clear, logical data entry system. Attendees at the NSCC will be able to view a hands-on demonstration of the program.

For more information, contact: AISC Software, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001 (312) 670-2400.

Southern Coatings Inc.
Booth 311

Southern Coatings will exhibit a full line of V.O.C. compliant products at this year's National Steel Construction Conference. Primers, intermediate and finish coats formulated in both solvent-based and water-based chemistry will be featured. Also, information on the new Enviro-Guard product line will be available.

For more information, contact: Southern Coatings Inc., P.O. Box 160, 730 Fulton, Sumter, SC 29150 (803) 775-6351.

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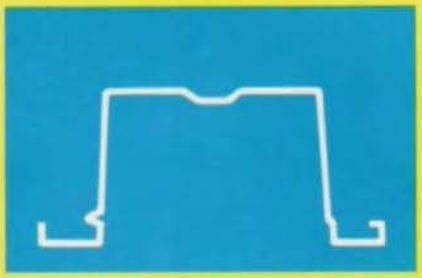

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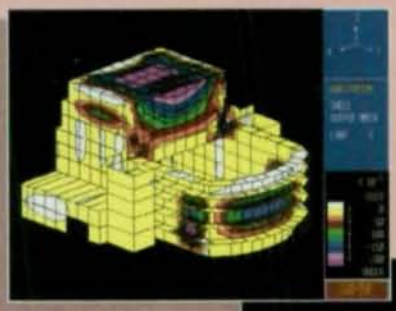

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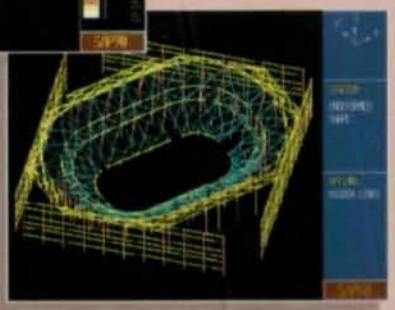

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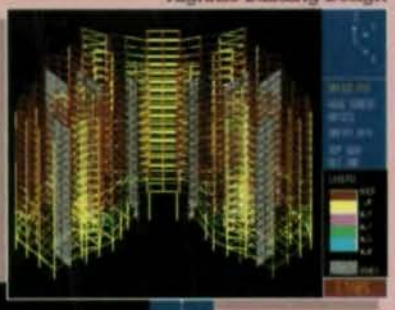

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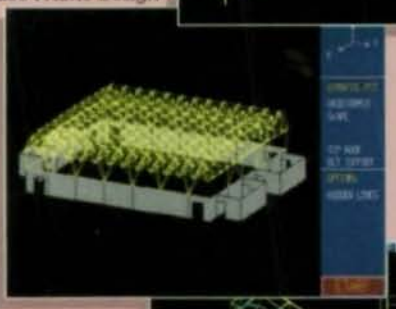

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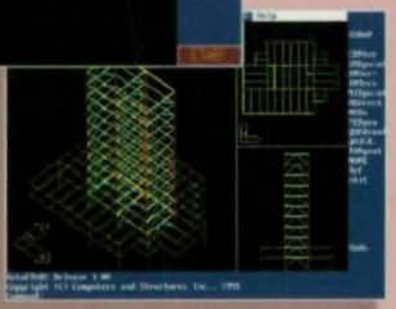

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