## POUR STOP SELECTION CHART

<table>
<thead>
<tr>
<th>SLAB DEPTH (Inches)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.00</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>4.25</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>4.50</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>4.75</td>
<td>20</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>5.00</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>5.25</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>5.50</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>5.75</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>6.00</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>6.25</td>
<td>18</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>6.50</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>6.75</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>7.00</td>
<td>16</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>7.25</td>
<td>16</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>7.50</td>
<td>16</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>7.75</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>8.00</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>8.25</td>
<td>14</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>8.50</td>
<td>14</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>8.75</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>9.00</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>9.25</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>9.50</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>9.75</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>10.00</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>10.25</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>10.50</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>10.75</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>11.00</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>11.25</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>11.50</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>11.75</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>12.00</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

### NOTES:

- The above selection table is based on the following criteria:
  1. Normal weight concrete (150pcf).
  2. Horizontal and vertical deflection is limited to 1/4" maximum for concrete dead load.
  3. Design stress is limited to 20 ksi for concrete dead load temporarily increased by one-third for the construction live load of 20 psf.
  4. Pour stop selection table does not consider the effect of the performance, deflection, or rotation of the pour stop support which may include both the supporting composite deck and/or the frame.
  5. Vertical leg return lip is recommended for type 16 and lighter.
  6. This selection is not meant to replace the judgment of experienced structural engineers and shall be considered as a reference only.

---

This chart is a repeat of our first DECK DESIGN DATA SHEET; the format has been revised to make the type (gage) selection easier.
Jim Bolling, President and CEO of Structural Software Company, is a second-generation steel man. His 15 years spent managing a 5,000-ton per year family fabricating shop gave him the insider's perspective.

This understanding of the steel man's needs has shaped every program that Structural Software Company markets.

Our programs speak the language of steel, instead of requiring you to become a programmer. And they are designed to work with you, the way you work, to reduce the time and the costs between the bid and the invoice.

**Estimating** figures labor and material costs and takes into account everything else that needs to happen. The program prices the dozens of items that go into a project, from the mill to the warehouse. Plus, it lets you change almost all of the pricing levels and labor codes to suit your needs.

**FabriCAD**, our computerized detailing program, is designed to cut through the steel man's most stubborn logjam—the long waits on details and shop drawings. You can gain control over your schedule and budget and smile at change orders.

**Vertical Bracing** works hand-in-hand with other detailing features to automatically detail X, V, K and Knee bracing with angles, double angles, and wide flange tees. It automatically details the bracing connections on the supporting beams and columns and lets you locate your working points wherever you want. Plus, it gives you an elevation view of any face.

**Material Allocation** lets you develop purchase orders by muting and combining your materials. Combine materials for mill or warehouse buying, and mut against your inventory, to recycle drops from previous job. Create cutting lists that will let you mark each beam with the job numbers and piece marks of the pieces you will cut from it.

If you also sell steel over the counter, **Point of Sale** will let you offer quotes over the phone, based upon material, tax, and labor costs, as well as the client's credit standing.

All of these programs run on IBM-AT or compatible microcomputers.

Call today and talk to some people who can speak your language.

---

**Structural Software Company**

5012 Plantation Road
P.O. Box 19220
Roanoke, VA 24019

(800) 776-9118
In order to meet a tight schedule and open in time for the Christmas shopping season, CambridgeSide Galleria’s below-grade parking structure utilized a steel frame, which allowed work on the retail portion to proceed at an accelerated rate. The story of this innovative project begins on page 22.
HISTAR®
A new generation of rolled beams and column shapes for economical steel construction.

Once again, ARBED leads the industry by featuring a trendsetting combination of mechanical, chemical and technological properties:

- HIGH YIELD STRENGTHS (up to 65 KSI) - even for ultra-heavy sections.
- OUTSTANDING TOUGHNESS PROPERTIES.
- EXTREMELY LOW CARBON EQUIVALENT — ensures excellent weldability.

A NEW PROCESS... QST.
The secret is in ARBED’s revolutionary new in-line QST process.

OTHER RECENT ARBED INNOVATIONS:
ARBED-ROLLED 40", .44", and "TAILOR-MADE" (WTM) series — famous for high section moduli, great lateral buckling resistance, and big savings in fabrication costs and weights. These products are also available in the new HISTAR quality as is our standard WF series and H BEARING PILES.

NEW LITERATURE AVAILABLE
Send now for complete data on all these ARBED products, contact Trade ARBED, Inc., 825 Third Ave., New York, NY 10022. (212) 486-9890, FAX 212-355-2159/2421.
In Canada: TradeARBED Canada, Inc., 3340 Mainway, Burlington, Ontario, Canada L7M 1A7. (416) 335-5710, FAX 416-335-1292.

TRADE ARBED Inc.
INNOVATORS OF STEEL CONSTRUCTION PRODUCTS.
Boom Or Bust?

For years, economists have examined the real estate market and expounded on its cyclic nature—a pattern reinforced by the minimum three-plus year lag time between a project's inception and its completion.

The first part of this decade is shaping up as the downside of the construction boom-bust cycle. But its a downside with a twist.

Since this issue is devoted to shopping centers, the retail market provides an appropriate example. Everyone involved in design and construction knows that the retail market is saturated. Dollars spent on design and construction should be down substantially in 1991.

But according to the latest figures from Cahners Economics, spending on retail construction is actually expected to increase slightly, from $31.2 billion in 1990 to $32.2 billion in 1991. Why?

Because the renovation market is growing by leaps and bounds.

"New construction is declining," according to Daryl Delano, a senior economist with Cahners Economics, the forecasting arm of Cahners Publishing. "Our forecast for the retail market implicitly assumes growth on the renovation side."

The retail market is an extreme example of the growth of renovation. Styles change rapidly in that market, and smart architects and engineers have always designed their structures to be adaptable. But its not the only area in which flexibility is crucial.

Health care is another obvious example, as is manufacturing. But even office buildings need to be flexible enough both to adapt to changes in technology and the need for growth and expansion.

How fast is renovation growing? A decade ago, less than 20% of building construction activity was renovation. Today, according to the Federal Government, more than half of the dollars spent in the building construction market are spent renovating old buildings.

Designers can capitalize on this trend in two ways.

First, it's important that young designers are trained in, or made aware of, historical practices. What type of structural systems are likely to be found in a 60-year-old building? And what kind of loads can those systems handle? It's feasible that engineering firms may soon find themselves following the model used in some architectural firms of having a principal devote himself exclusively to renovation projects—and thereby establishing his firm's expertise in that area.

Second, it's important that designers of new buildings realize that in the future—and that future may be only five or six years away—their designs will be renovated. The day isn't far away when a major criteria in judging the success of a design will be its inherent flexibility and consequentially its ability to readily and economically adapt to the needs of the owner now and in the future. SM
Before We Ship Our Structural Bolts And Nuts, They Have To Earn Their Stripes.

When bolts and nuts come from Nucor Fastener, you can have absolute confidence in their performance. That's because they're American made — and made to meet the toughest standards.

For starters, all the steel used in our structural bolts and nuts comes from Nucor Steel and other domestic steel mills. Plus, we provide raw material origin on all our certifications, and we can supply original steel certification for traceability requirements.

Our product line includes A325, A490 and A307 structural bolts and A563 grade C and heat treated grade DH structural nuts. And we've recently added mechanically galvanized structural nuts, bolts and washers along with ASTM Type 3 corrosion resistant/weathering products.

Our fully equipped laboratory lets us meet all ASTM quality standards. We provide proof tests and wedge tensile tests for all structural bolt products. And we can full-size tensile test our entire product size range instead of using machined samples.

What's more, we can meet special federal and state highway testing and certification requirements including rotational capacity testing.

All our fasteners are identified with a lot number on each container which allows traceability to materials, dimensions, processing and testing.

And because we maintain a 7,000-ton inventory of fasteners we can always supply what you need. So call us at 800/955-6826, FAX 219/337-5394 or write us at PO Box 6100, St. Joe, IN 46785 for more information. And give us the chance to earn your business.

Nucor Fastener
A Division of Nucor Corporation
As Workloads Decline, Marketing Efforts Shrink

A s workloads begin their cyclical decline, design firm marketing expenditures are starting to suffer, according to a new financial performance survey.

"Marketing expenditures as a percent of total revenue have been declining for several years," according to Howard Birnberg, president of Birnberg & Associates, a respected consulting firm that conducts an annual financial survey. "High levels of work in recent years may have discouraged designers from investing in this area. Unfortunately, with declining workloads, many firms may regret this decision. It's self-defeating."

Birnberg did note, however, that while the percentage of revenues spent on marketing in recent years was on the decline, the absolute amount spent on marketing had risen, since total revenues were up. Rising expenditures on marketing seem to have ended in 1989, however.

Designers spent 5.5% of their annual total revenues on marketing in 1984, 4.4% in 1988, and only 3.6% in 1990. Net profit on total revenues has declined to 7.0% in 1990, from 8.1% in 1989 and 1988.

The "1990 Financial Performance Survey of Design Firms" compiled data from 165 firms, of which 52.2% were engineers and 26.1% were architects.

Anecdotal evidence about marketing efforts shows mixed activity, according to Birnberg. "I've worked with a couple of larger firms that have begun in the past few years to pay much greater attention to both project management and marketing. It's no longer a question of a principal taking care of the marketing effort in his spare time. It's more structured. On the other hand, I'm aware of other large firms that have substantially cut, or even eliminated, their marketing departments as their work has declined."

Another measure of the problem that design firms will face in the early 1990s is climbing overhead rates, which reached a record low in 1988. "Part of this increase can be attributed to the declining workload in firms," Birnberg explained. "Much overhead in design firms is fairly fixed. Reducing these costs is a difficult and time-consuming process. Compounding the problem is the rising level of technical staff time charged to overhead areas as workload falls. Unless a firm's managers aggressively reduce technical staff, increase direct chargeable labor time, or cut overhead costs, the overhead rate will rise.

An overhead rate ratio can be calculated by dividing total firm overhead by total firm direct labor. The overhead rate before distributions for bonuses and profit fell to an all-time low of 135% in 1988, before climbing to 149% in 1989 and 150% in 1990.

Errors and omissions insurance accounted for, on average, 5.77% of total overhead before distributions. The average coverage was $1,328,280, while the average deductible was $69,800. After distributions, errors and omissions insurance was only 5.12% on average, with a median response of 4.68%.

The American Consulting En-
Continued on page 11
Eligibility
To be eligible, a bridge must be built of fabricated structural steel, must be located within the United States (defined as the 50 states, the District of Columbia, and all U.S. territories), and must have been completed and opened to traffic from July 1, 1986 through May 1, 1991.

Judging Criteria
Will be based primarily upon aesthetics, economics, design and engineering solutions. Quality of presentations, though not a criterion, is important.

Award Categories
Entries will be judged in one or more categories, but may receive only one award.

- Long Span One or more spans over 400 ft. in length.
- Medium Span, High Clearance Vertical clearance of 35 ft. or more with longest span between 125 and 400 ft.
- Medium Span, Low Clearance Vertical clearance less than 35 ft. with longest span between 125 and 400 ft.
- Short Span No single span greater than 125 ft. 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.

Entry Requirements
All entries must contain an entry form, photographs and a written description of the project.

1. Entry form: All information requested on the form must be completed in full.
2. Photographs: Professional quality 8x10 color prints of various views showing the entire bridge, including abutments. 35 mm slides should also be submitted if available. All photographs must be cleared for use by AISC.
3. Description: Explanation of design concept, problems and solutions, aesthetic studies, project economics and any unique or innovative aspect of the project. Include no larger than 11x17 drawings showing elevation, framing system and typical details.

Method of Presentation
Each entry should be submitted in an 8½" x 11" binder, containing transparent window sleeves for displaying inserts back to back. The entry form included in the brochure must be easily removable, so that the identification of the entry can be concealed during judging. All information requested on the entry form must be included.

Awards
The winners will be notified shortly after the June judging. Public announcements of the winners will be made in the September issue of Modern Steel Construction magazine. Award presentations will be made to the winning designers during the National Steel Bridge Symposium, September 16, 1991, in St. Louis, MO.

Deadline for Submission
| **Entry Date** | |  
| **Name of Bridge** |  
| **Completion Date** |  
| **Location** |  
| **Date opened to traffic** |  
| **Category in which entered** |  
| **Approx. total cost** |  
| **Span lengths** | **Roadway widths** | **Steel wt./sq. ft. of deck** |  
| **Vertical clearance** | **Steel tonnage** | **Painted:** Yes, No |  
| **Structural system(s) (describe briefly here)** |  
| **Innovative Concepts** |  
| **Descriptive data: Attach separate sheets (see entry requirements)** |  
| **No. of photographs enclosed:** Color prints, 35 mm slides, |  

**Design Firm:**
- **Address:**
- **Phone:**
- **Person to contact:**
- **Title:**

**Consulting Firm (if any):**
- **Address:**
- **Phone:**
- **Person to contact:**
- **Title:**

**General Contracting Firm:**
- **Address:**
- **Phone:**
- **Person to contact:**
- **Title:**

**Steel Fabricating Firm:**
- **Address:**
- **Phone:**
- **Person to contact:**
- **Title:**

**Steel Erecting Firm:**
- **Address:**
- **Phone:**
- **Person to contact:**
- **Title:**

**Owner:**
- **Address:**
- **Phone:**
- **Person to contact:**
- **Title:**

**This entry submitted by:**
- **Name:**
- **Firm:**
- **Address:**
- **Phone:**
- **City and State:**
- **Zip:**

*(ADDITIONAL ENTRIES MAY BE SUBMITTED ON COPIES OF THIS FORM)*
Survey, Cont.

In their "1990 Professional Liability Survey" reported similar findings. According to the ACEC report, insurance as a percent of billings dropped to 3.98% in 1990, compared with 4.21% in 1989 and 4.5% in 1988.

However, the ACEC also found that the percent of uninsured firms climbed to 21.6% from 19.0% in 1989.

Structural engineers had the highest insurance costs as a percent of total billings at 6.82%. However, only 16% of structural engineers were uninsured. Civil engineers had relatively low insurance costs at 3.5% of total billings, as did architectural/engineers at 3.1% of total billings.

"Although the liability crisis may be leveling off, it is still at a point where many engineers can't afford the high cost of claims and liability insurance," according to William Lewis, ACEC president. Lewis also expressed concern about the large number of uninsured firms. "The simple truth is that large numbers of firms are risking bankruptcy by going bare."

Firm size is the major determinant of whether a company carries insurance with 43% of firms with one-to-five employees going bare compared with only 1.38% of firms with more than 500 employees.

The ACEC survey reported that 39% of claims are "frivolous", while the other 61% result in some type of payment to the claimant. However, the survey also showed that the number of claims made against the profession is declining, from 43 claims per 100 firms in 1989 to 40 per 100 firms in 1990.

One bright spot in the Birnberg survey was the decline in the average collection period for collections on accounts receivable. The collection period fell to 67 days in 1990, compared with 69 days in 1989 and 77 days in 1988.

A copy of the 70-page report is available for $47.80 (including shipping) from: Birnberg & Associates/The Profit Center, 1227 West Wrightwood Ave., Chicago, IL 60614 (312) 664-2300.

For more information on the ACEC, contact Jeanne Quick at (202) 347-7474.
SSRC Holds Session On Inelastic Behavior

The featured presentation at the 1991 Annual Technical Session of the Structural Stability Research Council (SSRC) will be “Inelastic Behavior & Design of Frames.” The meeting will be April 16-17 in Chicago.

Council task groups as well as practicing engineers and research workers present their latest findings on a wide range of topics related to the stability of metal structures.

In addition, a special theme session on inelastic behavior will be held on April 16 and chaired by Wai Fah Chen of Purdue University. Speakers and topics include:
- Michael Ackroyd, First Principals Engineering: “Design Needs From Inelastic Analysis”;
- Russell Q. Bridge, The University of Sydney: “Design Using Advanced Analysis”;
- William McGuire, Cornell University: “Refining The Plastic Hinge Concept”;
- David A. Nethercot, University of Nottingham: “Test Results For The Verification Of Three-Dimensional Inelastic Second Order Analysis Of Flexibly Connected Frames”;
- Udo Vogel, University of Karlsruhe: “A Practical Approach To The Inelastic Analysis/Design Of Unbraced Steel Frames By Second Order Plastic Hinge Theory”;
- Donald W. White, Purdue University: “Consideration Of Inelastic Stability In Frame Design”.

The session will be followed by an evening panel discussion on “Inelastic Design Of Frames”, moderated by Jerome S. B. Iffland of Iffland, Kavanagh, Waterbury, P.C., New York. Panelists will include: Navin Amin, Skidmore, Owings & Merrill, San Francisco; Leo Argiris, Weiskopf & Pickworth, New York; and Richard Parmelee, Alfred Benesch & Co., Chicago.

For more information, contact: SSRC Headquarters, Fritz Engineering Laboratory #13, Lehigh University, Bethlehem, PA 18015 (215) 758-3522/3519. In the Chicago area, contact: Nestor R. Iwankiw (312) 670-5415.

Spec., Cont.

Other changes deal with through-fastened flanges, applicable steels, diaphragm construction, wall stud strength, and lateral buckling strength. In addition, 15 technical articles are planned to be added to the Specification’s bibliography.

To obtain a copy of the upcoming new Specification, including revisions from the current edition, contact: American Iron & Steel Institute, 1133 15th St., N.W., Washington, DC 20005.
Would you rather do the structural design of this building beam-by-beam – or floor-by-floor?

NOW!

With RAMSTEEL's™ integrated floor-by-floor analysis, one engineer can design an entire building in one day.

Starting at the roof and working to the base, RAMSTEEL integrates the results of the analysis of each successive floor, automating nearly the entire design process.

RAMSTEEL:
- Runs on Your PC
- Has a Windows 3.0™ based Interactive Graphical Modeler
- Automatically distributes surface, line, and point loads to supporting members
- Calculates and applies live load reduction factors
- Optimizes beam (composite or non-composite) and column design per ASD or LRFD
- Calculates quantity take-offs by member type
- Permits interactive output editing
- Automatically incorporates applicable requirements of major building codes

For complete state-of-the-art analysis of all lateral elements RAMSTEEL automatically interfaces with ETABS® or supplies a tabularized printout of all gravity loads to members of the lateral frames. An automatic interface with your CAD software generates floor framing plans.

Now is the time to find out more about the power of RAMSTEEL.

1-800-726-7789
FAX: 916-895-3544

RAM Analysis Integrated Structural Software
55 Independence Circle Suite 201
Chico, California 95926

All trademarks are the sole property of their respective companies.
Software Review

ECOM Associates' Steel Beam Program

By W. Britson, P.E., and B. Haley, P.E.

According to the program's documentation: “The ECOM Composite Steel Beam Design Program (SD3C) provides the ability to design or check composite steel beams comprised of standard shapes. This program determines critical moments, shears and deflections of prismatic beams and designs or checks the members using a database of structural elements. This database can be the ASD9 database supplied with the program or may be a user defined database created with the Section File Editor and General Section Properties Program (GSC).”

In addition to this, it should also be noted that this program will design/check for load cases with end moments and/or cantilevers.

The program was reviewed in five areas: system requirements; ease of loading the program onto a computer; documentation clarity; performance of stated function; and ease of use for practicing engineers. Each area was ranked from 1 to 5, using the following criteria:

5: This is a great program and I'd like to buy a copy.
4: This is a very effective, very useful program.
3: The program performs its stated goals adequately.
2: The program could be useful but needs to be improved.
1: The program is inadequate.

System Requirements
Rating: 5.0

The ECOM software package is written for use on most currently used IBM-compatible systems. These hardware requirements include the PC (8086-based), XT (8088-based), AT (80286-based), and the PS-2 (80386-based) machines with or without a math co-processor.

The computers require a minimum of 640K RAM and a 20 MB hard disk. The required operating system is MS-DOS or PC-DOS versions 3.0 or higher. A host of printers are compatible with the software.

Unlike many structural software packages, ECOM has very few hardware-related restrictions. The copy received for review contained only 3½” floppy disks, but 5½” are available. Anyone purchasing this program should make sure they specify the required disk size.

Loading
Rating: 2.0

Installation of the software is an easy task. Once the software installation is complete, however, terminal installation begins.

Terminal installation is a unique feature to the ECOM software. This is very useful if the machine is networked with other machines, but is cumbersome for standalone personal computer users. Terminal installation requires the user to possess a knowledge of the computer hardware. Note, though, that installing the terminal is a process that normally done rarely.

Documentation
Rating: 4.0

The documentation for the Composite Steel Beam program is divided into the following chapters:

Chapter 1. Introduction
Chapter 2. Keyboard Definitions & Software Installation
Chapter 3. Terminal Installation & Program Narrative
Chapter 4. Setting I/O Units and Defaults
Chapter 5. Example Problems

The Introduction includes sections describing Minimum System Requirements, an Input/Output synopsis, and a short description of the Design Procedure. The Input/Output synopsis visually explains what will be expected for input variables and the restrictions as far as loading is concerned. The description of the Design Procedure is too general to be of any prac-
tical value. We would rather have the detailed description of the design procedure and all program procedures included with the Program Examples.

The Keyboard Definitions and Software Installation are succinct and clear.

The Terminal Installation narrative well describes the procedure of installing different types of systems varying from an IBM PC to a DEC VT100. The general procedure is well documented for the practiced computer user, but novices may require more detail. For more information, the installer is referred to Chapter 4, but unfortunately, no further information is provided in that chapter.

The Program Narrative uses screen printout illustrations to explain each section of input. This is a very useful technique and saves time for the user by reducing the amount of reading material. Users should pay special attention to the sign convention. The sign convention for loads is gravity loads with a negative sign. This is typical for comprehensive frame programs, but atypical for individual steel utility programs. Because the typical engineer uses a program first and refers to the manual only after encountering a difficulty, we feel that the sign convention should be boldly emphasized throughout this narrative.

The chapter on Setting the I/O Units and Defaults also makes use of screen printouts and actually is self-explanatory within each menu.

The final chapter offers Example Problems with manual calculations and computer printouts for each of the two examples. Screen printout shows how all of the input would look on the users screen. This is an excellent method of offering a tutorial on the input as well as a way of verifying calculation methods and the program. There is an example for the AISC 9th Edition (ASD) Manual of Steel Construction as well as for the AISC 1st Edition (LRFD) Manual of Steel Construction. We noted, however, that both example problems are for the simplest of problems (uniform loading) encountered in practice. It would have been helpful if additional, more comprehensive examples were offered.

Program Functioning
Rating: 4.5

To determine the ability of the program to function, we devised a set of typical composite beam designs. The test included beams that would test most aspects of the input, loading, span, and analysis of the program. We found the program to function as described in its documentation. The accuracy of the results for the test problems was sufficient.

The ability of the program to function effectively is dependent on the user. In this case, users must be familiar with menu-based software and remember the menu branching. A flow chart would enhance the documentation.

As mentioned above, significant difficulty arises from the loading sign convention. Typical sign conventions used on member design programs is a positive for gravity loads. ECOM has adopted a convention consistent with the coordinate system. This is not a functional problem, but could lead to user error. In addition to emphasizing this point in the program's documentation, it should be highlighted in the menu.

Conclusions And Recommendations

Overall Rating: 3.5

The program is well prepared and executed. Drawbacks revolve around the use of menus and filing systems. The algorithms appear to give solutions that are correct for the selected examples, which is a big advantage over many packages that we have found to be carelessly written and distributed without quality control.

The filing system used in this program is cumbersome. Files for a particular project/problem/user are stored and deleted in a method over which the user has little control. Files in PC-based machines should be user controllable. In other programs, this is done by allowing the user to save (from hard drive to floppies for permanent storage) and delete files (from the hard drive at the user's discretion).

The menus are tedious to use. Perhaps in the next revision ECOM could combine many of the menus so the user can make decisions on the direction in which he/she would like to input information.

We would recommend this program for a heavy user. Casual users may find the menus hard to remember, confusing, or even aggravating.

We would recommend this program for a heavy user. Casual users may find the menus hard to remember, confusing, or even aggravating.

Wes Britton is vice president and deputy director of structural engineering at HTB, Inc., Oklahoma City, OK. Blake Haley is a structural engineer with HTB, Inc.
Florida Garden

Steel and glass combined to create an interior garden for a new mall near Palm Beach

Shopping center design in the 1980s all too often seemed like the construction of interchangeable cogs in a giant machine. Pick up a center in Texas and drop it in Connecticut; no one would notice the difference.

But from its inception, the 1.3 million-sq.-ft., two-level The Gardens of the Palm Beaches in Palm Beach Gardens, FL, was different. "Despite my firm's location in Michigan, I'm personally very familiar with this area of Florida," explained James P. Ryan, AIA, president of James P. Ryan Associates Architects and Planners in Farmington Hills. "We set out to design the quintessential Florida shopping center." To Ryan and the project's owner, Fobres/Cohen Properties, Inc., that meant translating the center's name into reality and creating an indoor garden.

"We talked about arboretsums and researched the European garden-type spaces from the 19th Century. Building one today would be very labor intensive and expensive," Ryan said. However, the old European glass houses provided a starting point for a design that could be simplified and translated into modern materials.

The center is designed as a mostly rectangular, 1,200'-long, two-story building with five anchors spaced around the perimeter. In front of each anchor tenant is a large court, with the largest court of all—the focal point of the entire development—located at the project's midpoint.

From floor to ceiling, the main court features a myriad of both tactile and visual images. "The coup de grace of the center is the space itself," Ryan stated. "Some of the finishes are reminiscent of Art
The design of the center reflects Art Deco influences but still manages to capture the unique spirit of Florida in both color and style. Photos by Baltazar Korab.

The design of the center reflects Art Deco influences but still manages to capture the unique spirit of Florida in both color and style. Photos by Baltazar Korab.

The design of the center reflects Art Deco influences but still manages to capture the unique spirit of Florida in both color and style. Photos by Baltazar Korab.

Deco detailing, but there's also a strong Florida influence.”

And despite its huge size, the space also is human-centric. “We wanted to break the space down, make it more habitable and inviting.” Towards that end, the open expanses are interrupted with waterways and plantings. Even the floor tile provides a visual richness, Ryan stressed. “We used six colors of floor tile. We’d start with three colors at each end of the center, and as we’d proceed, one color would drop out and another would be added. It’s a philosophy of color that made the space more interesting.”

In each court is a piece of sculpture selected for its surroundings by the architect. The pieces are all by American sculptors and some date back almost to the turn-of-the-century. “I selected pieces that were not contemporary, pieces that are romantic and realistic rather than abstract,” Ryan said. The budget for the five pieces of art was approximately $1 million.

But what ties all of the elements together and makes the center work is its steel frame.

“There’s not another material that would give us the light and airy feeling we wanted,” Ryan explained. Additionally, the steel could support the extensive network of skylights necessary to keep the center’s many plants and trees alive.

In the courts, the steel was left exposed and served as an architectural element. The steel theme also was picked up by the exterior entryways and by railings throughout the center.

Structural Design

Structural steel framing was selected as the primary structural frame to provide for a column-free mall and efficient retail spaces. The upper floor utilizes a composite steel frame, while the roof framing system is a structural steel frame with open web bar joists and a galvanized metal roof decking. The high wind loads of the Palm Beach area are resisted through a combi-
nation moment resistant steel frame and shear wall design.

The design of the retail portion of the center is a conventional steel frame with 30' x 30' bays. The floor on the upper level is composite construction supported on large A572 wide flange sections 30" to 33" in depth and spanning up to 70' across the mall. The roof has mostly long-span trusses up to 100' in length with a depth from 8' to 10'. The retail portion has either beams and joists or joists and joist girders at the roof line.

The project used 2,800 tons of A36 steel, 355 tons of A572, and 36 tons of tubular steel, according to AISC-member Kline Iron & Steel Co., Inc., Columbia, SC, the project's fabricator and erector.

Exposed Steel

"Within the courts, we made extensive use of exposed steel," explained George Ehler, P.E., president of Ehlert/Bryan, Inc., Southfield, MI. "All of the courts have a similar design, though the configurations vary."

In the center part of each court is a compression ring fabricated from segmented wide flanges or plate girders, depending on the size of the trusses supporting the ring. The trusses, which vary in size from 30" to 4' deep, are framed from a column or the long-span trusses discussed above. The exposed trusses have a sloping top chord and curved bottom chord, the latter primarily for aesthetics. The chords are composed of WT sections and the webs are either single or double angles.

"At the compression rings, large decorative holes were cut into the webs to allow in more light," Ehler said. The entire chord system was analyzed using the Images 3D software package from Celestial Software in Berkeley, CA. "We modeled each element separately as a series of multiple connected elements," he explained.

Most of the connections were field bolted, except for the compression ring segments, which have full penetration welds. Gen-
eral contractor was The Pepper Companies, Inc., Chicago.

Because the steel is exposed it had to be fabricated to precise tolerances, and a great deal of care was taken during erection. "Most of the courts were installed using two cranes, one holding the compression ring while the other installed the trusses," Ehler explained.

The large center court, however, required three cranes. "Throughout the lifting operation, the center crane's loads were continuously monitored to ensure that as the steel trusses were installed the loads were dissipating properly." During the erection, the load on the central crane from the weight of the compression ring decreased from 18,000 lbs. to less than 8,000 lbs. "When the crane was removed, the compression ring only deflected 1/8".

The Grand Court design included a computerized model with in excess of 200 elements, subjected to a combination of 19 various load cases. Due to the lack of symmetry at the Grand Court, emphasis was placed on the response of this system to 120-mile-per-hour wind loads.

The steel work was simplified by the chosen paint system, according to Ryan and Ehler. The steel was painted with an aqua-colored, one-coat system from AISC-member Tnemec. After the steel was erected, workers could simply spot finish any mussed areas. "After the erection was complete, the contractor didn't have to worry about painting any inaccessible areas," Ehler said.

Added Ryan: "The workmen reported that they found the light-colored steel easier to erect. The aqua color helped visibility and gave a psychological boost."

The non-exposed steel was cleaned to an SP7 level while the exposed architectural steel was cleaned to SP6. On the composite beams, the top flanges were left unpainted.

**Roof System**

One of the challenges in constructing the center was the integration of the various building components into the roof system. Due to the exposed nature of the steel, the system needed to accommodate not only the skylights and the structural steel, but also lighting, smoke evacuation systems, and fire protection systems. In addition, the large volume of the courts required that special attention be paid to the space's acoustical performance.

A field-assembled insulated metal roofing sandwich panel was selected as the material for the walls and roofs of the courts, and was placed between sections of skylights. Custom designed light fixtures were supported on the internally reinforced panels. Custom colored perforated liner panels were selected not only to blend in with the mall design, but also to provide acoustical relief. Smoke evacuation louvers were installed sideways to blend with the metal liner panel and concealed behind the exposed steel trusses.

Above the Grand Court is a catwalk system that was integrated within the exposed trusses to provide for theater lighting during fashion shows and other events held in the court.

The center's extensive skylight system enlivens the space. The 40,000 sq. ft. of glazing has a mirror-like outer surface and a clear inner surface. "We had to have enough light to allow the plants to grow, but enough reflective surface to keep down heat gain," Ryan explained.

"The overall concept of the center is to provide a level of experience for the shopper not presently available in any retail center in the area," Ryan stated. And in doing so, the designer has created a new definitive Florida mall.
The reasons fabricators call Chaparral are as strong as our steel.

**Broad Product Line.** Chaparral's beams, rounds, channels, flats and angles enable us to be your best source for one-stop shopping.

**Availability—What you need when you need it.** Chaparral offers innovative roll-and-hold programs to match your delivery requirements.

**Knowledgeable Shipping / Central Location.** Our centrally located mill allows us to ship with ease throughout North America. In fact, some of Chaparral's shipping innovations have become industry standards.

**Sales Force—The strongest in the industry.** Our sales teams are responsive to your needs. One phone call to any of our qualified professionals will take care of your complete order.

**Price. We're competitive.** Prices are quoted on a delivered basis. Give us a chance to meet or beat your current source. Just call us at 1 (800) 527-7979.

---

**CHAPARRAL STEEL**

Toll Free (800) 527-7979  In Texas (800) 442-6336
Local (214) 775-8241  Metro 299-5212  Telex 73-2406
300 Ward Road, Midlothian, Texas 76065-9651
Innovative Scheduling Saves A Shopping Season

Replacing concrete columns with steel in a three-level below-grade parking structure allowed the shopping center on top to be built more quickly

By Gene Sisco

The $120 million CambridgeSide Galleria was one of the most ambitious retail projects undertaken in New England in recent years. Located just across the Charles River from Boston's Beacon Hill, the 1.7 million-sq.-ft. facility already has attracted a large following from an urban population eager to shop in a state-of-the-art retailing environment.

The Galleria is the first phase of a 10-acre mixed-use project being developed by New England Development, Newton, MA. The mall consists of a 3-story, 800,000-sq.-ft. retail area built over three levels of below-grade parking for 1,800 cars.

The mall is unusual in its layout and layering. Normally, anchor stores are situated at either end of a suburban mall with many small stores sandwiched in between. Not so at CambridgeSide. The first floor consists solely of small stores, creating a "festival market" linking two marvelous public spaces at either end—the triangular Charles Park to the south and Lechmere Canal, a lively water feature to the North.

Placed above the urban market is, in effect, a two-story suburban mall with three strong anchors: Filene's, Lechmere, and Sears. Consistent with keeping the ends open to the park and canal, the anchors are pushed off to the side. The entire three-tiered shopping structure is visually tied together by a breathtaking 80'-high-by-600'-long arcade.

Towering overhead are 21 architectural steel gables that frame a continuous skylight band. At either end of the skylight "nave" sit massive 90' square cupolas supported by delicate diamond-pat-
terned trusses. Looking up at all of this order and harmony, the shopper discerns nothing of the scheduling obstacles that faced the project’s contractor, Beaver Builders, Newton, MA.

Soon after the start of construction in late May 1988, it became apparent to Steve Karp, New England Development’s chairman, that a February 1991 opening was going to be too late. The developer could not afford to miss the lucrative Fall/Christmas 1990 shopping season. According to Karp: “Timing is everything. You have to hit the market at the right time during one of three shopping seasons. If you miss a season you don’t open up the next day as with an office building or condominium project. Instead, you have to wait until the next season. Sometimes that can make the difference between a project making it or not; not only from the point of view of the cost of money, but also from how well the stores start and how the public perceives the center.”

Therefore, Karp set the team to work with a goal of opening the project by Mid-September 1990, chopping five months off the original schedule.

The CambridgeSide Galleria is an architecturally stunning retail center with 800,000 sq. ft. of retail area built over three levels of below-grade parking. Photo by Robert E. Mikrut
"Our task was to get the skin and roof on the building ahead of schedule, by New Years of 1990, so that we could proceed with our mechanicals and interiors work unimpeded by winter weather," explained Doug Goodnow, Beaver Builder's construction superintendent.

Given that the job used more than 7,000 tons of steel, it was quite an undertaking. Working with its scheduling consultant, Dataline Management Group, Beaver Builders met with its steel supplier and erector, AISC-members Montague-Betts, Lynchburg, VA, and United Steel Erectors, Everett, MA, to see if the goal could be achieved.

A comparative analysis by the team revealed that the stacking of two different structural systems as originally specified—precast for the below-grade parking and steel for the mall above—would eat up valuable time in the delivery, sequencing and erection process.

Precast had originally been chosen for the parking structure due to its fire protection characteristics. However, the design team quickly realized they could meet their needs with steel columns fireproofed with concrete, which presented a tremendous opportunity.

By using steel columns throughout the structure, construction could proceed at a much faster pace.

Beaver Builders recommended that the design team not think of the project as a conventional steel mall above a precast garage which was being built sequentially floor-by-floor. Instead, their concept was to erect a three-story structural steel frame and composite steel mall "in the air." Erection would be directly off of the mat foundation, 32' below grade with the mall supported by three-story steel stilt columns.

In this manner a rolling crane could work off the mat, setting six-story steel bay-by-bay as it moved. No added cost would be incurred to support the crane on the garage structure. Then, once the first floor mall decking was placed on the steel beams, work could safely pro-
ceed on the lower parking levels without impacting the schedule: Garage cast-in-place concrete floors were thereby taken off the critical path.

**Up-Up Construction**

This erection process was named "up-up" construction by the structural engineers, according to Steven Varga, P.E., principal with Weidlinger Associates. Adds his associate, Steve Highfill: "We have all heard of up-down construction whereby construction originates at grade level and proceeds at grade level and proceeds simultaneously up and down, digging as you go. The up-up construction utilized at CambridgeSide acknowledges that we started out at the basement level initially and that we took a giant leap to get up to the mall level. We skip areas that slow us down."

Weidlinger designed the 32'-high stilt columns with welded angle seats located where each cast-in-place flat slab would tie into it. They also designed the below-grade columns to be free-standing. In doing so, it was necessary to pay a premium in order to accommodate the unbraced length. However, this insured freedom of movement for the mat level construction.

Steel construction above the first floor of the mall was conventional. Bracing for the structure included a knee-braced moment frame in one direction and conventional bracing in the other direction.

Having determined schedule, system, and steel design, the contractor and his subs set out to produce an aggressive plan for supply and erection of steel. The project would demand the placing of a critical 5,000 tons of a total of 7,100 tons within six months.

The 10-acre site was divided into phases consisting of 32 divisions in which the steel erection would flow from south to north. "Before the steel arrived we determined a pace for ourselves to complete the mat foundation well ahead of the steel erection so there would not be

With "up-up" construction, the steel frame for the entire structure was erected, with the slabs for the garage levels added later. This type of construction method saved five months off the construction schedule compared to traditional construction where a concrete garage would be built, and then the steel retail center would be added on top.
Steel fabricator for the Cambridge-Side Galleria was Montague-Betts and steel erector was United Steel Erectors, Inc. Photo by Brian Neudorfer

an interruption to the flow," explained John Monaghan, Beaver Builder's project manager. This involved pouring 10,000 sq. ft. of mat surface area per week, much of it during winter months. By producing the mat early, large workable steel lay-down areas became available, thus mitigating urban site constraints.

With the mat ahead of the steel, Montague-Betts had to provide Beaver Builder's capacity requirements in order to get enough product to the site in order to keep erection output on schedule. With the assistance of two computerized drill lines in each of their Virginia plants, they were able to accommodate a demanding fabrication schedule. Deliveries average 200 tons per week, with some up to 500 tons. Shop drawings were turned around in two weeks despite the normal changes that arise in any fast-tracked job.

With an eye towards completing...
the structure by November and the roof deck by January 1990, United Steel Erectors recommended using three cranes plus one cherry picker on the project.

An 82-ton crane worked steel from the foundation to the first floor while two 165-ton tower cranes erected mall steel to the roof and cupolas.

"On steel delivery days, we were determined not to interrupt the tower cranes from their primary task of erecting steel," according to Bernie Macinnis, a superintendent with United Steel Erectors. "So we used a cherry picker strictly to unload the trucks and to shake out steel."

It was very important that all earth ramps for crane access to the hole be placed over an existing mat foundation. In this manner, as soon as each crane worked its way out, dirt could be removed from a fully prepared foundation below. Thus, the building's structure could be completed without stopping to place concrete foundations.

In order to realize the construction schedule, the erector was allowed to work 10 hour days and on Saturdays during the summer of 1989. As managers, Beaver Builders realized that spending additional resources on one key subcontractor—the steel erector—would create a ripple effect that would help the entire job.

"Many developers tend to underestimate the importance of the construction schedule and concentrate too much on the budget," explained Karp. "Time is money and sometimes you can spend more money on construction while saving it on the other end."

A mall can earn 30% of its annual revenues during the Christmas season. Beaver Builders was not only able to shorten the duration on the construction loan by five months on the $120 million project, but was able to earn earlier rental revenues for the developer. This was only possible due to the selection of steel over precast in the parking structure and an aggressive construction schedule.

Gene Sisco, AIA, is vice president of planning and development for Beaver Builders, Inc., Newton, MA.
Extending Retail Up And Down

Minneapolis' skyway system deposits shoppers on the second floor and creates retail space above and below the main level.

It's an axiom in multi-level shopping center design that the street level will house the prime retail space. Unless, of course, you're building in Minneapolis.

In response to its climate, downtown Minneapolis' city planners designed an extensive skybridge system that links most major buildings. And because of that bridge system, the second floor of the new Gavidae Common shopping mall is the prime level, rather than the first floor.

Gavidae Common is a 315,000-sq.-ft. specialty retail center with five levels of retail and two-and-a-half levels of below-grade parking. One end of the center is anchored by a Saks Fifth Avenue store, which occupies four floors.

Dignified Exterior

The center's exterior is clad in a warm beige French limestone to complement Norwest Center, a large office building which the center abuts on its south end. The main entrance is marked by a patterned glass wall flanked by stone piers inset with decorative light poles. As with other retail centers,
The exterior of Gaviidae Common features limestone cladding and other highly detailed finishes, creating a very dignified appearance. The pedestrian bridge connecting to Minneapolis' skyway system picks up many of the themes used on the interior. The atrium vault (opposite) is painted with blue "spikes" that direct the eye towards the skylight. The blue color, combined with gold leaf inlays, is reminiscent of a sparkling sky without being imitative. Photos by Balthazar & Christian Korah

the first floor features large glass display windows. In addition, two-story-high display windows are situated on the second floor in response to the second-story orientation of much of the pedestrian traffic in Minneapolis.

The limestone exterior, combined with the wonderfully detailed storefronts, present a highly dignified mien to the public. The inside, however, while equally dignified, is much more playful.

**Dramatic Atrium**

The interior features a dramatic five-story, 300'-long, 42'-wide atrium defined by a dark blue grid of exposed structural steel. A barrel vault rises above it and is decorated with a geometrical blue pattern with gold leaf accents. A skylight at the center of the vault brings natural light into the space. The column lines that are visible in the exterior are continued on the interior.

"We left the steel exposed to reinforce the rhythm of the design," explained Kristin Hawkins, an associate with Cesar Pelli & Associates, New Haven, CT, the project's architect. "We wanted the vault to appear delicate, and the exposed structure reinforces this feeling. Thin columns of steel mix a feeling of toughness with a feeling of delicateness." Associate architect on the project was Lohan Associates, Chicago.

Because of its position as the prime retail level, the second floor protrudes 14'-2" into atrium on all four sides. This presented a problem, though, of creating a potentially gloomy first floor. "To keep the first floor from feeling dark, we put glass block in the floor of the second level," Hawkins said. When the floor slab was cast, slots were left open to accommodate the glass block, explained William O'Neal, P.E., principal with Martin/Martin, Wheat Ridge, CO, the project's structural engineer.

**Vertical Integration**

Visually joining the two spaces are structural steel columns on the perimeter of the overhang that
emerge into the second floor space as light poles. And the glass-block theme is carried over into a connecting stairway between the two levels made with etched glass block steps and risers.

"The owner was concerned about the surface being slippery, but the sand-blasted surface is slip resistant even when wet," Hawkins said. In addition to the stair, the retail center has the usual escalators.

**Unique Pattern**

Rather than using signage to draw shoppers attention upward, the designers opted to utilize the structure itself. "The exposed steel columns start your eyes moving upward. We capitalized on that by creating a spiked blue pattern on the barrel vault that continues the visual movement until you reach the skylight," Hawkins explained.

"A lot of thought went into the pattern on the vault. It was important that it not mimic the idea of the sky, but still be reminiscent of it. And the gold leaf squares etched over the pattern catch the light and give life to the space."

Suspended from the vault is a large sculpture of a common loon, the state bird of Minnesota. Gaviidae, incidentally, is the Latin word for "common loon."

That playful touch, along with an abundance of natural light creates a visually varied and interesting space that complements the exterior while still blending in with the overall nearby buildings.

Before choosing a design for the exposed steel columns, the architect examined a wide variety of shapes, O'Neal reported. "The architect wanted a specific shape. The typical floor column is made up of four W10 x 30 wide flanges to form a cruciform."

**Lightweight Structure**

While the use of steel was important to the designer's desire to visually reveal the structure and the owner's preference for tenant flexibility, it was important to the engineer's need to reduce the structure's weight.

"There's a large loading dock beneath the structure and one of the reasons we used a steel frame was to reduce the load," explained O'Neal. To create the needed open space for delivery trucks, loads are transferred on four plate girders and a large truss.

The plate girders, which are 6' deep and 60' long, are located over the loading dock and the top flanges form the floor of the occupied space. The 20'-deep x 60'-long truss, however, is buried in a wall separating the mechanical room

Modern Steel Construction / February 1991 / 31
A unique feature of the center is a glass block staircase (above left) that connects the first and second floors. The exposed connections (above and top) were carefully chosen by the architect to present a specific shape—in this case, a cruciform.
from the rest of the floor. "The truss supports exterior columns and carries a much greater load than do the plate girders," O'Neal said.

A deep space between the loading dock and the first floor was originally intended as cafeteria/formal function space for a tenant in an adjacent office building. However, when those plans fell through, the space was converted into two-and-a-half levels of parking.

"Because of the high floor heights, we were able to slip another level in and a mezzanine," O'Neal said. To satisfy fire codes, the steel beams in the parking garage were encased in concrete.

From the ground floor to the roof, the center has a braced frame with composite floors consisting of 3/4 lightweight concrete on 2" metal deck.

The bracing consists of a 17' 9" concrete shear wall on the north face and steel X-bracing in two locations in the north-south direction and in the south wall. "Because Norwest Center rises off the south end of the building, there is a minimal wind load on the south face," O'Neal said.

The project used 1,100 tons of A572 Grade 50 steel. General contractor was a joint venture of Kraus Anderson/PCL, both of Minneapolis.

Pedestrian Skyway

A skybridge over Nicollet Avenue connects Gaviidae Common with City Center, and was designed as public art by Cesar Pelli in collaboration with Siah Armajani, an internationally renowned artist from Minneapolis.

"The pedestrian bridge shares the same sensibilities as the building," Hawkins said. "The detailing is very similar with its richness of color and exposed bolted connections. And the end that connects to the building has a panel of frosted glass that relates to the use of glass block on the inside."
Exposed Transformation

New skylights on an exposed structural system helped transform a tired mall into a bright, modern center.

Oglethorpe Mall in Savannah, GA, was typical of centers built in the late 1960s. "It was rather dark, with not a lot of natural light. It had dark flooring. There was not a lot of specialness about it," explained Henry W. Spiker, AIA, a senior associate with Thompson, Ventulett, Stainback & Associates, Inc., Atlanta, the project's renovation architect.

Although in an ideal location, the center's tired- and dated-looking physical condition caused the owner some concern about a possible loss of customers. In addition, the construction of a new mall nearby created worries about whether the center could retain its tenants and achieve optimum market rents.

"The mall seemed gloomy, with ineffective skylights and scattered 2x4 fluorescent lights," according to Spiker. "The quarry tile floor was dark, the ceiling structure exposed in many areas, and the natural piers between tenant storefronts were in disrepair or missing altogether."

In addition, interior landscaping was minimal and the store fronts were dark and uninviting. "The mall’s exterior entrances were heavy and fortress-like, with massive overhangs. The mall’s logo also was dated and lacked imagination to the point where there was little in the way of a positive recognizable mall identity."

But despite these problems, studies showed that a majority of customers had a strong affection...
Modern Steel Construction / February 1991

for the mall and referred to it as either “our” mall or simply “the” mall. With new competition on the way, the owner, U.S. Prime Property Inc., New York City, and manager, Dusco Property Management, Inc., Lancaster, PA, decided to redesign the 92,500 sq. ft. of common area in the mall to help maintain this customer loyalty. Included in the renovation were four courts and the corridors connecting them.

“Our goal was to stay within budget but still get as much impact as possible,” Spiker explained. “Therefore we focused on the interior courts.”

The mall was a steel building with bar joists and metal decks. To open up the space and admit more light, much of the bar joist construction in the courts was removed and replaced with a skylight assembly and wood decking, which was elevated above the former roof line to create a more spacious feeling. Louvered wall panels were added both to brighten the space and create a Southeastern feeling. And new landscaping and flooring were installed.

Unfortunately, the existing structural system was inadequate to support the new roof structure and the louvered wall panels, which were to be hung from beams, explained Walid Nannis, P.E., president of Nannis & Associates, Inc., Atlanta, the project’s structural engineer.

For example, the Center Court features white-painted exposed structural steel supporting a dramatic 40’ x 40’ structural pyramid skylight, a 20’ x 90’ gabled skylight, and three 20’ x 25’ gabled skylights.

“We utilized an exposed steel structure to create a slender, tall space and create the sense of an open, coastal architecture,” Spiker said. “There’s not another material that would have lent itself to this approach.” White paint was chosen to create a warm, comfortable feeling. The project used 26 tons of tubular steel for columns, ridge trim and skylight framing, and 262...
tons of A36 steel for columns, beams, skylight frames and entrance framing.

The top of the pyramid skylight is 54' above the ground floor level and 23' above the old roof line. As a result, this skylight assembly required substantial modification of a section of the roof about 160' x 90' in area, as well as two rows of new columns and bent beams spaced 5' on center. Small crossed beams were added purely for aesthetics and are not structural. However, the diamond pattern created as a result of the addition of these beams was picked up and repeated in the new signage for the center. All of the renovation work was done without shoring to minimize any interruptions to the mall activities.

The existing wall beams were inadequate to support the new louvered wall system, so new beams were introduced on top of the old beams.

Prior to being renovated, the interior of the mall seemed gloomy, with ineffective skylights and scattered 2x4 fluorescent lights. Also, the quarry tile floor was too dark.

THIS IS WHAT IT TAKES TO BE A BOLT MANUFACTURER IN THE 1990s:

- U.S. made steel
- Wide-range manufacturing capabilities
- Weathering steel: CORTEN X
- Guaranteed full traceability
- In-house lab testing
- Certification

ST. LOUIS SCREW & BOLT COMPANY
6901 N. Broadway/St. Louis, MO 63147/(314) 389-7500
FAX, (314) 389-7510
Toll Free, 1-800-237-7059

Modern Steel Construction / February 1991 / 37
“We used welded steel plates to combine the existing beams and new spandrel beams,” Nannis said. The beams were supported on existing columns, which in several cases had to be strengthened. “For six or eight columns we had to add welded plates to beef them up.”

Other areas of the mall also required substantial modification. In the J.C. Penney Court, for example, the addition of a new center pyramid skylight approximately 45' square and two 20' x 20' gabled skylights resulted in the modification of an almost 130' x 65' roof area. That roof structure in that part of the mall included trusses, which were kept, though additional bracing was added to replace the bar joists that were removed.

Thirteen individual new skylights were added between the various courts. These skylights required the cutting of several existing sloped roof frames, restructuring and strengthening adjacent existing frames without shoring any of the existing roof structure. Other skylights with a 20' square area were installed above the existing roof with only penetration at the four corner columns. The roof structure was then removed from below. This procedure was necessary so as not to interfere with the operation of the mall.

Towards that same end, all of the erection for the entire renovation project was performed between 9:30 p.m. and 8:30 a.m.

“One of the major factors that made the renovation process difficult was that there were no contract drawings to work from,” Nannis said. “The only available drawings were some incomplete structural steel shop drawings.”

In addition to renovating the interior common elements, the designers also renovated the mall’s five entrances. The extent of the renovation varied, however, by the expected usage of the entrance. Four of the entrances now feature exposed structural steel and skylights, while the fifth entrance was covered at the request of the anchor tenant in that location.

“The stucco-like entrance relates to the rest of the exterior of the mall, though we also picked up some of the diamond motif that was created with the steel,” explained Spiker. “The steel entrances pick up the interior concept. The diagonal bracing becomes an architectural element in addition to a structural element.”

The renovation cost $68 per gross enclosed sq. ft. “It transformed a 20-year-old plain, uninspiring mall into one with its own special identity and sense of place,” said Nannis. The transformation was so successful that it was the only renovation project to win a 1990 Design Award from the International Council of Shopping Centers.
STAAD-III/ISDS - Ranks #1 in America.

A recent ENR/McGraw Hill survey of the Architectural/Engineering/Construction industry has ranked STAAD-III/ISDS, from Research Engineers, as the #1 structural engineering software in the market today.

Simple to use, yet sophisticated in application, STAAD-III/ISDS offers the most comprehensive solution to your structural engineering needs. Today, Research Engineers, with six offices in four continents, is setting the structural engineering standard worldwide.

The choice of engineers since 1978, STAAD-III/ISDS is being used worldwide as an everyday companion in the design office. The first truly integrated structural engineering software, STAAD-III/ISDS combines geometric layout, analysis, design and drafting in a single software system.

STAAD-III/ISDS - #1 For a Reason.

Research Engineers, Inc.
A reputation you can build on.

For Information Call: 1-800-833-ISDS

RESEARCH ENGINEERS WORLDWIDE:
UK: Research Engineers (Europe) Ltd., 19 Lansdowne Court, Brighton Road, Purley Surrey CR8 2SD Phone: (081) 763-1393 Fax: (081) 763-1379 Telex: 929181
France: Research Engineers, 18 rue de Monceville, 28800 FLACEY Phone: 37.47.51.63 Fax: 37.47.44.63

W. Germany: Research Engineers, Wilhelm-Busch-Str.23, 6140 BENSHEIM 3 AUERBACH Phone: 06251/75437 Fax: 06251/75374
India: Research Engineers Pvt. Ltd., 42 B Durga Road, Calcutta 700 017 Phone: 448914 Telex: 214102
Vertical Retail Expansion

By expanding downward rather than up, Tyson's Corner Center in McLean, VA, economically doubled its leasable space

By Robert Knight, P.E.

The retail construction boom of the 1960s and 1970s has come full circle: A major component of some architectural firms' practices is now retail renovation.

Despite excellent locations, older centers just can't project the same up-to-date image as their newer competitors and often don't have the gross leasable area (GLA) to offer the diversity and number of stores customers have come to expect. By upgrading and expanding their facilities, developers are regaining market share, attracting high-end shops, and consequently increasing sales per square foot.

A highly successful example is RTKL Associate's renovation and expansion of Tysons Corner Center, an already prosperous shopping mall in the affluent Washington, DC, suburb of McLean, VA.

Built in 1968, the original two-level structure provided retail space only on the upper level. The full below-grade basement was used for storage, loading docks, offices and various tenant back-of-house functions. By providing new skylights and floor openings as...
well as excavating the area around the perimeter foundation wall, the existing basement level was economically converted to a new retail floor with space for 100 new shops.

In addition to renovating the existing mall, the project master plan included two lateral mall expansions totaling 40,000 sq. ft., the construction of two new anchor department stores (Nordstrom and Lord & Taylor), and the addition of four new parking decks with space for nearly 6,000 cars.

**Expansion Options**

The decision to expand into the existing basement level was not the only option considered by owner Lehndorff Management (USA) Ltd., Inc., architect/engineer RTKL, and construction manager Whiting-Turner Contracting Company.

The design team conducted pre-
The renovation sequence involved adding a new roof above the existing roof before removing the old roof. This sequence eliminated the need for any special weather protection. The work was complicated by the need to cut through a concrete slab to open up the lower level.
liminary studies on the feasibility of adding a new level above the existing roof, and several structural schemes were reviewed in conjunction with the “upwards-expansion” proposal. Various structural proposals were considered to deal with the problem of the existing mall columns and foundations not having the additional capacity required to support new floor and roof level.

One scheme for upwards-expansion involved reinforcing existing steel columns and spread footings. However, this option was complicated by the fact that a significant portion of the existing building columns are supported by belled caissons that extend through relatively poor fill materials. Increasing the capacity of these deep foundations would have been difficult and costly.

A second structural solution considered was to provide new columns and foundations between existing grid locations. Although conceptually simple, disadvantages of this scheme included the need to install new deep foundations in the confined basement area and the disruption of upper-level retail tenants due to the installation of new columns.

An additional complication surrounding the addition of a new floor level related to the structural requirements for resisting increased lateral loads due to wind. A solution involving numerous full height steel trusses threaded through the existing structure was considered, but it would have required temporary store closings and a loss of leasing flexibility.

**Downward Expansion**

Although presenting a separate set of challenges, a downward expansion into the existing basement level was clearly the best choice both for minimizing construction costs and disruption of existing retail tenants.

The new two-level mall was created by removing approximately 32,000 sq. ft. of existing floor structure and 47,000 sq. ft. of roof for the installation of new skylights.

An initial design plan called for removing the entire 42'-wide section of roof above the existing common mall. However, this scheme would have required provisions for temporary weather protection. While a clear spanning fabric structure or temporary weatherproof pedestrian walkways would have been feasible, both would have been extremely expensive.

Instead, to keep the mall common areas dry throughout the entire renovation process, the contractor installed the new skylights and support structure prior to demolishing the existing roof. The demolition and renovation sequence developed by the building team was implemented without requiring even a temporary closing of any mall tenant. RTKL’s design for the typical mall section called for the removal of a 15'-wide strip of floor and roof structure and the installation of new adjacent full height steel columns. The existing roof structure was hung from the new skylight support framing, eliminating the need for temporary protection as well as reducing the amount of needed new roof construction.

The existing mall construction was typically steel bar joists, wide-flange girders, and columns supported on either shallow spread footings or belled caissons. An exception to this was at the existing upper-level common mall area where one-way concrete joists spanning parallel to the mall length are supported by 42'-long W36 girders. Unfortunately, virtually all of the floor demolition occurred within the areas of concrete construction which resulted in higher construction costs. An existing steel-framed floor would have offered more flexibility for demolition and renovation operations while reducing costs and saving time.

**New Foundations**

The first step in the renovation was to construct foundations for the new mall columns. Shallow spread footings or augercast piles and caps were provided in the basement truck tunnel that paralleled the 1,500' length of the existing mall above. A custom low-overhead clearance rig was required to install 120 14”-diameter pressure grouted piles of lengths
The renovation provides space for 100 additional shops, as well as two new anchor department stores (top photo by Hedrich-Blessing). The skylights are supported by 60'-long, W27x146 girders that were set in place by helicopter. These members are designed to support both the new skylights and the existing roof framing.

ranging from 15' to 30'. New W10 columns were then erected between the foundations and the underside of the existing W36 girders.

The next step in the renovation sequence was to erect two 8' pipe columns at 60' on center through the existing roof structure. These columns bear on the existing W36 floor members directly above the new lower level columns. Existing roof bar joists were temporarily shored, cut, and then permanently connected to the new roof columns where interference occurred. Temporary weather protection was provided at new column penetrations through the existing roof.

With new support points in place above the existing roof, 60'-long W27x146 girders were set in place by helicopter. These members were designed to support the new skylight as well as existing roof framing. Wind load is transferred from the skylight to the existing roof level through torsional resistance of the W27 girder. A three-dimensional computer model of a typical 60' bay was created to facilitate analysis of the longspan girders under combined gravity and wind loading requirements.

**Roof Erection**

The next major step was to erect the architectural/structural roof trusses at 30' on center between W27 girders. After assembling and dismantling the roof trusses in the shop to check for fit-up, components were reassembled in place. These trusses feature exposed structural steel members. Chord members are WT4x89 with a curved bottom chord while web members are typically L21/2x21/2x1/4. Skylights were then erected and sealed above the new support framing.

The existing roof segments that remained were essentially hung from the new W27 girders. A 3/4"-thick plate hanger was installed between alternate existing steel joist top chord angles and welded in place. Diagonal web reinforcement for existing joist members was provided to eliminate excessive top chord bending. With the existing
structure supported and the new roof/skylight section complete and watertight, a 15'-wide section of existing roofing, deck, and joists was removed and dropped through chutes to the truck tunnel below.

Roof removal was followed by floor demolition. Temporary shoring towers and beams were erected tight to the underside of the existing floor structure. After isolating by sawcutting, the 15' widths of concrete construction were broken up and dropped to the tunnel floor. Immediately following floor demolition, a temporary cover was installed above each new opening to meet fire, dust and noise protection requirements. Construction of new bulkheads and handrails was completed below the temporary structure.

New Courts
In addition to the renovation of mall common area, four new department store courts and two feature mall courts were carved out of the existing structure. Large circular floor openings and pyramid skylights are featured in the department store courts. Typically used as columns, W12 beams as large as W12x170 were required to support the existing structure at the new department store openings in order to maintain desired ceiling heights and relatively column-free spaces.

The 60' x 125' feature courts required all new roof and skylight structure due to complexities with the existing high and sloping roof framing. Perimeter sections of new roof were first constructed below the existing roof. The installation of a two-story temporary vertical barricade surrounding the court center completed a watertight enclosure for mall pedestrian traffic. The existing roof could then be demolished from above. Floor demolition and construction of new roof trusses and skylights completed the basic renovation sequence. The 36'-long arched court trusses were constructed of exposed structural steel members, WT6 chords and L3x3 web members.

Virtually all demolition and structural renovation work was performed during the night shift. Although construction documents required the verification of existing dimensions and field conditions, access to many areas was limited up until a short time before commencement of work. For this reason, most new steel connections interfacing existing construction were provided with horizontal and sometimes vertical adjustment capability.

Robert Knight, P.E., is an associate principal with RTKL Associates, Inc., Baltimore, one of the nation's largest A/E firms with an international portfolio of retail, office, hospitality, mixed-use, health sciences and planning projects.

You can always spot the leader in the crowd... everyone is following them!

If you are watching the computerized detailing marketplace, you can't miss announcements. One company is adding stairs; another, bracing. One is moving their product to Unix and yet another is introducing a "unique" approach allowing a single member or sheet to be detailed independent of the rest of the structure.

And if you are watching the computerized detailing marketplace, you know that these companies are struggling just to catch up. And while they struggle, Dogwood is developing the next generation of detailing system. A system that not only works for you ...it works like you.

Dogwood Technologies, Inc. P.O. Box 52831 • Knoxville, TN 37950-9928 615-531-4073 • 800-346-0706
These 120-page books contain design aids for shear connections not previously published. Presented in easy-to-use tabular form, the books include designs for double-angle web-bolted connections, structural tee single shear connections and single-angle connections welded to the support. Included in these easy-to-use references are design aids for other connections reprinted from AISC, ASD and LRFD Manuals. They include double-angle web-welded connections, single-angle connections bolted to the support, end-plate shear connections, shear tabs, unstiffened and seated connections.

For Allowable Stress Design of Simple Shear Connections order S337. For Load and Resistance Factor Design of Simple Shear Connections order S338L.

ORDER FORM

Name ____________________________________________

Company _______________________________________

Street/P.O. Box __________________________________

City ____________________________________________

State ___________ Zip ____________

Phone __________________________________________

AISC Membership No. __________________________

1. S337 (price x number )= $________

   ASD

2. S338L (price x number )= $________

   LRFD

Subtotal = $________

Sales Tax (NY-CA-IL Residents)= $________

Orders under $100, add $3 (Orders above $100, please call)

TOTAL AMT. ENCLOSED= $________

Please enclose payment with order, no C.O.D. orders, American Currency Only)

☐ Visa ☐ Mastercard ☐ Check or Money Order

Card Number ___________________________ Expiration Date ____________

Signature __________________________________________

Phone Orders: AISC, 312/670-2400 x433

(Please have credit card ready)

Mail to: AISC, P.O. Box 806276, Chicago, IL 60680-4124
Steel Producers

Bethlehem Steel Corporation
Bethlehem, PA 18016-7699
(215) 694-2424

Mill products:
- Ingots, Blooms, Slabs, Billets;
- Wire Rods; Structural Shapes (W4 through W36) Structural Angles and Channels, Sheet, and H Piling;
- Plates; Rails; Joint Bars; Tie Plates;
- Hot Rolled Bars; Line Pipe; Wire Drawn; Black Plate; Electrolytic Tin Plate; and Sheets (Hot Rolled, Cold Rolled and Coated).

New structural shapes:
- Expanded range of W24, W27, W30, W33, and W36 shapes.

British Steel Inc.
475 North Martingale Road
Suite 400
Schaumburg, IL 60173-2222

Products:
- Carbon & Alloy Bar; Hot Roll, Cold Roll Galvanize Pre-paint & Electrical Galvalue; Wide Flange Beams; Carbon & Alloy Plate U.M.; Plate; Hot Rolled Special Sections; Carbon & Alloy & Heat Treated Rail; Sheet Piling;
- Semi-Finish Carbon (Slabs, Billet) and Stainless (Slabs, Billet);
- Stainless (Plate, Sheet, Wire Rod), Metal Cutting Bandsaw Strip, Narrow Strip; Var-Steels;
- Cooperware & Foundry Products for Iron Steel Making; Rolled Rings; Tubes (Seamless, Welded, Cold Drawn, OCTG).

Chaparral Steel
300 Ward Road
Midlothian, TX 76065-9651
(800) 527-7979

Products:
- Hot Rolled Rounds (Merchant & Special Bar Quality); Angles; Flats; Channels; Wide Flange Beams; Standard Beams; Bantam Beams; Reinforcing Bars
- Chaparral offers wide flange steel beams with 4” through 14” flanges.

Lukens Steel Company
Coatesville, PA 19320-3418
(215) 383-2000

Products:
- Lukens devotes all of its resources to producing steel in plate form, including carbon, alloy, armor, and clad steel plate.
- It produces steel plate in thicknesses up to 30”, as wide as 195”, and weighing more than 50 tons each.

Available Literature:
- Lukens “1990-91 Plate Steel Specifications Guide” outlines the chemistry and mechanical properties of the most commonly used carbon, alloy, and HSLA plate steels.

Northwestern Steel and Wire Co.
121 Wallace St.
Sterling, IL 61081
(815) 625-2500

Structural shapes:
- Wide flange beams (W6x9-25, W8x10-40, W10x12-112, W12x14-190, W14x22-257, W16x26-100, W18x35-119, W21x44-147, W24x55-162, W27x84-114; structural angles (3”x2½” to 6”x4½”); Bearing Pile; Channel; Flats; Straight & Cut Rods

Nucor-Yamato Steel Co.
P.O. Box 1228
Byltheville, AR 72316
(800) 289-6977

Products offered:
- W6x15-25; W8x24-67;
- W10x22-112; W14x22-132;
- W16x26-100; W18x35-119;
- W21x44-147; W24x55-162;
- HP8x36; HP10x42-57; HP12x53-84

Available in ASTM A36, ASTM A572 Gr 50 and CAS G40.21 Gr 44W (Canada Only)

Available literature:
- Nucor-Yamato Structural Shape Catalog
- Nucor-Yamato Plant/Facilities Brochure
  - Price Schedule
  - Rolling Schedule
  - Stock Lists

Modern Steel Construction / February 1991 / 47
Segmental and High Speed Steel blades...
To be on the leading edge of the industry you have to be sharp. For 30 years we've continually produced the highest quality blades with the quickest turn-around time. Our resegmentation process can be accomplished many times, but you only pay for the blade once. Call today and ask about our software support program.

USE OUR INSCO HOTLINE
1-800-845-3816

TradeARBED
825 Third Ave.
New York, NY 10022-7595
(212) 486-9890

New Products:
TradeARBED has added a number of very heavy and deep tailor-made structural shapes:
- WTM14x16x808;
- WTM14x16x873; WTM36x920;
- WTM44x16x230; WTM44x16x262;
- WTM44x16x291; WTM44x16x335.

Steel grades:
The development of the Quenching and Self-Tempering (QST) process for High Strength Low Alloy (HSLA) structural shapes allows TradeARBED to manufacture structural shapes in Grades 65 and 70 with excellent toughness and weldability.

Available literature:
- Car Parks in Structural Steel
- Truss Girders out of H-Shapes
- Short Span Composite Bridges
- Composite Beams
- Composite Columns
- Multi-Story Industrial Buildings

USX Corp.
P.O. Box 86
Pittsburgh, PA 15230-0086
(800) 874-3381

Finished Steel Products:
- Structural Shapes (Wide Flange and H-Piles); Plates (Regular Carbon, HSLA and Alloy), and Strip Mill Plate; Pipe (Seamless, CW, ERW); Sheets (HR, CR, Hot Dip and Electro-Galvanized, Galvalume, and Painted); Tin Mill Products. New WF Shapes include: W18x130+143; W21x166; W24x103, 176-492; W27x129, 194-448; W30x90, 148, 292-391; W33x169, 263-354; W36x232, 256, 328, 359.

Available Literature:
- USS Steel Shapes, 1990 Edition
- Coated Steel Brochure
- Galvalume Brochure
- Handbook of USS Plate Steels Various Properties Cards

New Products:
- USS COR-TEN B-QT Steel (ASTM A852), a new high strength steel ideal for bridge construction; and USS O-TEN, a new 50KSI plate grade with improved through-thickness properties, good notch toughness and weldability.
Experience the High-Performance Power

AWS International Welding Exposition

DETOIIT 1991
April 16-18
and 72nd Annual Convention
April 14-19

• Idea Power – Just one idea from the intense focus on technology and practical applications could save many times the cost of attending!

• Buying Power – Compare the latest equipment for intelligent purchasing decisions. Over 400 exhibitors ... many live demonstrations!

• Information Power – More than 100 in-depth seminars and conferences help keep business and careers in high gear!

• People Power – Exchange views with peers and industry leaders... CEOs, engineers, instructors, fabricators, inspectors, educators and researchers. They all attend the AWS Exposition!

Plus ... a special management conference, "The Manufacture of Welded Products," is scheduled for April 18 & 19. The Conference will be of particular interest to executives and managers of manufacturing operations. Registrants receive free admission to the welding show and all technical sessions.

If you buy, specify or recommend ... you need to be at the performance-proven AWS Welding Exposition.

American Welding Society
550 N.W. LeJeune Rd., P.O. Box 351040
Miami, Florida 33135, 305 443-9353
800 443-9353; in Fla. 800 423-9353
Telefax 305 443-7559
Telex AMWELD SOC 51-9245

Send me a 1991 AWS International Welding Exposition and Convention program with registration and hotel forms.

Name ____________________________
Company ____________________________
Address ____________________________
City ____________________________ State _______ Zip _______

Area Code, Business Telephone ____________________________

Special! Advance registration saves you time and money. Call or write before March 1, 1991.

□ Check here for more facts on special management conference
# Advertisers' Index

### A
- AISC Prize Bridge Competition ........................................ 9
- American Welding Society ........................................... 49

### B
- BDS Technical Services .................................................. 27
- Bouras, Nicholas J ...................................................... Cover II

### C
- CAST ................................................................. 27
- Chapparal ............................................................. 21
- Computer Detailing ..................................................... 19
- Computers & Structures ............................................... Cover IV

### D
- Design Data ............................................................ 11
- Dogwood Technologies .................................................. 45

### E
- EPIC Metals ............................................................ Cover III
- Ecom Associates ........................................................ 27

### I
- Insco Saw Blades ........................................................ 48

### J
- Jancy Engineering ....................................................... 19

### K
- KOPE-Ing ..................................................................... 26

### M
- Modern Steel Construction ............................................ 33

### N
- Nucor Fastener .......................................................... 7

### O
- Omnitech ..................................................................... 26

### R
- RAM Analysis ................................................................ 13
- RISA ............................................................................ 26
- Research Engineers ...................................................... 39
- Riopelle Engineering Sales ............................................ 12

### S
- St Louis Screw & Bolt ..................................................... 37
- Structural Analysis, Inc ............................................... 33
- Structural Software ........................................................ 3

### T
- TradeARBED .................................................................. 5

### V
- Valmont Industries .......................................................... 38

For advertising information, contact:

- Eric K. Nieman
- Pattis/3M
- 7161 North Cicero
- Lincolnwood, IL 60646
- (708) 679-1100
- FAX (708) 679-5926

For advertising information in OK, NE, KS, SD, ND, MN, CA, MT, WY, CO, NM, AZ, UT, ID, WA, OR, HI, AK, and Canada, contact:

- Ed Sreniawski
- Pattis/3M
- 7161 North Cicero
- Lincolnwood, IL 60646
- (708) 679-1100
- FAX (708) 679-5926
EPIC LONG-SPAN DECKS

E750 - SPANS TO 32 FT.
E600 - SPANS TO 26 FT.
E450 - SPANS TO 23 FT.
E300 - SPANS TO 15 FT.

AVAILABLE FOR DELIVERY—NOW
Galvanized G60-G90
Lengths to 50 ft.

Plated Decks—Plain or perforated
Most complete line of deck products
in 5/8" to 7 1/2" depths

OUR SERVICE WILL SAVE YOU TIME & MONEY
Epic has these profiles available for shipment
on an A.S.A.P. Basis!

Your order will be processed in One Week
in most cases. Ask about our A.S.A.P. Service.

Call (412) 351-3913 today for price and
delivery information and for product advice
on all types of Form Decks, Composite
Decks, Long-Span and Roof Decks.

Manufacturing Plants:
- Pittsburgh, Pa.
- Chicago, Ill.
- Lakeland, Fla.

Dealer Inquiries Invited

EPIC METALS CORPORATION
Eleven Talbot Avenue, Rankin, PA 15104
PHONE: 412/351-3913
TWX: 710-664-4424
EPICMETAL BRDK
State of the Art
Personal Computer Software for Structural and Earthquake Engineering
Developed by Edward L. Wilson & Ashraf Habibullah

ETABS®
Building Analysis & Design

SAFE™
Slab Analysis & Design

ETABS®
Building Analysis & Design

For more information:
Computers & Structures, Inc.
1995 University Avenue
Berkeley, California 94704
TEL: (415) 845-2177
FAX: (415) 845-4096
TWX: 5101003830 CSI BERKELEY