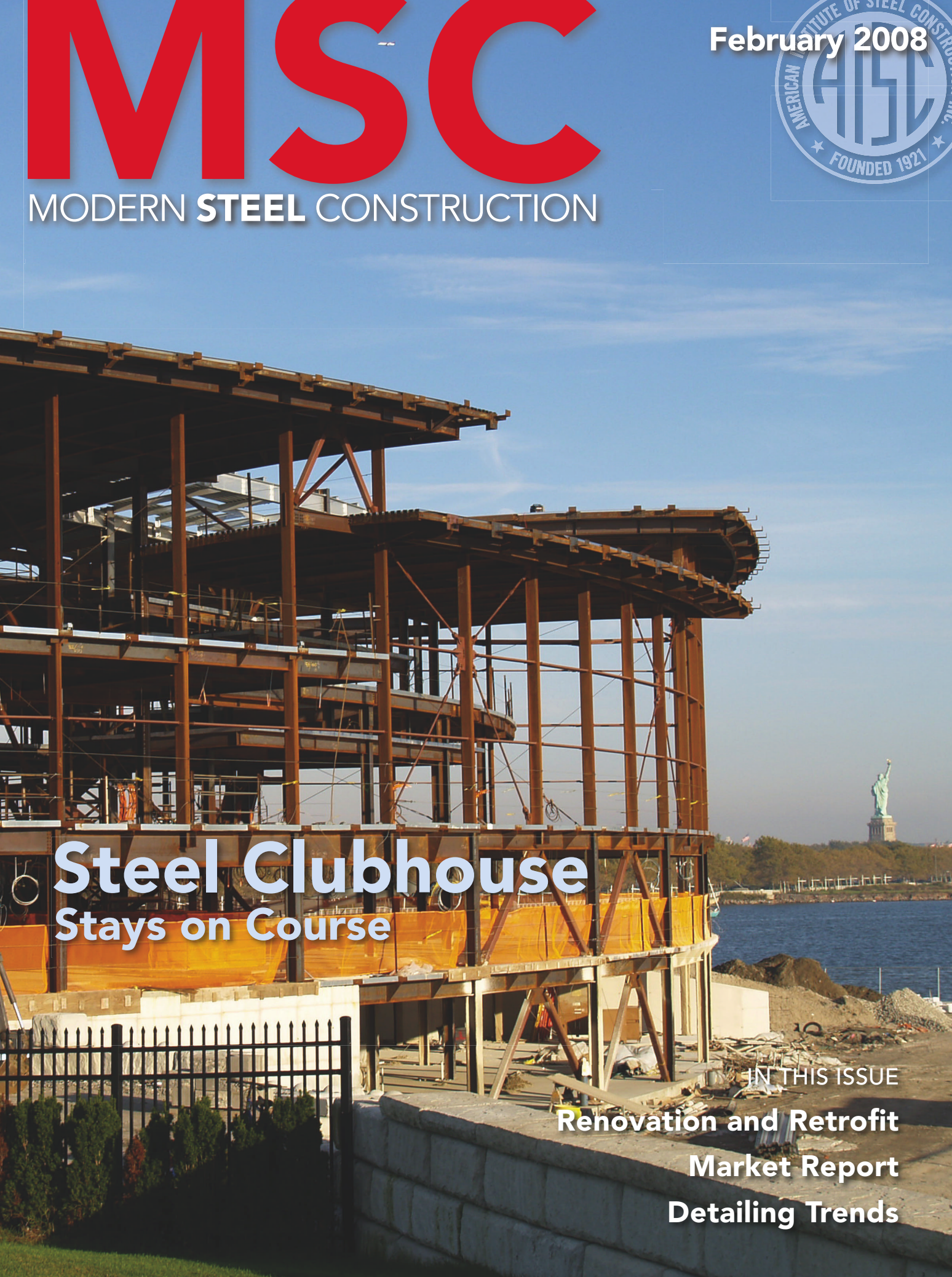
MSC
MODERN STEEL CONSTRUCTION
February 2008



Steel Clubhouse
Stays on Course

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Renovation and Retrofit

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Detailing Trends

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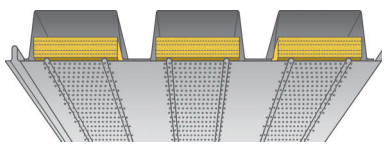
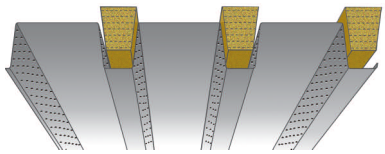
SUMMARY OF ACOUSTIC TEST DATA FOR STANDARD DECK CONSTRUCTIONS



CELLULAR TYPE (NCAS SHOWN)



STANDARD TYPE (NSA SHOWN)

ASTM C423 ACOUSTIC TEST REPORT	PRODUCT	FREQUENCY/SOUND ABSORPTION COEFFICIENT						NRC
		125	250	500	1000	2000	4000	
A76-125 (Non-Polyencapsulated)	BA, BIA	0.47	0.93	1.06	0.96	0.56	0.23	0.90
A76-124 (Non-Polyencapsulated)	NSA, NIA	0.59	1.00	1.05	0.95	0.60	0.34	0.90
A02-246 (Polyencapsulated)		0.84	1.08	1.03	0.79	0.44	0.35	0.85
A79-181 (Non-Polyencapsulated)	JA	0.83	0.99	0.97	0.78	0.53	0.43	0.80
A02-245 (Polyencapsulated)		1.09	1.14	1.12	0.78	0.56	0.50	0.90
A02-239 (Polyencapsulated)	HA6	1.15	1.10	1.02	0.61	0.52	0.40	0.80
A00-94 (Non-Polyencapsulated)	HA7.5	1.12	1.03	0.87	0.63	0.58	0.63	0.80
A02-241 (Polyencapsulated)		1.39	1.16	0.94	0.58	0.46	0.44	0.80
A02-237 (Non-Polyencapsulated)	BCAS	0.44	0.58	0.71	0.96	0.87	0.58	0.80
A03-108 (Polyencapsulated)		0.40	0.58	0.79	1.08	0.80	0.55	0.80
A02-238 (Non-Polyencapsulated)	NCAS	0.89	0.67	1.12	1.04	0.83	0.67	0.90
A03-107 (Polyencapsulated)		0.65	0.74	0.89	1.05	0.73	0.46	0.85
A04-007 (Non-Polyencapsulated)	JCAS	1.00	1.00	1.09	0.94	0.78	0.74	0.95
A03-129 (Non-Polyencapsulated)	HCA6S	1.23	1.01	1.10	0.88	0.84	0.75	0.95
A03-127 (Non-Polyencapsulated)	HCA7.5S	1.35	1.04	1.08	0.77	0.83	0.71	0.95

NOTE:

This table presents the acoustic test results for our Standard Products & Insulation Systems. Non-standard system test results are available for some products and normally include a variation in either insulation density or thickness, or deck perforation pattern. The standards are preferred. Contact the Summit, NJ office if greater performance is necessary.

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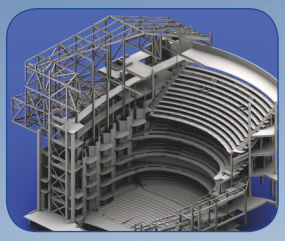
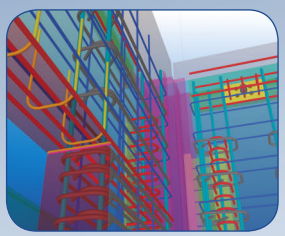
"At the end of the day, your 3D model will most probably end up in Tekla Structures, so why not start with it!"
– Ray Young, Arup

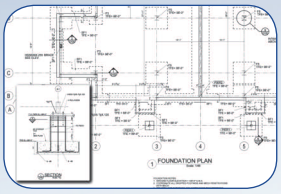
Structures That Do The Job

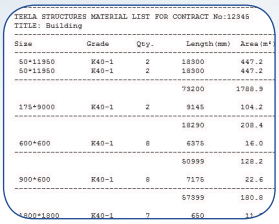


COLLABORATE - Exchange model data with architects and other designers



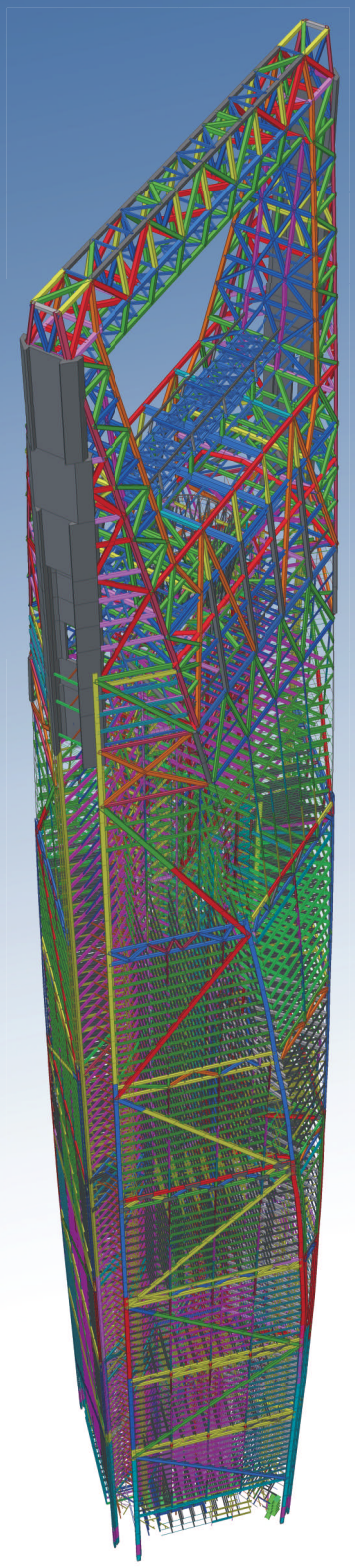
DESIGN - Use the best structural modeling tool to bring your ideas into practice




TEKLA STRUCTURES MATERIAL LIST FOR CONTRACT No:12345
TITLE: Building

Size	Grade	Qty.	Length(mm)	Area(m²)
50*11950	K40-1	2	18300	447.2
50*11950	K40-1	2	18300	447.2
			73200	1788.9
175*9000	K40-1	2	9145	104.2
			18290	208.4
600*600	K40-1	8	6375	16.0
			50999	128.2
900*600	K40-1	8	7175	22.6
			57399	180.8
1800*1800	K40-1	7	650	11

DELIVER - Produce quality plans, elevations and details directly from the model



Model: Financial Center, Shanghai, China

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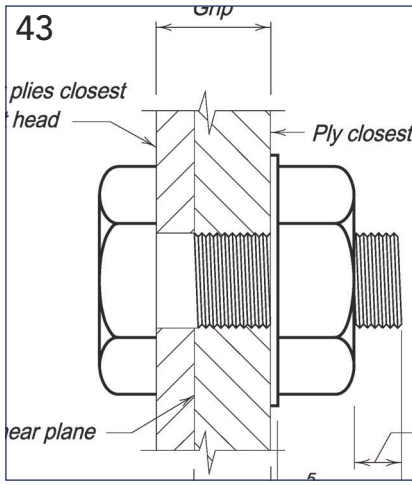

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ON THE COVER: Liberty National Golf Club, Jersey City, N.J. (Photo: Crystal Steel)

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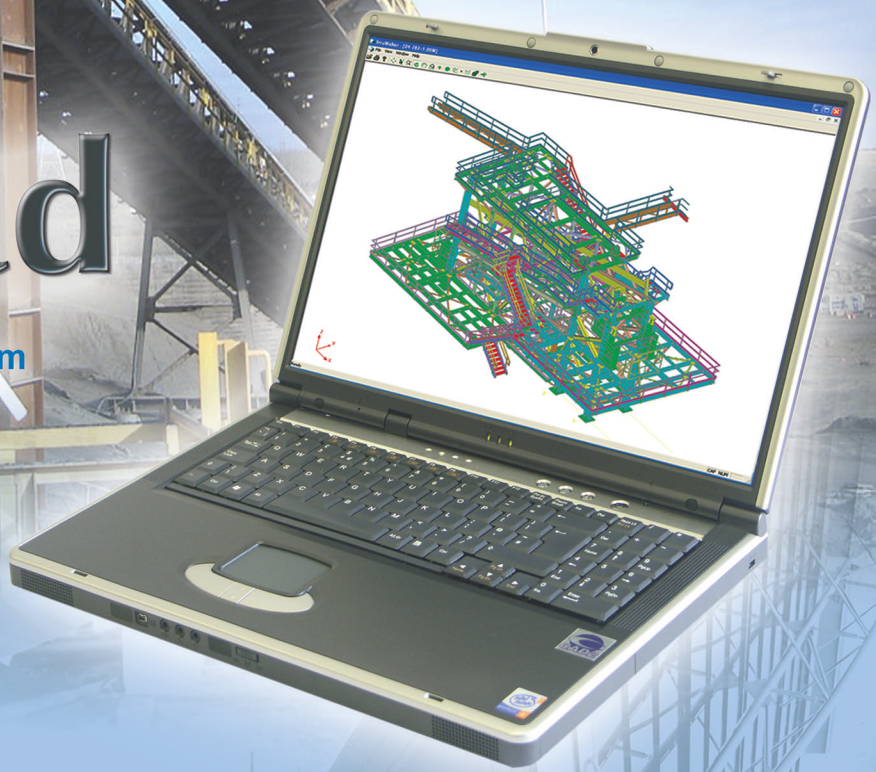
The power to innovate

Project:	Steepbank Mine Dry Surge Conveyor
Client:	Suncor Energy
Engineers:	Colt Engineering Corp Krupp Canada
Detailers:	M&D Drafting Ltd
Fabricator:	Waiward Steel Fabricators Ltd

'We fast-track detailed the Suncor Energy Steepbank Mine Dry Surge Stacking Conveyors using StruCad.

The clash detection system in StruCad was vital in the elimination of access problems and member conflicts. This feature when combined with StruCad freeware was invaluable in facilitating efficient project team collaboration. The quality and accuracy of the 8975 automatic drawings generated for this project was first rate and all concerned were very complimentary.'

M&D Drafting Ltd.



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editor's note

AS I WAS READING MY MAIL TODAY, I HAD TO CHUCKLE WHEN I READ A HEADLINE STATING, "GIANT SEALS HELP PROTECT ST. PETERSBURG FROM FLOODING." Coincidentally, my daughter and I had just had a discussion about homographs, so I recognized that a seal could be a sea mammal or an O-ring. It's great having kids in school; you learn new things or relearn those millions of facts that you've forgotten over time.

To be honest, when my daughter first used the term homograph, I was uncertain of its meaning. Fortunately, I could quickly boot up a computer, open Google, and type: "define: homograph" (quickly followed, of course, by "define: homonym" and "define: homophone"). The problem comes, however, in trying to figure out which source that Google refers you to is the most accurate. In the old days (say, five years ago) you'd pull out Webster's; today, you can look something up in Wikipedia, but you're never quite sure if the information is accurate.

So while I love the web as a resource, I still prefer more vetted sources if they're readily available. That's why I'm sometimes surprised by some of the things I read online. For example, one of my favorite e-mail lists is steel-detail@yahoogroups.com. This group of detailers regularly discusses current events in the detailing community and helps out with a wide range of issues. But every once in a while I'm surprised by a posting, such as this recent inquiry: "I have a situation where I have a TS 12 × 12 × ⅜ column and a TS beam 12 × 8 × ⅜ and the engineer has called out a moment connection per AISC. I cannot find an example in AISC 9th edition or HSS connection manual or AISC Volume 2 Connections. Does anyone have an idea where to look or an example? No loads are given." Moving beyond the outdated designations (TS) and references (9th edition, etc.), why not simply ask the AISC Steel Solutions Center? This free service quickly provides authoritative answers for anyone working on fabricated structural steel. You can email **solutions@aisc.org**, call **866.ASK.AISC**, or visit the new *Modern Steel Construction* web site at **www.modernsteel.com** and click the ASK AISC link in the bottom right-hand corner (immediately below the answer to a current question).

Access to authoritative information is one of the big reasons people join associations such as AISC. And the dissemination of information is one of the reasons AISC publishes this magazine. In the past, our emphasis at MSC has been on project stories, though we've always tried publishing information-rich features such as Steel Interchange. Beginning in 2008, we're greatly expanding our number of regular features while moving some information out of the magazine and onto our web site.

New columns are focused on business issues, industry forecasting, and shop and field issues. We have also added "Topping Out" (a last-word from an interesting perspective) and "People to Know" (an article contributed by a significant person involved in design or construction).

We've also greatly changed the product section. Rather than focusing on specific categories, we're running just a few interesting new products each month. If you're looking for a specific type of product, you can find listings on the MSC web site in our searchable Product Directory.

Likewise, we're no longer printing steel availability listings. Instead, you can find current information on which shapes are being produced by which manufacturers by visiting **www.modernsteel.com** and clicking STEEL AVAILABILITY.

I hope you enjoy the changes! And as always, we'd love to hear your opinion. You can either e-mail us or post a comment in the reader feedback section on the new site (**www.modernsteel.com/readerfeedback**).

SCOTT MELNICK
EDITOR

MSC
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Editorial Offices
One E. Wacker Dr., Suite 700
Chicago, IL 60601
312.670.2400 tel
312.896.9022 fax

Editorial Contacts
EDITOR & PUBLISHER
Scott L. Melnick
312.670.8314
melnick@modernsteel.com

MANAGING EDITOR
Keith A. Grubb, P.E., S.E.
312.670.8318
grubb@modernsteel.com

ASSOCIATE EDITOR
Geoff Weisenberger
312.670.8316
weisenberger@modernsteel.com

AISC Officers
CHAIRMAN
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Advertising Contact
Account Manager
Louis Gurthet
231.228.2274 tel
231.228.7759 fax
gurthet@modernsteel.com

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Nut Tightening on Anchor Rods

When considering nut installation on a threaded anchor rod, how is the pretension specified on the drawings? The desire is to prohibit loosening of the nut under load reversal. I see the recommendations for anchor-rod nut installation on pages 14-10 and 14-11 of the 13th edition AISC manual; however, the minimum bolt pretension force shown in Table J3.1 does not seem to apply. Is the required tensile force still $0.7F_u$ of the anchor rod?

Steel-to-concrete anchor-rod installations are a completely different subject than high-strength bolt installations used in steel-to-steel connections. The AISC specification does not require pretensioned installation for an anchor rod. The suggestions given in Part 14 of the *Manual* are recommendations as to how to achieve a tightened connection but are not representative of a pretensioned condition.

In the majority of cases, and particularly for axial compression loaded column bases, anchor rods primarily are present for erection and serve no calculated function in the final structure. In other cases, such as moment bases or bases subject to uplift, the rods are necessary for force transfer. But these details also usually do not require pretension.

If you have a condition where loosening of the nut might be a consideration, such as in vibrating machinery, you may want to consider double-nutting or proprietary thread-locking methods.

If you choose to require pretensioned anchor rods, you would need to define how much pretension is required, how that pretension is to be achieved, and how that pretension is to be maintained against such factors as creep in the concrete and the variations in bond along the length of the rod over time.

Kurt Gustafson, S.E., P.E.

Combined Forces

The title of Section H1.3 of the 2005 AISC specification is "Doubly Symmetric Members in Single Axis Flexure and Compression." This title indicates that this section can be used for doubly symmetric I-sections and rectangular (or round) HSS as well. Bending can be either in the major axis or the minor axis. After reading the Commentary, my understanding is that this section is intended for doubly symmetric I-sections subjected to *major* axis bending only. Is section H1.3 applicable to HSS?

Yes, this Section applies to HSS, and the application is not limited to wide-flange shapes. LTB limit states are rare for HSS, but it is conceivable for this to occur in highly rectangular box shapes. At the top of page 73 in the 2005 AISC specification (a free download at **www.aisc.org/2005spec**), it states that in cases where the single-axis flexure is in the weak axis, it is permitted to neglect the moment ratio in Equation H1-2. This is because weak-axis bending cannot result in LTB. Thus, in this case, in-plane stability is addressed with Equations H1-1 as indicated in Section H1.3(a), and out-of-plane buckling is then simply a function of the axial load ratio.

The parabolic equation is meant to address the additional capacity that you can get out of a beam-column that has a limit state of flexural buckling (axial) and LTB (flexure) in the same direction. This additional capacity comes from the use of the parabolic formulation, whereas the Equations in Section H1-1 have a straight-line formulation.

Amanuel Gebremeskel, P.E.

Determining r_t

I am searching for information pertaining to r_t. I am looking to see if there are any equations that can be used to calculate this value. I have looked through a couple of text books but have not found an equation for this. Can you point me in the right direction?

The radius of gyration r_t is defined as the radius of gyration of the flange components in flexural compression plus one-third of the web area in compression due to the application of major axis bending moment alone. Equation (F4-10) in the 2005 AISC specification (a free download at **www.aisc.org/2005spec**) defines r_t. The User Note also provides a simplification that you can use if you so prefer.

Kurt Gustafson, S.E., P.E.

LRFD or ASD

What is the difference between LRFD and ASD design?

Pages 2-6 and 2-7 of the 13th edition AISC manual (available at **www.aisc.org/bookstore**) provide detailed statements on the two approaches. The 2005 AISC specification supports both approaches with no preference for either one. Section B3, particularly subsections 3 and 4, of the AISC specification (a free download at **www.aisc.org/2005spec**) addresses the difference between these two approaches.

Although more significant differences used to exist between previous LRFD and ASD specifications, we have intentionally brought ASD and LRFD into essential equivalency in the 2005 AISC specification. The difference between them now amounts to whether you calculate your loads using LRFD load combinations from ASCE 7 or ASD load combinations from ASCE 7.

Amanuel Gebremeskel, P.E.

Steel for High-temperature Applications

The Brockenbrough and Merritt text referenced in Part 2 of the 13th edition AISC manual indicates that "For special elevated-temperature applications in which structural steels do not provide adequate properties, special alloy and stainless steels with excellent high-temperature properties are available." Can you direct me to publications on the properties of these special alloy and stainless steels?

Such steels are not commonly used in building construction and are not covered by the AISC specification. However, *The Making, Shaping and Treating of Steel*, published by U.S. Steel, includes a Chapter on "Steels for Elevated-Temperature Service." This text is still published (I found it through **amazon.com**).

Kurt Gustafson, S.E., P.E.

Diagonal Brace Connection

In considering a brace-to-gusset connection for a SCBF, it is my understanding that the Uniform Force Method is generally the most economical method for determining gusset size and welds (13th edition page 13-3). However, I noticed that most of the examples in the new *Seismic Design Manual* use the Whitmore section (pages 3-58, 3-66, etc.). Are there any advantages and/or restrictions in using the Whitmore section versus the Uniform Force Method? Is there any reason the Whitmore section was used in the *Seismic Design Manual* versus the Uniform Force Method?

These are not two different methods of bracing connection design. Rather, they are both used in the design of bracing connections.

The Uniform Force Method is a bracing connection design method that entails selecting the geometry of the connection so that moments do not exist (or at least are minimized) on the three connection interfaces between the gusset plate, beam, and column. This way one can design these connections for shear and tension only.

The Whitmore section on the other hand allows the calculation of the effective width of the gusset plate to resist the load from the brace in the connection of the brace to the gusset. Please see page 13-3 for examples of the former and 9-3 for examples of the latter.

Therefore, the two checks are applied to solve different problems, and a direct comparison of the two methods is not appropriate. For a gusset plate in a compression brace connection, for instance, the uniform force method would be used to design the connection of the plate to the beam and column, whereas the Whitmore method would be applied to check the plate itself for buckling. Both checks could influence the thickness of the gusset plate, but these address different limit states.

Amanuel Gebremeskel, P.E.

Section Properties of Historic Shape

I recently attended the AISC seminar *Design Steel Your Way* (www.aisc.org/seminars) and received the AISC manual and companion CD. In a project I am working on we have a shape that we cannot locate in the historical shapes database that was included on the CD, nor in any texts that we currently have. I was wondering if you might be able to shed some light on some of its dimensions and properties.

The building was built by the government in 1951. On the drawings the shape is called out as a 12WF19. We are looking to do some analysis on this structure and wondering if you could direct us to where we can find the properties?

It is likely that the shape was incorrectly designated on the drawings as a WF shape. Rather, I think the designer or drafter did not write the correct shape designation. Many of the lighter wide-flange shapes at the time were officially designated as B or BL shapes. Look on the CD under the ASD5 (the 5th edition manual was in effect in 1951) using the designation BLB. You will find a 12-in. beam at 19 lb per foot.

Kurt Gustafson, S.E., P.E.

Strain Hardening

AISC 341-05 requires $1.1R_y$ for the design of some connections and R_y in other places. Why is this so? Should it not be only $1.1R_y$, since I understand the 1.1 is to account for the increase in strength due to strain hardening under cyclic load? If this is the case, all elements would be subject to cyclic loading in a seismic event, and hence $1.1R_y$ should be applicable everywhere.

You are correct that the 1.1 factor is used to take strain hardening into consideration. Note that the flexural checks tend to include the 1.1 factor while the axial checks do not. This is because the strain in flexural members is much greater than that for axial members. In order to understand this, imagine a brace that yields in tension. Before the yielded part can experience strain hardening the entire brace would have to yield, thus elongating the entire brace considerably, by which point the cycle is reversed. This is not the case when a wide-flange yields in flexure where the hinge location is concentrated and the section in tension is forced to go into strain hardening before the cycle reversal.

Amanuel Gebremeskel, P.E.

The complete collection of Steel Interchange questions and answers is available online. Find questions and answers related to just about any topic by using our full-text search capability. Visit Steel Interchange online at **www.modernsteel.com**.

Kurt Gustafson is the director of technical assistance and Amanuel Gebremeskel is a senior engineer in AISC's Steel Solutions Center. Charlie Carter is AISC's chief structural engineer, and Lou Geschwindner is AISC's vice president of engineering and research.

If you have a question or problem that your fellow readers might help you solve, please forward it to us. At the same time, feel free to respond to any of the questions that you have read here. Contact Steel Interchange via AISC's Steel Solutions Center:

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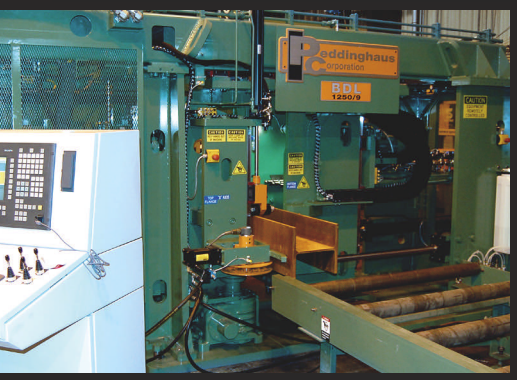

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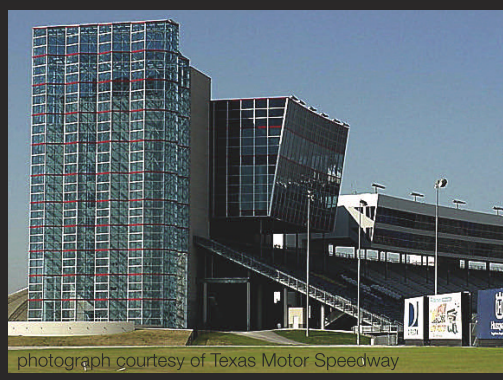

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steel quiz

LOOKING FOR A CHALLENGE? *Modern Steel Construction*'s monthly Steel Quiz tests your knowledge of steel design and construction. Most answers can be found in the 2005 *Specification for Structural Steel Buildings*, available as a free download from AISC's web site, **www.aisc.org/2005spec**. Where appropriate, other industry standards are also referenced.

This month's Steel Quiz was developed by AISC's Steel Solutions Center. Sharpen your pencils and go!

1 **True/False:** When reviewing an existing structure that was originally designed using allowable stress design, the evaluation analysis must use the same approach.

2 **True/False:** Given a specific dead load and live load on a beam, that beam designed using LRFD load combinations will have a greater design strength, and thus greater capacity, than if the ASD load combinations had been used.

3 What is meant by the term *compact section*?

4 How can one determine if a section is compact or not?

5 **True/False:** If a beam shape is compact, the full plastic capacity can be used for the flexural design.

6 What is the difference between web local crippling and web local yielding?

7 What is shear buckling?

8 What is shear lag?

9 How many Seismic Design Categories are included in the ASCE 7 standard?
- **a.** two
- **b.** three
- **c.** four
- **d.** five
- **e.** six

10 **True/False:** A structure classified as Seismic Design Category C is not specifically required by ASCE 7-05 to be detailed in accordance with the AISC *Seismic Provisions* if $R = 3$ is used.

TURN PAGE FOR ANSWERS

steel quiz

ANSWERS

1 **False.** The nominal strength of a structure or structural component is independent of the approach used in the analysis. One can select to use any load approach consistent with those permitted by the applicable building code or ASCE 7 standard. However, the evaluation must use the same approach on the strength side.

2 **False.** The nominal strength of the beam is not dependent on the load approach used in the design. Only the resistance factor applied for LRFD and the safety factor applied for ASD differ. Depending on the relative intensities of the dead and live loads, the LRFD or ASD approach may produce a more efficient design. They are essentially equivalent at a live-to-dead-load ratio of 3 for the load combination that considers dead plus live loading.

3 A compact section is one that is capable of developing full plastic stress distribution before the onset of local buckling of any of the components.

4 Compactness is determined based on local buckling as discussed in question 3. Local buckling can occur on a compression element if the element is too thin to accommodate the compressive force. The AISC specification defines limiting width-thickness ratios (b/t or h/t) for compression elements of various shapes, depending on whether these are stiffened or unstiffened, and if the stress distribution is uniform or not. The limiting width-thickness ratios for compression elements are listed in Table B4.1 of the *Specification* (a free download at www.aisc.org/2005spec).

5 This is a trick question, as not enough information is given to know if this statement is true or false. The full plastic moment capacity can be assumed if the beam member has adequate lateral bracing to prevent lateral-torsional buckling of the member itself. If the laterally unbraced length exceeds the limiting unbraced length for the limit state of yielding (L_p) of the shape, the flexural strength is reduced from the full plastic moment capacity. See Section F of the AISC specification for details. See the beam tables in Part 3 of the 13th edition manual for L_p of specific hot-rolled shapes.

6 Web local crippling is characterized as crumpling of the web into buckled waves directly beneath a compressive load. When this occurs, it will generally be in more slender webs. Web local yielding applies to both tensile and compressive forces of bearing beneath the load, occurring in stockier webs.

The limit state for web local yielding is covered in Section J10.2, and the limit state of web local crippling is covered in Section J10.3 of the AISC specification.

7 Shear buckling is the mode in which a plate element, such as the web of a beam, deforms under pure shear applied in the plane of the plate. Section G2 of the AISC specification covers the limit state of shear buckling.

8 Shear lag occurs when an axially loaded tension member has end connections that are not collinear with the load. An example would be fastening only one leg of an angle. In such a detail the connected leg becomes overloaded if the connection length is short enough to limit the amount of load that can be transmitted through the unconnected leg. This phenomenon is critical only in tension members because it relates to the rupture limit state, which is not a factor in the design of compression members. Also, as the length of the connection increases, the effect of the shear lag decreases. See Table D3.1 of the AISC specification for shear lag factors for connections to tension members.

9 **e.** Six Seismic Design Categories, A, B, C, D, E, and F are included in the ASCE 7 standard.

10 **True.** The classification of "Steel Systems not Specifically Detailed for Seismic Resistance Excluding Cantilever Column Systems" is permitted to be used in SDC A, B, and C in accordance with ASCE 7-05, when $R = 3$ is used. See ASCE 7-05 and Table 12.2-1 for further requirements.

Anyone is welcome to submit questions and answers for Steel Quiz. If you are interested in submitting one question or an entire quiz, contact AISC's Steel Solutions Center at 866. ASK.AISC or at **solutions@aisc.org**.

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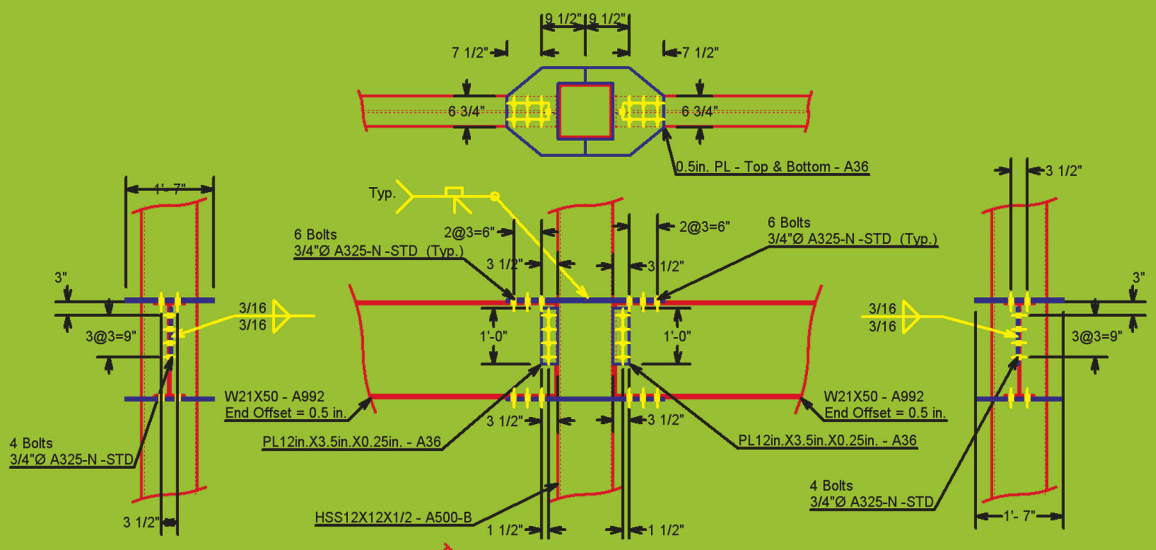
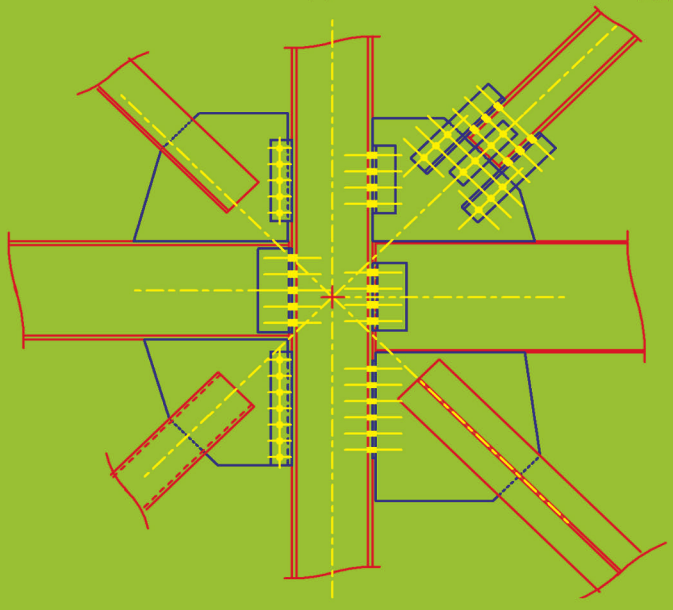
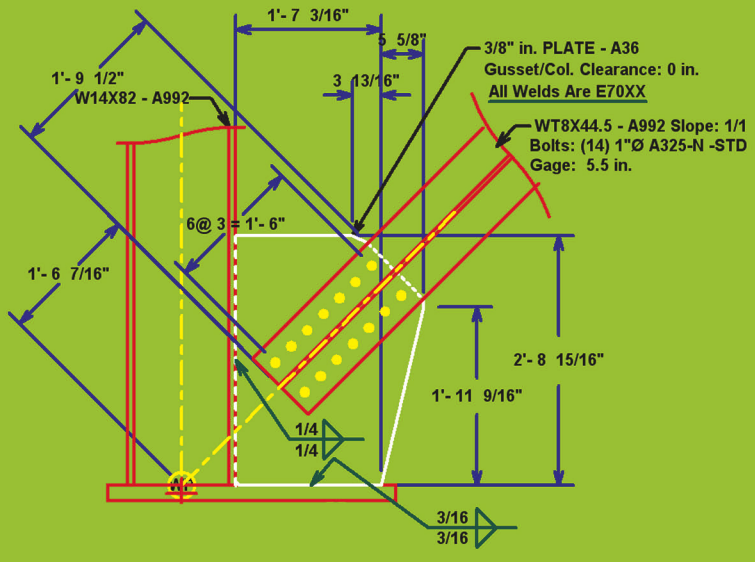
ASD * LRFD * METRIC (SI) * IMPERIAL

SHEAR AND MOMENT CONNECTIONS * COLUMN AND BEAM SPLICES * BRACED FRAME CONNECTIONS

PREQUALIFIED SEISMIC MOMENT CONNECTIONS







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R. Shankar Nair is a principal and senior vice president of Teng & Associates, Inc. in Chicago. He received his Ph.D. from the University of Illinois at Urbana-Champaign in 1969 and is licensed to practice engineering in 44 states. He is a member of the National Academy of Engineering and was the winner of the 2007 T.R. Higgins Lectureship Award. Nair currently serves as Chairman of AISC's Task Committee on Stability Analysis and Design and was responsible for the development of the stability analysis and design provisions in the 2005 AISC specification.

The course is free to view and continuing education credit can be obtained by watching the presentation and then purchasing and completing an online quiz on the course content. Check out all of AISC's online continuing education courses at **www.aisc.org/elearning**.

CONFERENCES

Register Now for The Steel Conference!

If you haven't registered yet for the 2008 North American Steel Construction Conference, there's still time! More than 3,000 engineers, fabricators, erectors, and detailers are expected to attend this year's Steel Conference, which will take place April 2–5 in Nashville, Tenn. See the advance program in the December 2007 issue or visit **www.aisc.org/nascc** for a complete schedule of conference events and instructions for pre-registration.

With nearly 90 technical sessions, The Steel Conference is the industry's premier education event. It provides structural engineers, steel fabricators, erectors, and detailers with practical information and the latest design and construction techniques. The conference is a key networking opportunity. Its extensive trade show features products and services ranging from fabrication machinery, galvanizing, and connection products to detailing and engineering software. The conference also incorporates the Structural Stability Research Council's Annual Stability Conference. Online registration is available through March 27, 2008. After March 27, registrations will be taken onsite, but at higher rates.

AISI NEWS

Boring Retires from AISI, Is Succeeded by Wills

The American Iron and Steel Institute (AISI) has announced that Delbert F. Boring, P.E., vice president of construction market development, has retired from the Institute after 31 years of service.

Boring joined AISI in 1976 as regional director of construction codes and standards and was eventually promoted to director of construction codes and standards. In 2003, he was promoted to vice president of construction market development, where he was responsible for developing and implementing the Market Development Strategic Plan 2005–2009 for AISI's Construction Market program. He was also responsible for oversight of AISI's Codes and Standards program.

Robert J. Wills, P.E., currently AISI's director of construction codes and standards, has assumed responsibility for AISI's Construction Market program. Wills, who has over 18 years of experience with AISI, served as director of construction codes and standards, where he was responsible for managing steel industry activity related to the development processes for numerous national, state, and local building code organizations, ensuring that the resulting regulations reflected current practice and did not inhibit the safe use of steel products.

CODES

Changes to AWS D1.5 and D1.3

The American Welding Society recently announced the latest version of its *AASHTO/AWSD1.5M/D1.5:2008—Bridge Welding Code* to be used in conjunction with the *AASHTO Standard Specification for Highway Bridges* or *AASHTO LRFD Bridge Design Specifications*. This code covers the best practices and general provisions of routine bridge welding applications.

Significant updates from the previous version, as provided by Todd Niemann, P.E., Structural Metals and Bridge Inspection Engineer with the Minn. Department of Transportation and *AASHTO/AWS D1.5* Chairman, include:

- ✓ The addition of HPS 50W and HPS 70W and the deletion of 70W.
- ✓ Updates to Tables 4.1, 4.2, 4.4, and 4.5 (filler metal, preheat, and stress relief requirements).
- ✓ New WPS and PQR forms and revised samples of these forms.
- ✓ Illustrations for measuring camber.
- ✓ Optional supplemental moisture-resistant designators.
- ✓ Machining and testing tolerances for performance test specimens.
- ✓ Additions and revisions to usage, handling, and storage requirements for consumables in fracture-critical applications.
- ✓ Revisions to inspection personnel qualifications.
- ✓ Additions for Commentary for Sections 2,3,4,5, and 6 and Annex G.

AWS D1.3: D1.3-98, Structural Welding Code—Sheet Steel has also been updated recently. According to D. Robert Lawrence II, CWI, CWE, Buildings Division Welding Engineer with Butler Manufacturing Co. and Chair of *AWS D1.3*, significant changes to this Code include:

- ✓ A new table for the selection of the proper code—D1.1 or D1.3—including selection possibilities of the applicable code when there is a code overlap.
- ✓ A table of essential variables for prequalified and qualified welding procedures.
- ✓ A new section for exception from some of the requirements of D1.1 for Arc Plug, Arc Spot, and Arc Seam welds for the attachment of decking, with commentary.
- ✓ Corrections for the applicable thickness ranges for qualified Welding Procedures in the figures.
- ✓ Updates to the material listings while retaining the older listings when there has been an ASTM name designation change without real physical changes (A-1008 and A-1011), including the addition of high-formability materials.
- ✓ Clarification of the qualification inspection and testing requirements.
- ✓ Corrections to formulas.
- ✓ Improvement of the sketches to better depict the desired and important details and dimensions.

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What about the exhibit hall?
This year's exhibit hall features more than 400 booths with more than 160 exhibitors demonstrating the latest products. You'll find fabrication equipment, detailing software, connection products, safety equipment, engineering software, and coatings. Equipment manufacturers typically provide full demonstrations of their equipment—steel beams are cut, punched, and drilled right on the exhibit-hall floor! The exhibit hall is open April 2–4, 2008.

What will I learn?
Learn about topics ranging from composite steel joists to sharing digital models to designing to avoid floor vibration. Some sessions focus on technical engineering issues, while others focus on fabrication, erection, or detailing. Following up on our successful program offering "Top Hits from Top Profs," this year we're also offering "Essays from Experts." In this new series of lectures, we've asked some of the top professionals to present a topic they find interesting. Speakers include Larry Griffis on wind, Duane Miller on welding, Robert McNamara on damping, and Ron Hamburger on simplifying design. The conference also offers a pre-conference short course on BIM and a post-conference short course on the design of low- and mid-rise buildings.

For more information, visit
www.aisc.org/nascc

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- The Advanced Bill as a Deliverable
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- 3D Software and Complex Hip and Valley Roof Systems
- Getting Dimensions: Will 3D Modeling Help?
- Got Stiffness?
- Latest Developments in Steel Plate Shear Walls
- Designing Deck Diaphragms for Ductile Systems
- Part One: An Introduction to Earthquake Engineering and Seismic Codes—Ductility
- Part Two: An Introduction to Earthquake Engineering and Seismic Codes—Seismic Provisions
- Part Three: An Introduction to Earthquake Engineering and Seismic Codes—Tips and Examples
- AESS and the New Canadian Matrix: A Category Approach
- Effects of Post-Tensioned Concrete Slabs on Composite Steel Beams
- Engineering Ethics: You Be The Judge
- Steel Solutions for Low-Floor-to-Floor Multi-Story Residential Housing
- Rules of Thumb for Steel Design
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- Procedures and Processes to Manage CNC Data
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- Five Useful Stability Concepts
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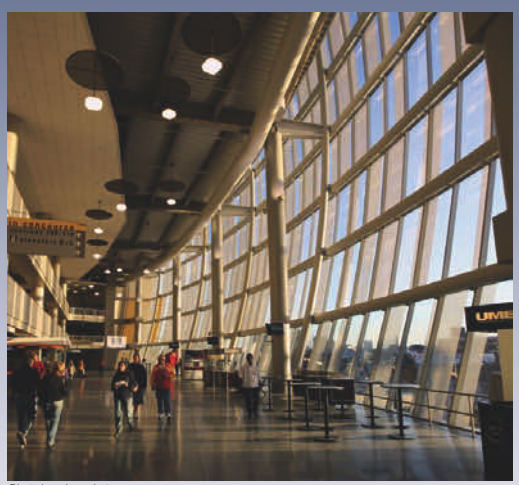

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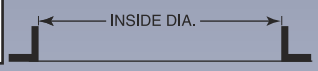
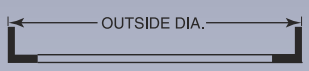


10"x10"x1" Angle

2 Angle Rings Leg In

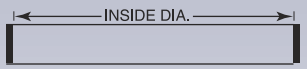


10"x10"x1" Angle

3 Flat Bar Rings The Hard Way

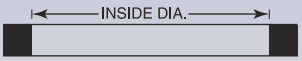
24"x10" Flat

4 Flat Bar Rings The Easy Way



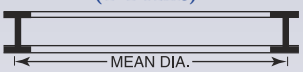
36"x12" Flat

5 Square Bar Rings



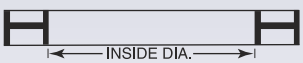
18" Square

6 Beam Rings The Easy Way (Y-Y Axis)



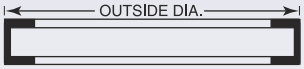
44"x 285#, 36"x 848#

7 Beam Rings The Hard Way (X-X Axis)



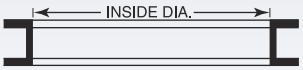
44"x 285#

8 Channel Rings Flanges In



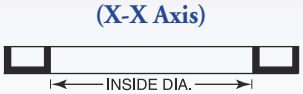
Any Size

9 Channel Rings Flanges Out



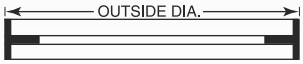
Any Size

10 Channel Rings The Hard Way (X-X Axis)



Any Size

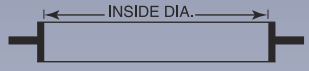
11 Tee Rings Stem In



22"x142 1/2# Tee

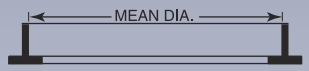
We bend ALL sizes up to:

12 Tee Rings Stem Out



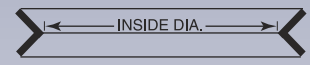
22"x142 1/2# Tee

13 Tee Rings Stem Up



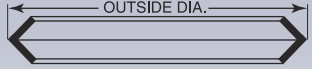
22"x142 1/2# Tee

14 Angle Rings Heel In



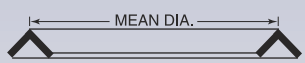
8"x8"x1" Angle

15 Angle Rings Heel Out



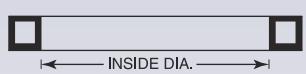
8"x8"x1" Angle

16 Angle Rings Heel Up



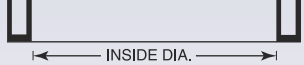
8"x8"x1" Angle

17 Square Tube Rings



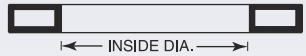
16" Square Tube
20"x12"x 1/2" Tube

18 Rectangular Tube Rings The Easy Way (Y-Y Axis)



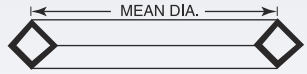
20"x12"x 1/2" Tube

19 Rectangular Tube Rings The Hard Way (X-X Axis)



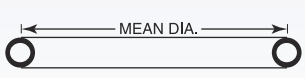
20"x12"x 1/2" Tube

20 Square Tube Diagonally



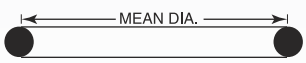
12"x 5/8" Square Tube

21 Round Tube & Pipe Rings



20"Sched.80 Pipe

22 Round Bar Rings



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AISC NEWS

AISC Offers Advice on Recent HSS Issues

Questions first arose a few months ago about the mechanical properties of imported HSS, as well as the credibility and reliability of the documentation provided when the imported products entered the U.S. and Canada. At that time, AISC advised that it was premature to draw any conclusions until information could be assembled and independently reviewed.

Since then, we have collected the available data, which represents a limited number of tests on mechanical and chemical properties. AISC staff and industry materials consultants have reviewed this data and noted the following:

- ✓ Many of the tests were performed to different procedures and protocols than are required for HSS in ASTM A500, and therefore lacked uniformity for analysis.
- ✓ Testing speeds varied significantly among the tests that were reported to us.
- ✓ There was no control or tracking of the location of test specimens as to what position they came from in the width and length of the coil.

Despite these factors, each of which will induce significant variations in the testing results, the mean of the independent test results was similar to the mean of the material test report (MTR) values. As should be expected, these factors did result in a higher standard of deviation. Accordingly, it is AISC's conclusion that this does not represent a building code issue.

"Perhaps the most important recommendation is that the buyer should know and evaluate their material supply chain," stated Roger Ferch, P.E., AISC's president. "As with any other purchase, don't just look at the quoted price, but also consider the quality, reputation, and experience of the supplier." Also, it is important to verify that the material and its documentation meet ASTM A500 requirements when they are received. A few MTRs AISC received with the information submitted to us were for material that had been accepted by the purchaser with metric values reported on the MTRs that did not meet the minimum ASTM requirements. Such deviations can be avoided with simple receiving inspection of the material to ensure it is as it was ordered.

In addition, AISC has received reports of seam weld quality concerns with imported HSS. The seam weld deficiencies that led to these concerns can be seen on the California Division of the State Architect website (**www.dsa.dgs.ca.gov/labs/hss_pictures.htm**), based upon their discovery of weld seam problems in some imported HSS. As can be seen in the photographs on the site, the defective material is such that the defects are identifiable through visual inspection.

The limited information that is available to date on this topic and the anecdotal nature of reports of weld seam defects leads us to believe there is no crisis in HSS supply, and no dramatic response is necessary. "Producer quality control is an essential part of the supply chain, and we believe that North American producers are routinely exercising good QC processes," explained Louis F. Geschwindner, Ph.D., P.E., vice president of engineering and research at AISC. "Receiving inspection at various levels is a routine method to evaluate supplier quality control, and we believe that steel service centers and fabricators are properly performing this function. Where a supplier is new or unknown, these reports may be cause to increase vigilance to ensure that the material they supply is acceptable."

AISC will continue to monitor these situations and keep the design community and construction industry informed of any changes. If additional information is needed, please contact AISC's chief structural engineer, Charles Carter, P.E., S.E., at carter@aisc.org or contact the AISC Steel Solutions Center at solutions@aisc.org.

ENGINEERING JOURNAL

Call for EJ Papers

AISC is always looking for *Engineering Journal* articles on interesting topics pertinent to steel design, research, and fabrication methods, or new products of significance to the uses of steel in construction. We are especially seeking technical articles with practical applications in the steel industry. If you have a new idea or an improvement on an old idea, please submit your paper for publication in EJ.

Please send your paper in duplicate to Cynthia Duncan, Editor, c/o AISC, 1 E. Wacker Drive, Suite 700, Chicago, IL, 60601, or e-mail your submittal to duncan@aisc.org.

Detailed information on our review process and requirements for submittals can be found in each *Engineering Journal* issue or at **www.aisc.org/ej**.

In addition, all published papers are eligible for the Best EJ Paper of the Year award. Cast your vote for the best *Engineering Journal* paper of 2007 at **www.aisc.org/ejsurvey** and become eligible for a free trip to the 2008 Steel Conference, held April 2–5 in Nashville. A drawing will be held in early March 2008.

All articles published in *Engineering Journal* in 2007 are included in the survey (excluding Discussions). The winning author will also receive free registration to the 2008 NASCC, as well as round-trip airfare and a one-night stay at the conference hotel.

Cast your vote today! Votes will not be accepted after February 28, 2008.

letters

Green in Practice

In your December Editor's Note on sustainability, you posed the question, "What are you doing to be green at your company?" We have a very small office and are trying to use real cloth towels to minimize the amount of paper towels we use.

Dyson actually makes a hand dryer that works. I used it at an architect's office in New York. The suction almost removed my wedding ring.

When reviewing drawings, we always ask for them electronically. We only print them on paper when necessary.

Most interesting, I am getting comments during my formal presentations to architects that they are "considering" low floor-to-floor height systems for buildings that normally would not require low floor-to-floor heights. Some architects have mentioned schools, office buildings, and modest two- to three-story structures. Lowering floor-to-floor heights reduces the amount of building materials used and decreases the volume of the building for heating, cooling, etc.

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TEXAS AND THE MID-SOUTH

Inspired Innovation

BY NISSIM AGASSI, P.E., SCOTT KAMEN, AIA, DENISE KEAVENEY, AND OPHIR AGASSI

A job that begins as a routine inspection for façade restoration suddenly turns into a challenging structural replacement project when severe underlying structural failures are found.

ELEVEN WAVERLY PLACE WAS BUILT IN 1929 AS A 12-STORY HOTEL WITH A BRICK AND TERRA-COTTA FAÇADE. As with many historic New York buildings, its function has changed over the years, and it now houses commercial space on the first floor and residential apartments above. And also as with many vintage buildings, façade restoration work was inevitable.

Agassi Consulting Engineers and Bond Street Architecture & Design were initially called in for the restoration of the building façade and compliance with New York City Local Law 11, Façade Inspection Program. However, the discovery of unsafe structural conditions during our initial inspection prompted the owner to expand the scope of our work.

Our initial façade inspection identified two main issues: the extensive spalling of the salmon exterior brick and the deterioration and instability of the building parapets. To ensure the safety of the pedestrians below, a sidewalk bridge was immediately erected before we proceeded with an intensive exploration and testing program to determine the causes of the façade deterioration.

A Deeper Problem

Our examination revealed that the deterioration was not confined merely to the façade, but in fact extended further inside the building. We discovered severe corrosion of the spandrel steel at the main roof level. Also, the roof cinder concrete slab, which was supported by the corroded structural steel frame, was itself spalling. The slab reinforcing bars were severely corroded and some were completely severed. Large chunks of concrete had already fallen and were lying precariously on the flimsy stucco ceiling, which had never been meant to carry loads and which itself was hanging from the same deteriorated roof slab some 30 in. below.

The discoveries from the façade examination raised a red flag but did not provide sufficient conclusive information for decision-making concerning the entire roof slab and framing system. Was this a local weakness or was the decay more widespread?

We immediately apprised the owner of our findings and requested to conduct hands-on observation of the entire cinder concrete slab and the steel framing system from inside the 12th-floor apartments.

After this further exploration, we ascertained that the problems observed during the façade inspection were indeed widespread. Water leaks over the years had caused severe corrosion of the structural steel and reinforcing rods and non-reversible deterioration of the cinder concrete slab over the entire roof area. When we tried to core the slab, it simply crumbled. The deteriorated slab had little strength, if any, to support itself and the other rooftop loading. The flimsy 1-in. stucco ceiling that was hanging from the deteriorated roof slab was the only barrier between the falling concrete debris and the occupants of the 12th floor—truly a disaster waiting to happen.

The façade of Eleven Waverly Place wasn't the only thing that needed attending to.

Our first response to these discoveries was to address the safety of the building occupants. With the owner's complete cooperation we were able to vacate the entire 12th floor and the penthouse from the potentially dangerous situation. In order to protect the occupants of the 11th floor, the stucco ceiling of the entire 12th floor was completely removed, and all deteriorated roof slab sections were immediately shored as each apartment was vacated.

Replace or Repair?

The most obvious solution would have been to reinforce the structural steel members and connections. However, this would necessitate the removal of the three-story penthouse, as it was supported by the structure that required reinforcing, and the sections most in need of reinforcement would have been inaccessible while the penthouse remained intact.

In addition, the steel members and connections would have had to be exposed first, necessitating the immediate demolition of the deteriorated roof slab, so that the steel members and connections could be inspected, cleaned, and repaired. This in turn would have required the construction of a collapse platform to contain debris and safeguard the occupants of the 11th floor below.

Removal of the slab meant removal of the existing roofing as well, a step that would have left the building exposed to the elements. Tenting the building as a measure for weather protection would have added significant cost and become a maintenance item, and could also have interfered with the repair work itself.

Full replacement wasn't an option either, as it would have necessitated the use of a crane to lift the new steel to the roof. According to the NYC Department of Buildings Regulations, swinging of structural steel members by a crane or crane boom over the main roof area would have required that two floors below the roof level be vacated.

So, full replacement was out as an option, and reinforcement looked to be a daunting task as well; project constraints were quickly narrowing down our choices.

Reframing the Challenge

At this point, the challenge was to repair the corroded steel while at the same time leaving the penthouse intact and all of the main building services in full operation. Furthermore, we were determined to do all work without swinging a crane over the building in order to avoid having to evacuate the 11th floor. We also wished to avoid tenting the entire roof while removing the existing slab and roofing system, in order to avoid significant additional costs. To do this without exposing the 12th floor directly to the elements, we would have to leave the existing roof in place until after the structural steel repairs were completed from inside the 12th floor. With this in mind, the questions we now had to answer were:

1. How would we repair the underlying steel structure without removing the penthouse and while keeping the existing slab and roofing in place?
2. How could we achieve the imperative objective of protecting the occupants on the 11th floor from the deteriorated roof while gaining the access we needed to do the repair work? In other words, how would we protect the 11th floor from direct impact during demolition and possible collapse of the deteriorated slab, and how would we avoid the forest of shores from impeding the repair work?
3. How would we protect the building's interior from the elements, and how would we maintain the stability of the roof parapets and penthouse structure during the process of removing and replacing the existing roof slab once we began this process?

An Unexpected Solution

Once it became clear that there was no practical way to increase the load-carrying capacity of the steel structural system through reinforcement, we had to come up with an alternative. Our chosen solution was load reduction combined with a novel relief and transfer system.

Load reduction was achieved by implementing a plan to eliminate 3 in. to 15 in. of cinder fill used to slope the roof towards the roof drains, approximately 3 in. of cinder concrete topping, and 2 in. of built-up roofing. This was accomplished by adding 13 more drains in addition to the two original drains, and by using a waterproofing membrane that did not require the roof to be sloped. As a preventative measure, however, we required that the top of the new concrete be sloped by up to 1 in. at high points. Relieving and transferring loads, nonetheless, had to be done first and required further ingenuity.

Fortunately, the original roof was constructed with a plenum space for ventilation and for containing the building's main mechanical piping system. The plenum space offered room for new support girders but limited them to a shallow depth of 8 in. to 10 in. These new, shallow support girders, installed a few inches below the existing ones, would undergo relatively large deflections but would function suitably as a stage against which the existing girders could be jacked and partially relieved of their load, while the roof slab stiffness would be maintained by the coupled system of the existing and new girders acting in unison. By jacking and "freezing" the deformed position between the existing and new girders at specific jacking points, locking in a predetermined force through the insertion of calibrated bearing plates, we were able to permanently relieve the existing corroded girders of their excessive load, transferring it to the new support girders.

The jacking system had to be worked out in detail and required careful calibration of forces and deflections at each jacking location, coupled with proper sequencing. Two pre-calibrated jacks were used at each jacking location, one on each side of a permanent bearing plate. Where a few existing girders were interconnected, a simultaneous jacking of all interconnected girders was necessary.

A mock-up was performed, which proved useful in confirming our expectations. It indicated that reaching an exact pre-specified jacking force was possible, but it took some time to calibrate the desired force and the thickness of the corresponding permanent bearing plate. To speed up the field operations, we provided an acceptable range for the final jacking force in lieu of a specific force for each jacking location.

Rather than placing a crane on the roof and swinging a boom over the building,

New steel members were lifted by a crane at street level and needled through a 12th-floor window for installation under the main roof.

Chunks of the deteriorated cinder concrete roof slab landed on the flimsy stucco ceiling. The ceiling was hung from the same deteriorated roof slab.

the structural steel fabricator and erector used a crane at street level to haul all steel members to the 12th floor, delivering them through the windows and rolling them into place. Long steel members were cut into manageable 10-ft to 12-ft segments to be spliced in place during erection.

In the end, completely jacking the existing girders eliminated the need to reinforce the corroded steel girders while permanently increasing the overall load-carrying capacity of the roof's structural system.

Maximizing Efficiency

In order for the structural steel repair work to advance from beneath the roof and relieve the 12th floor from direct loading and impact during the roof slab demolition, or in the event of a possible collapse of the deteriorated slab, we had to remove the temporary shores. At the same time, we still needed a shoring platform in place until the deteriorated slab could be replaced.

Our solution incorporated a temporary shoring scheme with permanent supports for the roof into one system. This way we were able to confine both the problem and solution to the roof level. The combined system eliminated the temporary shores altogether, ensured the efficient and orderly implementation of the work, maximized the protection of occupants and workers, and minimized the building's exposure to the elements.

Like the existing girders, the existing steel filler beams supporting the roof slab were left in place and not repaired at all. Instead, new sister beams were installed in each bay and were fitted with steel shelf angles welded to the beam webs. The angles supported a temporary metal deck placed against the bottom of the existing roof slab. This temporary deck served two functions: as a collapse-protection platform during construction and as a stage for demolishing the existing slab. Once the deteriorated roof slab was demolished, the temporary deck was removed and a new permanent metal deck was installed on top of the sister beams. The reason for moving the position of the metal deck and placing it above the sister beams was to avoid 3 in. of concrete dead load in the new roof.

The process of demolition and replacement of the roof slab took place from above. Before removing the existing slab, however, we needed to stabilize the roof parapets since widespread deterioration at the parapets caused a concern for their stability if the existing slab were to be demolished. This was accomplished by reinforcing the parapets and anchoring them to the spandrel beams.

The building was kept watertight by a temporary, loosely laid rubber membrane using the new permanent drains we had installed at the main roof. This membrane was installed in sections immediately following the removal of the existing roofing and cinder fill, and remained in place until the new waterproofing system could be installed.

The demolition of the deteriorated roof slab and the installation of the new concrete slab were accomplished by dividing the roof area into predetermined workable sections. We used a carefully planned pattern of sequential demolition and reconstruction in order to maintain the stability of the penthouse structure while the roof slab diaphragm was open. The temporary rubber roofing system was rolled open in the morning and closed at the end of each workday. This approach entirely eliminated the need for tenting the roof and penthouse, which would have impeded the slab demolition and reconstruction, and

would have added significantly to the cost of the project.

Penthouse Project

Underneath the penthouse itself, the damage to the existing slab at roof level was less extensive than the damage at the open roof area. Therefore, to further maximize efficiency and cost, we left the existing slab in place and re-supported it from below. We installed a new metal deck ½ in. to 1 in. under the slab, and the space between the slab and the metal deck was grouted using SikaGrout 212. Injecting the grout into this narrow space, so that it completely and uniformly filled the gap between the slab and the metal deck, presented a significant technical challenge, but one that was met successfully. A full-scale test panel of an entire bay confirmed that we succeeded in applying the grout as needed, thereby solidifying the slab and providing it with a firm and continuous support.

Completing the Project

After completing the restoration work at roof level, we turned to the penthouse, which required individual treatment of a few elements such as the partial reinforcing of exterior columns and the restoration of a distinctive copper roof over the water tank. At the same time we picked up the pace with the façade cleaning and restoration, which required the installation of hung scaffolding from the now-restored roof level. MSC

Nissim Agassi is a principal with Agassi Consulting Engineers. Scott Kamen is a principal and Denise Keaveney is an architect with Bond Street Architecture & Design. Ophir Agassi is an artist and writer in New York.

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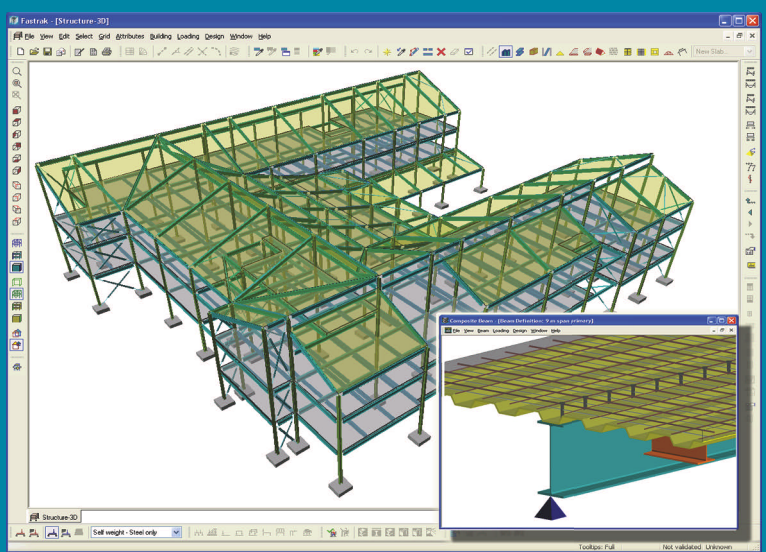

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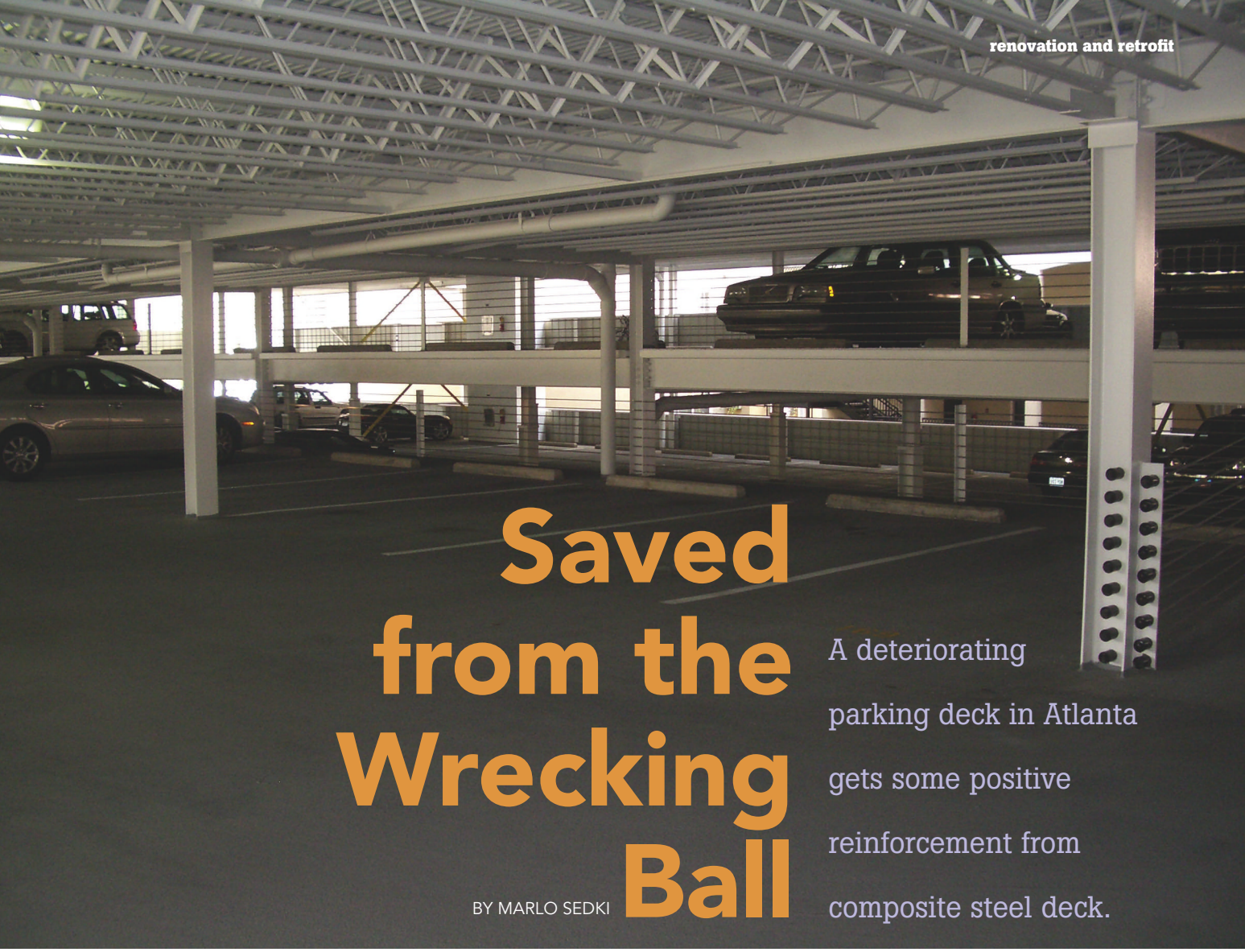

Saved from the Wrecking Ball

A deteriorating parking deck in Atlanta gets some positive reinforcement from composite steel deck.

BY MARLO SEDKI

YOU'VE HEARD THE OLD SAYING: "IF IT AIN'T BROKE, DON'T FIX IT." Well, here's a follow-up: "If it *is* broke, *do* fix it—don't destroy it!" That's the philosophy Sedki & Russ Structural Engineers embraced when confronted with a rapidly deteriorating parking deck at the Cornerstone Village condominium building in Atlanta.

The original analysis called for the garage to be demolished and bebuilt. However, the homeowners association for the building did not have the funds to build a new parking deck. So, Sedki & Russ found a way to renovate the structure.

Critical Cracking

Cornerstone Village's original parking deck consisted of concrete slab on steel joists. Almost immediately after the six-story deck was completed in 1999, problems, such as cracking in the slab, corrosion of the steel frame (due to water seepage through the cracks), and vibrations and deflection in the deck, began to appear. The cracking got worse with time, and in some locations the slab even punched through the metal deck. Areas where the slab was badly cracked had to be barricaded, and in other locations steel plates and angles were placed under the slab.

The homeowners association hired a testing lab to analyze the situation. The lab's report stated that the design of the concrete slab did not meet load requirements at mid-span between the joists (per the 1994 *Standard Building Code*, the slab must support 50 psf live load or a concentrated load of 2,000 lb acting on an area of 20 sq. in.), and it recommended removing the slab and replacing it with a new, lightweight composite floor slab.

The original floor slab specified was 3½ in. thick at the high point and 2½ in. thick at the drains. The slab was on 28-gauge corrugated metal form reinforced with welded wire fabric. The deck was bearing on steel joists at 2 ft 8 in. on center in the driving lanes and 2 ft 6⅞ in. in the parking lanes, with the exception of the first bay, which was 3 ft 13⁄16 in.

The consensus was that the concrete slab was unsalvageable and needed to be replaced. Temporary repairs were made, consisting of inverted 1½-in.-deep 18-gauge type F metal roof deck over the slab, spanning between the joists and in the driving lanes only. Wood planks, 2 × 6, were cut to fit and added to fill in the valleys of the deck. The wood planks and decking were connected to the slab with ½-in.-diameter carriage bolts at close spacings.

The repairs were inspected monthly and performed satisfactorily for a while, but after approximately two years, the wood started to splinter and the bolts started to loosen. At this point, Sedki & Russ was hired to design the permanent repairs.

Driving Forward

The project had to be completed quickly because of the inconvenience to

residents, who were required to park several blocks away during construction. First, the concrete slab and deck in the driving lanes the ramps were removed, leaving just the parking lanes. Then, new joists were installed between the existing joists, and three rows of cross-bracing were installed, welded between the top and bottom chords of joists and at crossover points. The bottom chords of the joists located at the one-third points of the beam spans were extended with 2-in. angles. To stiffen the beams and increase their moment capacity, 1-in. round rods were welded at their top and bottom flanges.

A new 26-gauge corrugated galvanized metal deck spans the existing and new joists. The deck was connected to each joist with welding washers at 12 in. on center. The welding washers were 2 in. high for slab thicknesses 3 in. or greater, and 1½ in. high for thinner slab thicknesses. These washers have a groove at the top to support a continuous #3 bar, which placed the mesh at the top over the joists.

The concrete poured for the new slab was 4,000 psi with a 3-in. maximum slump, and 1.5 lb of fiberglass mesh per cubic yard. The slab is reinforced with welded wire fabric.

Crack-control joints were added at a few locations over joists at column lines, and alternating bars were cut at the joints. The joints were tooled, not saw-cut, and then filled with ISO-Flex 880 joint filler.

In the parking lanes, additional joists were placed between the existing ones. Since the deck was still in place, the joists were shipped with no camber and without bearing ends. After the new joists were in place, they were jacked up tight under the existing slab, and the bearing ends were placed. To provide lateral bracing to the top chord, ⅜-in.-diameter expansion bolts between the top-chord angles were anchored into the slab above. Three rows of cross bracing and joist bottom chord extensions were added to the bottom flange of the beam.

After being cleaned in accordance with SSPC-SP3 or SSPC-DP2, the entire steel frame was painted; it was spot-primed with Tnemec Series 135 and then a full coat of Tnemec Series 115 DF was applied. The last step was to apply Neogard Auto-Gard Waterproofing, a vehicular traffic-bearing waterproofing membrane, over the entire deck. The renovation was completed last year.

With the project complete, the garage is now structurally sound and safe for parking.

The original concrete slab was so badly cracked that it had punched through the deck in some places. Portions of the slab were barricaded.

Throughout the garage, new joists were added in between the original joists to decrease the slab's span.

The only drawback is that residents don't get as much exercise walking to their cars anymore. MSC

Marlo Sedki is vice president of marketing with Sedki & Russ Structural Engineers, Inc.

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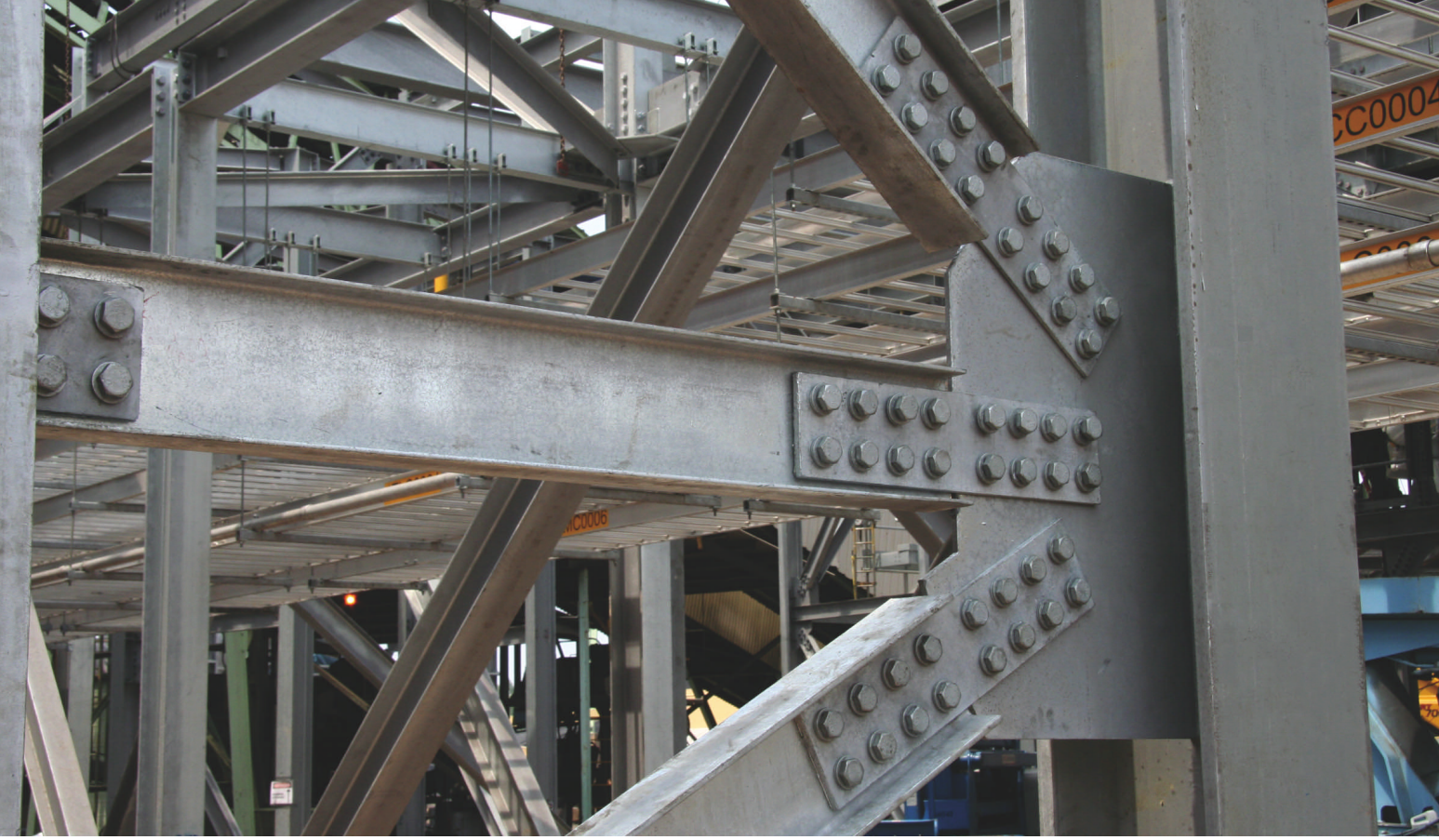

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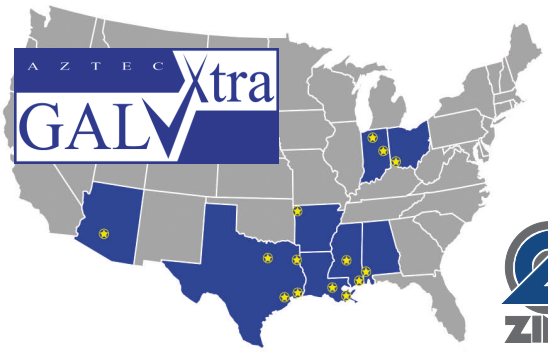

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Breaking the Surface

BY ZAREH B. GREGORIAN, P.E., AND GAREN B. GREGORIAN, P.E.

The cosmetic renovation of a New England building grows to include a significant structural repair.

FEW THINGS ARE AS FRUSTRATING AS BUYING A BUILDING ONLY TO DISCOVER THAT YOU'RE ALSO BUYING INTO STRUCTURAL DAMAGE. But that's just what happened when a major bank purchased a one-story reinforced concrete building, constructed in the early 1900s, with the plan of renovating it to house a new branch.

A stepped crack had developed on the concrete block wall on the building's western side, adjacent to a corner concrete column. Although the wall appeared to be a non-bearing filler wall, the owner was concerned with the situation and wished to investigate the reason for the cracking and repair it before the renovation was complete and the new tenants moved in.

The owner brought in an architectural consultant, Ardalan Associates, as well as structural design firm Gregorian Engineers to evaluate the situation at the corner column and concrete block wall area, determine the extent of the crack, prepare a condition survey report, and suggest repair methods.

Unfortunately, no existing structural drawings were available for review, and almost all structural elements were concealed by gypsum board and suspended ceilings, preventing observation of the structural framing system in the first floor and ceiling area. So, the engineers had to make measurements of the existing structural elements and document the existing conditions in accordance with ACI guidelines.

The condition survey report compiled by the evaluation team included drawings indicating size and location of existing members, as well as photographs and descriptions of the structural condition of the corner based on visual observation and tap testing (striking the surface with a hammer and a steel bar).

Preliminary Investigation

During our initial visit, we noticed a 3-in.-wide crack that extended through the entire cross section of the column. The crack was diagonal, at a 45° angle, at the top of the column approximately 6 in. below the floor and column joint. Settlement, measuring approximately 5 in., was also observed at the corner of the building.

The existing structural system consisted of rectangular and square columns (in the basement) supporting the floor structure on a 25-ft by 20-ft system in the long and short direction. The floor system consisted of a one-way cast-in-place joist system with reinforced concrete girders spanning the 25-ft-long dimension. The joist system spanned 20 ft, resting on the girders.

Repair Options

The following factors were critical in the selection of repair options:

- ✓ Repairs had to be performed as quickly as possible.
- ✓ The building had to be secured to avoid vandalism.
- ✓ Repair materials had to be readily available.
- ✓ The repairs had to be relatively simple.
- ✓ The aesthetics of the finished product were not of concern because the area would not be exposed to view.
- ✓ Structural repairs had to cause minimal disruption to the other renovation work being performed.

Three repair options were considered:

1. Repair the column and the attached corner roof beams using FRP (fiberglass-reinforced polymer) sheets. This option was

Above: The damaged corner column (on the right) is actually at the junction of the main building and an adjacent building.

Enlarged view of the corner cracked column. The surrounding structure is covered and could not be observed.

Hollow steel columns, 6 in. by 6 in., now reinforce the damaged concrete corner.

eliminated since it would not alleviate the decreased load-carrying capacity of the inclined column due to deformation. Also, with the column being at the corner of the building and the crack being close to the roof, a beam-column joint would make the installation difficult and unpractical.

2. Demolish and reconstruct the column and part of the roof. This option was ruled out due to problems performing demolition in a congested area and because it would take too long.

3. Relieve the load on the damaged corner column by installing steel support columns to support the concrete roof beams framing into the column.

Option 3 was eventually selected. Since the structure had settled and cracked and was out-of-plumb, the best solution was to support the existing concrete frame using new structural steel members to transfer

the load to the foundation. This solution required minimal demolition, and the steel columns could be fabricated in the shop and transported to the site for installation. In addition, installation was performed in one day, and the whole operation was performed in less than a week, without disrupting the non-structural renovation work.

Installing the Columns

Six-inch-square HSS columns with 12-in. by 12-in. base and cap plates were installed and anchored with 5/8-in.-diameter epoxy anchors. The columns were installed about 24 in. away from the cracked corner column to support the roof corner beams where the concrete was intact, and away from the deteriorated concrete areas.

The base plates were installed on the existing basement wall on the exterior side (at the rear wall) and on the concrete basement ceiling beam on the inside (at the side wall). The side wall column was continued to the basement slab by adding steel columns supporting the concrete basement beam from below. Non-shrink grout was used at the base and cap plate support locations.

Looking Forward and Upward

With the installation of the new steel columns, the concrete corner column no longer acted as a load-bearing element. To prevent possible further deterioration, the deteriorated part of the column and part of the attached roof beams were cleaned, steel dowels were installed at the 3-in. gap, and the gap and repairs were filled with concrete.

Finally, in anticipation of expanding the building upward, a new steel column independent from the existing structural system was installed at the newly reinforced corner. As such, steel has prepared the building for the present, with an eye on the future. MSC

Zareh B. Gregorian is a principal and Garen B. Gregorian is a project manager with Gregorian Engineers.

Architectural Consultant
Ardalan Associates, LLC, Newton Center, Mass.

Structural Engineering Consultant
Gregorian Engineers, Belmont, Mass.

Photos courtesy of Gregorian Engineers.

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The 19th Hole

BY JEFFREY URDAN

Sweeping views of the New York skyline and complex, artistic steel framing characterize a soon-to-be-open golf course clubhouse on the Jersey shore.

Willowbend Development

LIKE GOLF? IF SO, THERE'S A NEW COURSE ON THE JERSEY CITY, N.J. WATERFRONT. Just bring your clubs and your spikes—and the $500,000 membership fee (you also have to be invited to join). Once you're in, you can arrive by land, sea, or air: by car, private yacht service with onboard concierge, or helicopter.

While it may be exclusive in terms of membership, the soon-to-be-open Liberty National Golf Club possesses architectural, environmental, and structural attributes that everyone can appreciate. From an envi-

Crystal Steel

ronmental standpoint, the course uses local grasses and employs an advanced rainwater reclamation system to irrigate the greenery, and mature trees were planted throughout. Further, it was built on a 250-acre brownfield site, and all aspects of the project were designed with sustainability in mind.

From a design perspective, the owner wished the clubhouse, framed in steel, to be evocative of a luxury yacht, given the waterfront setting. Visitors are greeted with a 24-ft-long cantilevered canopy and enter into a dramatic reception area with 30-ft ceilings, beyond which are framed views of Midtown Manhattan and the Statue of Liberty.

Fast and Complex

And then there's the structural steel framing itself. "The grid for this project is not the customary orthogonal grid, with rectangular bays and X and Y coordinates or dimensions that everyone is used to working with," says Chris Christoforou, the engineer of record with Thornton Tomasetti's Newark office. "Every column is located with polar coordinates based on an angle and a distance from one of four focus points. So all the beams are connecting to radial-laid girders, some of them curving; no two connections on the job are alike."

Christoforou notes that the structural design team didn't set out to work with steel specifically. However, the fast-track project schedule required very quick erection of the structural frame. The architect began the project drawings in 2006, and the project was scheduled to open in the sum-

Thornton Tomasetti

Beams are connected to radial-laid girders instead of the customary orthogonal grid.

mer of 2008, about a year ahead of what would be expected for a project of this size and complexity, says Christoforou.

Since the building geometry is so complex, a concrete contractor would have required a longer schedule—and expediting the schedule would have made the project prohibitively expensive to do in concrete. In addition, long cantilevers on the roof, with its curved profile, would have made concrete an even more impractical choice. So, the compressed time frame really made steel the only viable option.

Technology and Teamwork

Fabricator Crystal Steel's detailing team developed its initial wireframe using StruCAD. The team consisted of 13 detailers and checkers working for nearly five months on parallel portions of the StruCAD model, really pushing the software to

Thornton Tomasetti

its limits and beyond. "StruCAD was not designed to work in this type of multi-user environment, but StruCAD's tech support group helped us find a way to fool the system into thinking it was multiple jobs," says Bill Lo, president of Crystal Steel.

When the detailing manager met with the design team and walked them through the 3D model, there were a lot of questions about design intent and how to bring the various elements together. The architect and engineer worked openly and constructively with the fabricator in a close collaboration that would extend over the next several months as the design blossomed and the steel details were nailed down in parallel. Crystal Steel submitted connection geometry and computations directly to the design team while concurrently posting the submissions to an internal web site for project record.

Many of the connection details were complex in nature due to the geometry of the structure.

The Devil is in the Details

The geometry in plan view was difficult due to the polar grid, but that wasn't the end of the challenges; the vertical geometry of the sloping side-wall framing and the curved surface of the roof made 3D detailing a necessity. If an architectural feature was based on a certain set of dimensions and that geometry was adjusted in any direction, the change caused a ripple effect of changes throughout the steel model.

Because of the complex geometry of the framing members, few of the connection details could be considered "standard." In fact, the individual connection geometry could not be determined until the overall framing geometry for the structure was fully developed and confirmed. StruCAD's 3D modeling enabled Crystal Steel to provide precise locations for every individual piece of steel on the project without spending weeks calculating angles of rotation. Once member locations had been established, connection computations were provided by Crystal Steel's structural consultant, Columbia Engineering, Inc. In the end, more than 2,200 piece details were produced along with the corresponding computations for the connections.

Approvals, Transmittals, Comments and Stamps

Once the shop drawings were complete, they were submitted for review via the project website created by the construction manager. Rather than print drawings, pack them up and mail them, unpack and stamp them "Received," review, comment, copy comments to multiple sets, repack, re-ship, etc., the drawings were uploaded once, and all team members were notified.

In addition, the architect's and engineer's stamps had been given to the fabricator in advance so that they could be digitally incorporated into the drawing template, saving hours of manual stamping on each set of drawings. Using Adobe Acrobat, the architect and engineer could mark up the drawings online with no need to print each one. Reviewed drawings were returned via the same quick upload to the project site. According to the architect, approximately one-third of the 2,200 shop drawings were never printed out, saving paper and time.

Cutting Steel

With approved drawings in hand, Crystal Steel set to work fabricating the job. More than 75% of the job consisted of

pieces with skewed cuts, and there were about 100 pieces of rolled material for the roof. With the ongoing design modifications that come with a fast-track job, loading trailers at the last minute was critical. "If we had run this like a normal job—worked the pieces and then loaded them right onto the trailers—we would have unloaded trailers twice for every time we loaded them," says Bill Gibris, vice president of operations for Crystal Steel. "We held off until the last possible second to load because we knew there would be design changes coming, and we didn't want to have to locate finished pieces in the middle of a trailer, then unload and rework them to conform to new information that had just been developed by the design team or incorporated by our detailers. Fabrication was working so closely to design that changes were flowing daily."

Putting it All Together

Despite the complexity of the project and the fast-track schedule, the steel came together just fine, thanks to the close collaboration between the design team and the fabricator. As Darley Travers, Crystal Steel's project manager, put it: "If you have 100% perfect details and 100% perfect fabrication, it doesn't matter how complex the building is—the steel fits together perfectly." MSC

Jeffrey Urdan is vice president of Crystal Steel Fabricators.

Owner
Willowbend Development, LLC, New York

Architect
Lindsay Newman Architecture and Design, New York

Structural Engineer
Thornton Tomasetti, Newark, N.J.

Steel Fabricator and Detailer
Crystal Steel Fabricators, Inc., Delmar, Del. (AISC Member)

Fabricator's Consulting Engineer
Columbia Engineering, Inc., Columbia, Md.

Erector
Shamrock Construction Group Inc., Matawan, N.J. (AISC Member)

Construction Manager
Bovis Lend Lease, Princeton, N.J.

Steel Detailing Software
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In Charge of Your Future

BY BRIAN MILLER

Becoming AISC Certified is a forward-looking business strategy.

"I HAVEN'T YET WON OR LOST A JOB BASED ON A REQUIREMENT FOR AISC CERTIFICATION."

This reply is frequently offered by leaders of steel fabrication and erection firms when asked about becoming AISC Certified. The statement may be true on its face, but it also suggests a limited appreciation for the contribution that an AISC Certified quality management system makes toward both current and future business success.

More than Just a Ticket to the Dance

Even when not specifically required for a project, an AISC Certified quality management system supports a firm's ability to position itself well in a value-based selection process. Of course, offering the lowest price is a key factor. But increasingly, construction decision-makers are willing to assign additional value to firms that are able to demonstrate the abilities to reduce risk and consistently meet project requirements. An AISC Certified company can readily demonstrate that it has the resources, qualified workforce, and process controls necessary to meet project needs.

When it comes to pricing, an AISC Certified Quality management system can give a firm a clear advantage. If you believe that it costs more to provide high quality service, think again. You are likely not looking deep enough, past the "Tip of the Iceberg" to the hidden costs of poor quality.[1] Savings in the production cost of rework and field fixes are readily recognized, but often less acknowledged or accepted is the very real cost-saving potential in the reduction of inefficiency and non-value-added activity. For example, consider how rework contributes to the cost of these associated activities: purchasing, billing, overtime, planning and scheduling, detailing, project management, reputation, and transportation costs. These ancillary costs are often not collected and reported. Quality authorities claim that the hidden costs of poor quality are more than double the visible costs.

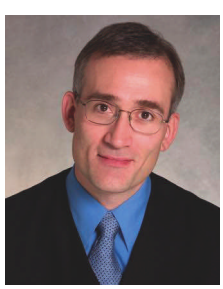
The Power to Change

Previous Quality Corner articles have explored in detail the contributions that AISC Certification and a commitment to quality can make on an organization's profitability—through higher margins and cost reduction.[2] Another very important way that AISC Certification contributes to success and profitability is through strategy planning and development.

When the quote shared earlier, "I haven't yet won or lost a job based on a requirement for AISC Certification," is offered as a reason for not becoming AISC Certified, it highlights an all-too-common practice in our industry of waiting to change until forced to do something differently. The kind of change that eventually results is often difficult to accommodate: poorly timed, unplanned, and disruptive.

In today's rapidly changing business environment, strategists agree that long-range strategic planning is losing its relevance.[3] Of course, anticipation is advantageous in times of change; successful business strategies continually change and conform to emerging opportunities and industry trends. Two modern goals for business strategy are resiliency and sustainability. Resiliency enables large changes to take place in rapid, organized, evolutionary steps, avoiding disruptive surprises and organizational trauma.[4] Sustainability locks in these incremental changes, keeping the direction of the organization focused forward rather than backward. At first, the way to achieve this kind of dynamic strategy planning and development may seem elusive—i.e., until you make the connection that the AISC Certified quality management system that drives continual quality improvement can also be directed toward continual improvement of your business strategy.

Representatives of the Boston Consulting group recommend an integrated three-lens approach to business performance improvement strategy.[5] Their recommendation aligns with the aim of the AISC Certification programs to be customer-focused, management-driven, and process-based.



Brian Miller is AISC's director of certification.

Quality Corner is a monthly feature that covers topics ranging from how to specify a certified company to how long it takes to become a certified company. If you are interested in browsing our electronic archive, please visit **www.aisc.org/QualityCorner**.

➜ **Customer-focused (products and services).** Product and service decisions should be made on the basis of what customers truly value. Communication channels established as part of an AISC Certified quality management system provide a conduit for customer feedback directly to top management via regular management reviews. Evaluation of customer feedback should lead to continually improving communication methods. An opportunity for strategy adjustment should also be part of each review meeting.

➜ **Management-driven (business objectives).** Strategy decisions are always made in the context of the company's overarching business objectives. Customer-focused or process-based strategies that imperil an organization by damaging profitability or detracting from higher-value opportunities must be avoided. AISC Certification provides for establishment of goals and measurements from which to make fact-based decisions.

➜ **Process-based (production process).** Strategy planning and development depends on understanding how to provide products and services efficiently, cost-effectively, and within schedules. AISC Certification supports procedures and process control that define capability, variability, and how rapidly change can be accommodated. AISC Certification-required internal audits serve to regularly assess and gather information about capability and potential throughout an organization.

Internal audits also provide a tremendous opportunity for two-way communication within an organization. Cross-functional internal audit teams help build and identify talent within an organization and support a network for communicating ideas and opportunities.

Investing too much in "what is" and too little in "what could be" can cause steel fabrication and erection firms to falter. A business can't assume that past success means future success. Rapid changes in technological advances and globalization provide opportunities, but those opportunities are

10 Signs of Innovation Dysfunction

Futurist Jim Carroll, who spoke at the American Society for Quality's World Conference on Quality and Improvement in the spring of 2007, identified these ten signs that you've got innovation dysfunction within your organization:

- ➜ People laugh at new ideas.
- ➜ Someone who identifies a problem is shunned.
- ➜ Innovation is the privileged practice of a special group.
- ➜ The phrase "You can't do that because we've always done it this way," follows every new idea.
- ➜ No one can remember the last time anyone did anything really cool.
- ➜ People think innovation is about R&D.
- ➜ People have convinced themselves that competing on price is normal.
- ➜ The organization is focused more on process than success.
- ➜ There are lots of baby boomers about, and few people younger than 25.
- ➜ After any type of surprise—product, market, industry, or organizational change—everyone sits back and asks, "Wow, where did that come from?"

accompanied by increasing competitive pressure from more suppliers in a wider geographic range. The advantages of size, capitalization, and long-time establishment are shrinking in contrast to the advantages of being able to anticipate change and dynamically adjust business strategies.

Business strategies that do not change are subject to a variety of types of decay. Strategies will be replicated by competitors, stripping their power to produce above-average returns. Strategies can also be replaced by competitors with creative solutions that provide higher customer value in the forms of quality, scheduling, or flexibility. And strategies can be gutted by customers and suppliers who use information technology to identify and carve big slabs out of margins. Who hasn't heard of, or been lured into, online reverse auctions for fabricated and erected steel?

Commit to Change, and a Successful Future, on Your Terms

Now is the time to start strengthening the ability of your business strategy to anticipate and profit from change. Work toward "what could be" on your own terms; changing only when you are forced to will only increase the pain and will deny you opportunities to benefit from the change.

Apply this thinking to becoming AISC Certified.[6] Begin the process now as part of a forward-looking business strategy and take full advantage of the additional strength the program can bring to your operation. You will not realize the value the program has to offer if you wait until AISC Certification is a requirement placed between you and that project that your firm absolutely must have in order to survive. Ready or not, the requirement of AISC Certification is likely coming soon to your business. Owners and specifiers are increasingly looking to AISC Certification as a qualification tool that will improve the pool of candidates for their projects. Participation in the program is expanding rapidly, with more than 700 fabricators and 120 erectors currently participating in the program.

Use what you have established in your AISC Certified quality management system to qualify for higher-value work, lower your costs, and continually update your business strategy to anticipate future changes and opportunities. Quality guru W. Edwards Deming reinforces the last point with this statement in his book *Out of the Crisis*: "Learning is not compulsory… neither is survival." MSC

References and Additional Reading

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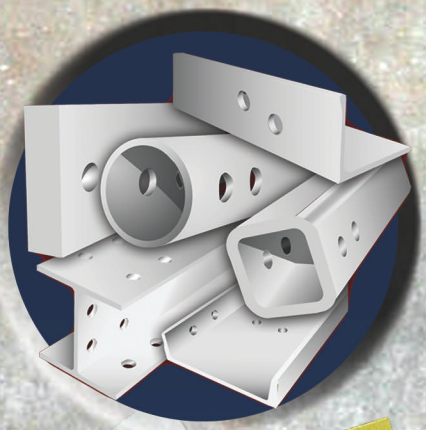

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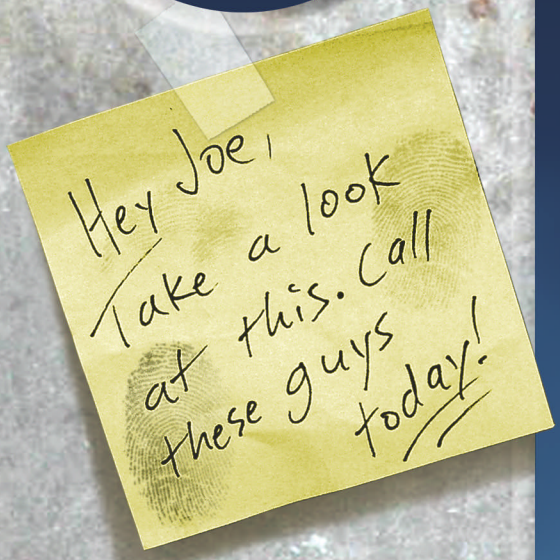

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Simple Shear Connection Limit States

BY ERIKA WINTERS-DOWNEY, S.E.

Understanding limit states is essential to understanding steel connection design. Here's a look at common limit states for simple shear connections.

GOOD CONNECTION DESIGN IS ALL ABOUT FOLLOWING LOAD THROUGH ALL THE ELEMENTS IN ITS PATH. Load must be able to transfer from beam web to bolts to angles to more bolts and through to the supporting web. Each of these connection elements has their own set of discrete limit states. A quick review of these limit states is a good check to make sure you are covering all your bases when designing. The following is a list of references and also some examples of the most common limit states to be checked on simple shear connections.

1 Bolt Shear

Specification Section J3.6

$R_n = F_n A_b$ (J3-1) $\phi = 0.75$ (LRFD)
$\Omega = 2.00$ (ASD)

Additional References

Manual Table 7-1; *Specification* Table J3.2

Bolt shear is based upon the limit state of shear rupture of the bolt. Equation J3-1 in *Specification* Section J3.6 is general and applies to both tension and shear in bolts. The nominal strengths for use in Equation J3-1 are obtained from Table J3.2. The designer must know what bolt grade is to be used and whether he is including (N) or excluding (X) threads from the shear plane. It is conservative to design all cases assuming threads are included in the shear plane. Table 7-15 in the *Manual* gives dimensions of high-strength fasteners. Threads can be present in the "grip" area between the nut or washer and the bolt head, but cannot be fully engaged at the interface of the two plies that are being joined by the connection. A portion of one thread may be present at the shear plane and still be considered excluded, as the strength of the full bolt diameter is present at this location. Eccentricity considerations for bolted connections have been noted in the included table.

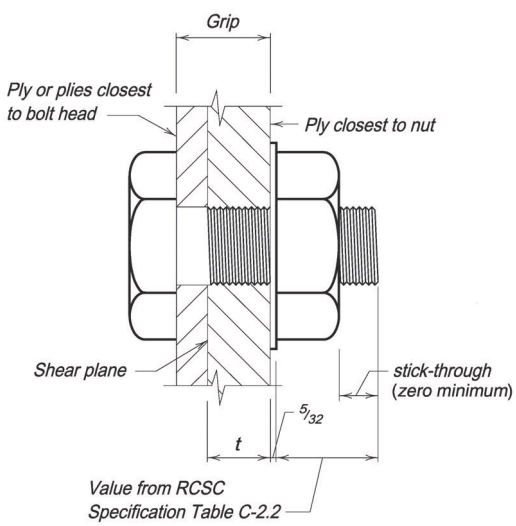

Figure 1. Bolt threads are excluded from the shear plane in this illustration.

2 Bolt Bearing

Specification Section J3.10

$R_n = 1.2 L_c t F_u \le 2.4 d t F_u$ (J3-6a)

or

$R_n = 1.5 L_c t F_u \le 3.0 d t F_u$ (J3-6b) $\phi = 0.75$ (LRFD)
$\Omega = 2.00$ (ASD)

Additional References

Bearing strength based on bolt spacing (Gr. 50 and 36): *Manual* Table 7-5

Bearing strength based on edge distance (Gr. 50 and 36): *Manual* Table 7-6

Bolts bear both on the structural member and any connection material (angles, plates, etc.). Hence, the equations in Section J3.10 must be checked for both of these situations. The nominal strength equations evaluate bearing strength based on both edge distance and the deformation of a hole edge. The lesser of these values will control your design. The edge distance value in the equation can be either the clear distance between adjacent bolt holes or between a bolt hole and the material edge.

Section J3.10 (a) gives two equations for the nominal strength of bolts bearing against the connection material. Equation J3-6a uses a factor of

Erika Winters-Downey is an AISC regional engineer based in Kansas City.

2.4 and applies when "deformation at the bolt hole at service load is a design consideration," and equation J3-6b uses a factor of 3.0 and applies when "deformation at the bolt hole is not a consideration." How does the designer know if deformation at bolt holes is of concern? The answer to this question is linked to the development of the equations themselves. The $3.0dtF_u$ expression is the original equation that was developed when rupture limit states and deformation were first investigated. While this limit state is correct, it was found that extensive deformation will occur before it is reached. The 2.4 factor came about as a means to limit deformation when necessary. The Commentary to the *Specification* does note that hole elongation of ¼ in. or more will likely be observed when the applied force is greater than $2.4dtF_u$. It is up to the design engineer to evaluate whether this amount of hole deformation would be detrimental to the structure or connection designs.

Tables 7-5 and 7-6 in the *Manual* ("Available Bearing Strength at Bolt Holes Based on Bolt Spacing and Based on Edge Distance") are based upon equation J3-6a.

3 Shear Yield

Specification Section J4.2

$R_n = 0.60F_yA_g$ (J4-3) $\phi = 1.0$ (LRFD) $\Omega = 1.50$ (ASD)

This limit state is fairly straightforward. On a given shear plane, the shear yield strength of the gross section of the material must be greater than the applied load. This limit state applies to both bolted and welded connections. However, it is worth discussing the resistance factors and safety factors for LRFD and ASD as they apply to this limit state in the 2005 specification. For LRFD the resistance factor, ϕ, is 1.0. Previous editions of LRFD used a resistance factor of 0.9. This is one area of the 2005 specification where LRFD has been altered to conform to prior editions of ASD. One of the fundamental relationships in the 2005 specification between ASD and LRFD is that $\phi = 1.5/\Omega$ (Ω is the safety factor for ASD design). Previous editions of the ASD specification were written so that the safety factor for this limit state was 1.5. When LRFD was written, the resistance factor of 0.9 caused the equivalent safety factor of this limit state to increase to 1.67. The Commentary notes that this increase of about 10% in LRFD values was over-conservative and is supported by considerable historic evidence of the satisfactory performance of traditional ASD-designed connections.

It should also be noted that the area A_g is measured on the critical shear plane of the member or connecting element. It is not necessarily the cross-sectional area, A, of the member as located in the section properties tables in part 1 of the *Manual*. On a wide-flange section the area A_g, as it applies to shear yield, is the web area only and not the entire cross-section.

Shear yield should also be evaluated on the main supported member, particularly if its top and/or bottom flanges are coped in the connection region.

4 Shear Rupture

Specification Section J4.2

$R_n = 0.6F_uA_{nv}$ (J4-4) $\phi = 0.75$ (LRFD) $\Omega = 2.00$ (ASD)

Shear rupture occurs on the net section, as opposed to shear yield, which occurs on the gross section. Consider the typical stress-strain curve for steel. The shear yielding limit state occurs when the material stress advances past the elastic region. Advance further along the curve, and there is a point after strain hardening where the material will rupture. This is the point where shear rupture occurs. On the gross section, the limit state of shear yield will always be reached before the limit state of shear rupture. However, connections tend to have features (such as bolt holes) that constrain yielding and cause localized stress concentrations. Because of this, rupture may occur on the net section before gross yielding can occur away from the net section.

Hang-ups in applying equation J4-4 usually come into play when calculating the net area of the cross-section, A_{nv}. The proper cross section to use in calculating this area is one cut through the element in the direction of the applied shear force. When subtracting area due to bolt holes, an extra 1/16 in. is added to the hole size dimension per *Specification* Section B3.13(b). This is in addition to the bolt hole being larger than the bolt diameter. For standard holes, this results in the area subtracted for bolt holes being ⅛ in. larger than the bolt diameter. See RCSC specification Table 3.1 for bolt hole sizes. This extra area is taken into account in Table 9-1, "Reduction in Area for Holes." These hole reductions have

also been applied in Tables in Part 10 of the *Manual*.

5 Block Shear Rupture

Specification Section J4.3

$R_n = 0.6F_uA_{nv} + U_{bs}F_uA_{nt}$
$\leq 0.6F_yA_{gv} + U_{bs}F_uA_{nt}$ (J4-5)

$\phi = 0.75$ (LRFD)
$\Omega = 2.00$(ASD)

Additional References
Manual Table 9-3

Block shear is the tearing out of a block of material at a connection as shown in Figure 2. Numerically, it is the sum of shear yield or shear rupture on a failure path parallel to the load and tension rupture perpendicular to the load. It most often applies on coped beam sections, gusset plates, and angle legs. It also is applicable to the perimeter of welded connections, such as an angle welded to a gusset plate. Calculations have been simplified in the 2005 specification.

The specification can be read as:

R_n = Shear Rupture + Tension Rupture
$\leq$ Shear Yield + Tension Rupture

U_{bs} in equation J4-5 is either 1 or 0.5.

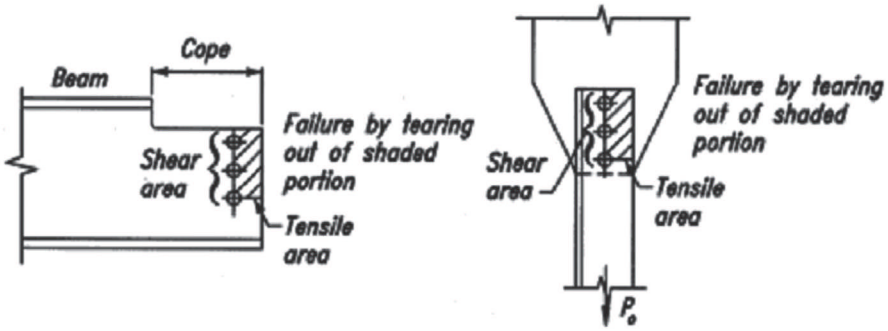

Figure 2. Typical block shear failure paths from AISC *Specification* Commentary.

Cases where 0.5 is applicable are illustrated in the Commentary. *Manual* Tables 9-3a, b, and c list reduced nominal load capacities for tension rupture, shear yield, and shear rupture components of the equation respectively. They are shown for ASD and LRFD and grade 36 or 50 steel. It is easier than ever to evaluate block shear!

6 Fillet Welds in Shear

Specification Section J2.4

Weld Metal: $R_n = F_wA_w$ (J2-3)
ϕ=0.75(LRFD) Ω=2.00(ASD)

Additional References:
Weld strength Table J2.5
Minimum fillet weld sizes Table J 2.4

Weld strength is determined using the strength level of the electrode and the length, orientation, and effective throat of the weld. Electrodes with F_{exx} = 70ksi are the most common. Eccentrically loaded welds can be analyzed using the Instantaneous Center of Rotation Method or the Elastic Method. See Manual Part 8 for how to apply these methods.

Welds are only permitted to share load with bolts in shear connections when the bolt holes are standard or short-slotted and

the slots are transverse to the direction of the load. The strength of the bolts in the connection is then limited to 50% of the available bearing strength of the bolted connection. See *Specification* Section J1.8 for more information.

Minimum sizes of fillet welds and partial-joint penetration welds are given in Tables J2.3 and 2.4 in the Specification and are based on the thickness of the thinner part joined. This is a change from previous editions of the *Specification*, in which minimum weld sizes were based off the thicker part joined.

7 Base Metal at Welds

Specification Section J2.4

Base Metal: $R_n = F_{BM}A_{BM}$ (J2-4)

$\phi = 0.75$ (LRFD)

$\Omega = 2.00$ (ASD)

Additional References

Weld strength, Table J2.5

Minimum fillet weld sizes, Table J2.4

The nominal strength of a welded connection is the lower value between the strength of the base metal at the weld and the weld itself. The base metal must be checked for the limit states of shear yield and/or shear rupture. Table J2.4 gives minimum thicknesses for base metal at welds. This assures that the shear rupture strength of the base metal will match the shear rupture strength of the weld.

In Conclusion

There are limit states outside the scope of this article, such as coped beam limits states, prying action, and local buckling. These are addressed in detail in Parts 7 (Bolts), 8 (Welds), and 9 (Connection Elements) in the *Manual*.

As a summary, I have included two tables detailing limit states to be checked for various connection configurations. These tables follow the connections outlined in Part 10 of the *Manual*. I hope you find this helpful in your design! MSC

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LIMIT STATES FOR SEATED CONNECTIONS

	Unstiffened Seated Connection (Welded)	Unstiffened Seated Connection (Bolted)	Stiffened Seat (Welded)	Stiffened Seat (Bolted)
Table in *Manual*	10-6	10-5	10-8	10-7
BOLTS				
shear rupture (slip for SC) eccentricity not considered unless noted		X		X
CONNECTION MATERIAL (ANGLES OR PLATES)				
bolt bearing		X		X
shear yielding	X, 8	X, 8	X, 9	
shear rupture			X, 10	
flexural yielding	X, 8	X, 8		
end bearing			X	X
WELDS				
shear strength	X, 4		X, 4	
BEAM WEB				
web local yield	X	X	X	X
web local cripling	X	X	X	X
SUPPORTING ELEMENT				
bolt bearing		X		X
shear rupture at weld, 5	X,4		X	
punching shear			X	

LIMIT STATES FOR CONVENTIONAL SHEAR CONNECTIONS

	Double Angle (All-Bolted)	Single Angle (All-Bolted)	Double Angle (Bolted-Welded) welded to beam	Double Angle (Bolted-Welded) welded to support	Single Angle (Bolted-Welded) welded to support	Double Angle (All-Welded)	Shear End Plate (Welded-Bolted)	Conventional Single Plate
Table in *Manual*	10-1	10-10	10-2 10-1	10-2 10-1	10-11 10-10	10-3	10-4	10-9
BOLTS								
shear rupture (slip for SC) eccentricity not considered unless noted	X	X, 11	X	X	X, 11		X	X, 13
CONNECTION MATERIAL (ANGLES OR PLATES)								
bolt bearing	X	X	X	X	X		X	X
shear yielding	X	X	X, 6	X, 6	X, 6	X, 6	X	X
shear rupture	X	X	X, 6	X, 6	X, 6	X, 6	X	X
block shear rupture	X	X	X	X	X		X	X
flexural yielding		X, 11			X, 11			
flexural rupture		X, 11						
WELDS								
shear strength			X, 3	X, 4	X, 3	X, 3	X	X, 7
BEAM WEB								
bolt bearing	X	X		X	X			X
block yield rupture	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2		X, 1, 2
shear yielding	X, 2	X, 2	X, 2	X, 2	X, 2	X, 2		X, 2
shear rupture	X, 2	X, 2		X, 2	X, 2			X, 2
flexural yielding	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2, 12	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2
local buckling	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2	X, 1, 2
shear rupture at weld, 5			X			X	X	
SUPPORTING ELEMENT								
bolt bearing	X	X	X				X	
shear rupture at weld, 5				X	X	X		X

NOTES FOR BOTH TABLES

1. Required with top cope only.
2. Required with top and bottom cope.
3. Instantaneous center of rotation method to account for eccentricity.
4. Elastic method to account for eccentricity.
5. See "Connecting Element Rupture Strength at Welds" in Part 9 of the *Steel Construction Manual* (usually indicated by a minimum thickness required in the tables).
6. Minimum thickness of angle is required to handle these requirements, based on weld thickness. See *Manual* Part 10.
7. Minimum weld size, $^5/_8 t_p$, required for weld to match plate strength.
8. On outstanding leg of angle.
9. Limit state addressed by having a minimum thickness of the stiffener equal to the beam web thickness multiplied by the ratio of the F_y of the beam material to the F_y of the stiffener material.
10. Limit state addressed by having a minimum thickness of the stiffener equal to $2w$ for stiffener material with F_y = 36 ksi or $1.5w$ for stiffener material with F_y = 50 ksi.
11. Eccentricity of the load to the bolt group is always considered in the angle leg attached to the support. Eccentricity should be considered in the case of a double vertical row of bolts through the web of the supported beam or if the eccentricity exceeds 3 in.
12. Required with bottom cope only.
13. The requirement for eccentricity is based on the number of bolts in the row.

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READING THE TEA LEAVES

While the long-term future of steel availabilty is unclear, and regardless of the construction market, it appears that availability will increase in 2008 from 2007.

BY JOHN P. CROSS, P.E.

WHAT WILL THE FUTURE HOLD for the structural steel industry? Will steel be readily available for construction projects in 2008 and beyond? Will fabricators be working at levels approaching the capacity of their shops? What cost trends will impact the project level costs of structural steel?

These questions and similar ones quickly gain the attention of decision-makers both inside and outside of the structural steel industry. Regretfully, there is no absolute answer to what trends will impact the structural steel industry and, by extension, projects that use structural steel. But while a guaranteed view of the future does not exist, it is possible to examine current trends and external economic factors to come to a better understanding of what *may* be occurring in the future.

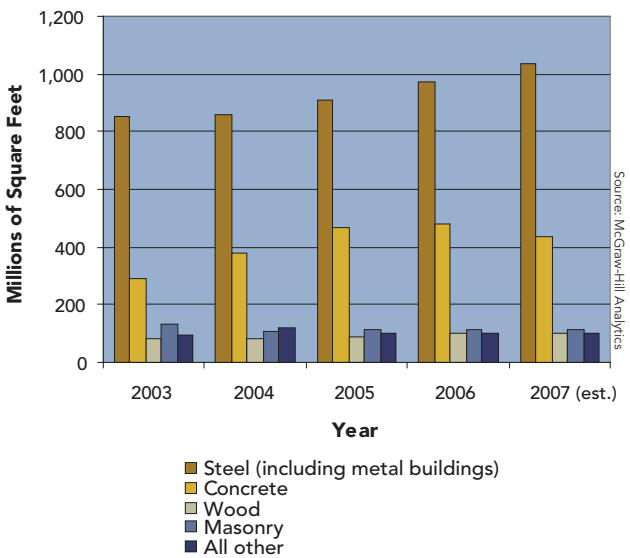
The goal of this new column is to provide information on some of the "tea leaves" that can give an indication of what the future may hold, a future that looks very positive with respect to both steel demand and supply. But to understand that future it is necessary to understand the dynamics of the structural steel market.

The Supply Chain

The structural steel industry in the United States annually supplies fabricated and erected structural steel framing to more than 50,000 buildings through a network of producers, service centers, steel fabricators, and erectors. Non-residential building construction accounts for 50% of the demand for structural steel. The other 50% is comprised of residential buildings greater than four stories in height (15%); non-building structures, which include open-air stadiums, power plants, process and petrochemical facilities, and bridges (15%); and non-structural uses such as rack systems, mobile homes, trailers, and marine applications (20%).

Each step of the supply chain for structural steel is impacted by two factors: the size of the construction marketplace and the percentage of structures utilizing structural steel frames. The prime market for structural steel (non-residential and multi-story residential construction) has grown by 15% since 2004, and the marketshare of structural steel has grown from 50% to 54%. The combined impact of these two trends has increased the prime market demand for structural steel by 21%. At the same time, significant growth has occurred in the non-building marketplace, resulting in an overall increase in product demand of 25% to nearly 8 million tons of structural steel.

Framing Material Utilization



Material Demand

The demand for framing materials, measured by square footage of prime market construction, is illustrated in the figure below. It is important to note that structural steel holds a nearly two-to-one advantage in framing system selection compared to concrete. The implication of this market dominance by steel is that for each percentage point of growth or shrinkage in the prime market, the demand for structural steel changes significantly by 50,000 tons. Similarly, a 1% change in marketshare in a constant market the size

John Cross is AISC's vice president of marketing.

of 2007's will be reflected in a change of 100,000 tons of structural steel on an annual basis.

Construction economists differ on their assessment of the size of the non-residential and multi-story residential building markets for 2008, with predictions varying from slight growth to a moderate decline in square feet constructed. In looking at the projections it is important to distinguish between dollar volume projections and square footage projections. While dollar volume projections provide both revenue expectations and correlation to other economic trends, square footage projections provide a more meaningful measure of the demand for structural steel tonnage. The most optimistic forecast for 2008 is a 4% growth in construction starts, which would generate an increased demand of 200,000 tons for structural steel, while the most pessimistic forecast is for a 6% decrease in market size, lowering demand for structural steel by 300,000 tons.

Service centers that handle 70% of the structural steel product in the U.S. are currently holding just under three months of supply in inventory.

The U.S. structural steel supply chain is certainly capable of adjusting to either an increase or decrease in overall market demand. Demand for product is felt most directly at the producer level, where domestic capacity is scheduled to increase by nearly one million tons in 2008. Service centers that handle 70% of the structural steel product in the U.S. are currently holding just under three months of supply in inventory. This inventory acts as a shock absorber leveling out any unexpected peaks in demand for structural product. An increased number of fabricators and erectors are currently indicating an increase in available shop hours.

So what's the bottom line? While the overall direction of the construction marketplace in 2008 is unclear, availability of structural steel will improve as compared to 2007. MSC

Next edition: The Cost Dynamic.

CONSTRUCTABILITY – NOW MORE THAN EVER!

Applying the philosophy of constructability into your projects will garner numerous benefits.

BY DAVID I. RUBY, P.E., S.E.

DO YOU EVER ASK YOURSELF, "Why did I choose this industry?" Your answer is probably similar to others reading this magazine. Perhaps as a child, you enjoyed erector sets and taking your mother's toaster apart. Perhaps you loved going to the steel mill with your father and couldn't imagine not being involved with an industry that built such important structures.

For me, it was growing up in a small town outside of Pittsburgh, surrounded by what, at the time, was a thriving U.S. steel industry. Upon graduation from high school, I began my career as a steel detailer, where I learned the importance of accurate and coordinated details and began developing a passion for constructability as a design philosophy.

con·struc·ta·bi·li·ty
\kən-ˈstrək-tə-ˈbi-lə-tē\ *philosophy*

The integration of construction knowledge and experience in planning, design, procurement, and construction of the project consistent with overall project objectives.

Constructability

Constructability provides all the elements that attract designers and constructors to the industry; that feed our desire to create and build; that fuel our excitement and generate enthusiasm in our daily lives; that engage us in developing solutions for those nearly impossible situations; and that allow us to express our dedication to the safety and welfare of the public. In short, constructability facilitates the desire to be creative, to help mankind, and to leave the world a better place.

My construction knowledge and experience, the root of my constructability philosophy, were gained through hands-on experience as an engineer for the American Bridge Division of U.S. Steel Corporation. During my 10-plus years at AB, I was immersed in and exposed to all aspects of the steel industry: shop detail drawing preparation, connection design, fabrication procedure development, weld design and quality, erection stability analysis, and procedure development. I developed shop fabrication procedures and assisted shop personnel in preparing quality control procedures. And I often discussed installation and rigging concepts with ironworkers at jobsites on a variety of projects such as the New York World's Fair Unisphere, the Tagus River Bridge in Portugal, the Astoria-Megler Bridge in Oregon, San Francisco's Embarcadero Hyatt Hotel, and the Aon Center, John Hancock Building, and Sears Tower in Chicago, to name a few.

While thus engaged, I developed an understanding of structural steel as a building material, as well as an appreciation and respect for the tradesmen and their skills. I became familiar with the equipment used in the steel construction process and expanded my grasp of site constraints and limitations and their impact on that process. Following my career at AB, I served as the chief structural engineer for John Portman & Associates in Atlanta, where I honed my design philosophy by focusing on structural framing concepts that could be built effectively and efficiently. All of this experience, along with seven more years serving as the director of engineering for a design-build contractor, enabled me to begin my own structural consulting firm and put this knowledge and experience into practice.

While many design professionals may know what makes a project "constructable," additional benefits can almost always be derived from the involvement of an industry professional. The constructability design philosophy, when incorporated into the planning and conceptual stages of a project, provides for a more informed decision-making process based upon up-to-date costs, material availability, framing options, and other value-engineered solutions. In addition, design document reviews, subcontractor qualifications, site constraints, weather impact, and schedule concerns can be evaluated earlier in the process when construction-related options and alternatives are included in the decision matrix.

While constructability is typically associated with reviewing design documents only when budget issues surface, this is just the tip of the iceberg; oftentimes, such reviews are performed too late in the process to realize real benefits to clients, consultants, and contractors.

Sophisticated facility owners, having benefited from constructability reviews in the past, are now beginning to realize the need for constructability within the design and construction process—and not just as it relates to money. These owners recognize that construction

David I. Ruby is the chairman and founding principal of Ruby & Associates, Inc. in Farmington Hills, Mich.

knowledge included within the design matrix, even at higher initial design costs, makes for drastically reduced schedules, lower construction costs, fewer change orders, and lower facility maintenance costs.

Constructability as a design philosophy promises the following:

- ➜ Construction knowledge and experience will be infused into the design from initial planning through construction.
- ➜ Design and construction teams should be integrated if you want to achieve the most effective design.
- ➜ Enhanced cooperation, reduced costs, an improved schedule, and minimal litigation.
- ➜ A finished facility that exceeds owner expectations.

Used optimally, the constructability design process allows the design team to visualize the construction of a project prior to beginning the actual design, and to maintain that vision throughout the process. This approach maximizes simplicity, economy, and speed of construction while considering such project-specific factors as site conditions, code restrictions, and owner requirements. Beginning in the planning process, maturing during the conceptual design stage, and continuing through final design, the constructability design process links project planning with design and construction.

Remember: Constructability is a design philosophy, not a single, one-time event. It is a philosophy that incorporates the following into the design delivery process:

Visualization of clients wants and needs; of the architectural program, including M/E/P sytems; and of structural options, alternatives, and installation considerations.

Innovation/imagination, resulting in a clear, concise project vision of concept, attributes, and constraints; and clean-slate concept development with designers who actively seek and incorporate construction input.

Collaboration/coordination between designers and constructors, as well as designers and construction trades.

Maintenance, because those involved remain focused on the vision through collaboration and coordination.

Enter BIM

With the advent of BIM, constructability has become that much more critical. BIM is not just a combination of design technologies that represent every building component in a virtual environment, nor is it merely a 3D rendering of a building. Rather, BIM is a radical departure from the traditional design delivery process. BIM, as a delivery process, provides the construction community a complete 3D database that can be downloaded for estimating, scheduling, detailing, advance bill production, automated shop drawing, and construction planning for all of the trades. In short, BIM is a means to communicate a complete project delivery concept developed with constructability as the design philosophy.

While constructability is the philosophy that allows everyone on the design team to participate throughout the process, BIM is the tool that provides the means to communicate the results of our cooperative and collaborative efforts. Through the combination of the two, the construction process can be visualized and coordinated. Constructability, when introduced into the design process, provides the information necessary to achieve the early definition of the structural system. Such an infusion of construction knowledge allows for the initial coordination with other materials, earlier and more accurate estimates of cost, refined schedules, and the development of necessary sections and details.

Such a collaborative interface between design and industry professionals greatly increases efficiency and quality. And although traditional roles will continue to exist, constructability-enhanced BIM will begin to blur the relationships between designers and constructors, as constructors become active members of the design team engaged in the collaborative development of the final solution.

Practical Application

Ultimately, this marriage of concept and technology seeks to integrate the design and construction process and reap the benefits of collaboration. These benefits aren't too shabby: Research from the Construction Industry Institute indicates that cost reductions of at least 6% and as high as 23% are possible, with benefit/cost ratios as high as ten to one.

But how can we, the design professionals, best achieve these results? How can we improve the process? How can we infuse construction knowledge and experience into our design process? How can we begin to fully understand the steel construction industry and how our design decisions impact it?

For starters, we can become more active within industry organizations such as, AISC, ACI, PCI, and others. We can attend industry conferences, such as the North American Steel Construction Conference, and better utilize the resources available to us. We can explore innovative ideas with industry professionals on how to gain the advantages of steel-framed construction or how to successfully develop a composite construction option on our next project. We can explore how other design professionals, owners, and general contractors have successfully incorporated constructability on similar projects, saving time and money. We can become knowledgeable about the relative costs of various materials or framing options and the benefits and advantages of using various materials.

We can also develop a relationship with a structural steel industry professional. Invite an industry professional to your office. Include them in your project discussions, openly discuss the design criteria, brainstorm framing options, review the project construction constraints, and explore framing alternatives and connection options. In addition, visit fabrication shops and jobsites. Watch the activities, including receiving, fabricating, cleaning, painting, loading and unloading, lifting and setting, and finally, bolting and welding. Ask questions about the process, about connections, about good and bad details, and about fab shop "do's and don'ts."

Finally, consider utilizing CIS/2 interoperability on your next project. Contact a local fabricator and explore the options available through the transfer of your 3D design model to the fabricator's shop detailing program. Consider reviewing the design via computer, without the traditional submittal of countless shop drawings. In doing so, you will be able to identify and confirm the critical connections and members on the screen, rotate the model, view the members and their connections, visually confirm that the connections meet the project design requirements, verify the main material sizing, and make any necessary notations or comments on the screen before the fabrication process.

Through this process you will be able to respond faster, reduce cost, save time, and improve communication. In addition, your visualization of the structure will be enhanced. This will prompt constructability issues to surface, and their solutions will improve and enhance your final product: the client's building. MSC

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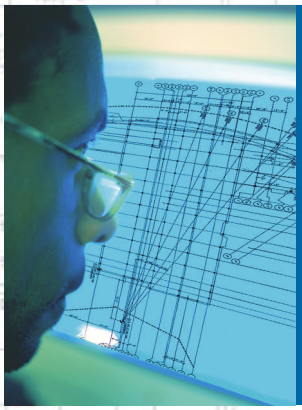

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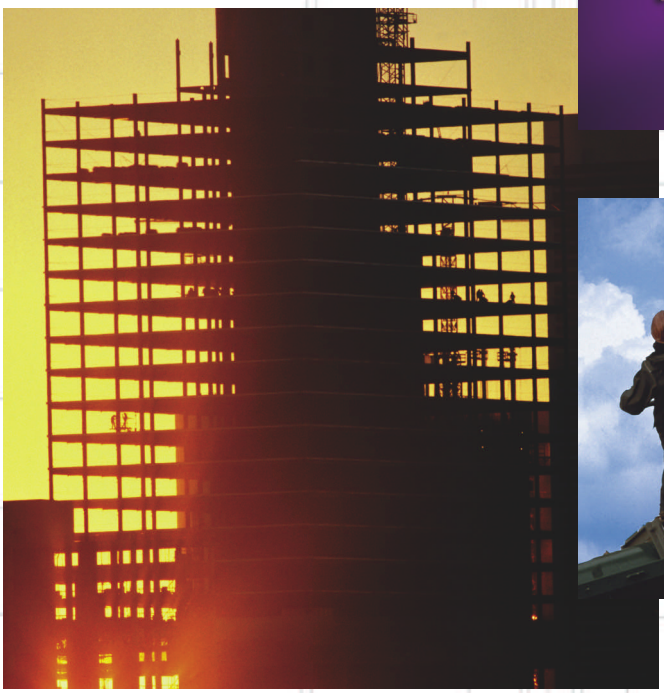

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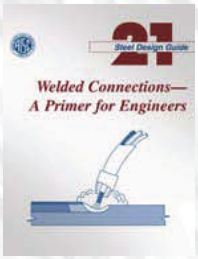

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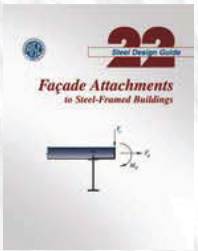
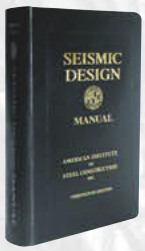


Façade Attachments to Steel Frames

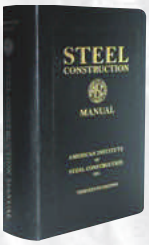
Perhaps the most complicated details in a building occur where the façade and structural frame meet. The details of this interface have a significant impact on the cost of the project. The performance issues that affect the façade attachment details include: proper support of the façade elements, structural anchorage to the frame, relative movements, fire protection, waterproofing, thermal and moisture migration, air infiltration, and sound transmission. Just as these details need to integrate performance issues, the design team needs to coordinate responsibilities between the architect, base building engineer, façade engineer, general contractor, steel fabricator, steel erector, and façade subcontractors.



AISC Seismic Provisions/Manual

AISC Seismic Design – Updates and Resources for the 21st Century

Structural engineers across the country have appealed to AISC for good resources and continuing education seminars on seismic design. In response, Thomas Sabol, Ph.D. – referencing AISC's extensive seismic design resources – has developed a seminar to meet those needs. If you are a practicing structural engineer looking to increase your knowledge of seismic design of structural steel – make sure you attend this seminar!



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Register online at www.aisc.org/2008seminars

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Façade Attachments Seminar

- ☐ 2/6 Charlotte, NC
- ☐ 2/7 Dallas, TX
- ☐ 3/5 Oklahoma City, OK
- ☐ 3/6 Atlanta, GA
- ☐ 3/11 Cincinnati, OH
- ☐ 3/12 Miami, FL
- ☐ 4/22 San Francisco, CA
- ☐ 4/23 Seattle, WA
- ☐ 5/20 Detroit, MI
- ☐ 5/21 Chicago, IL

Specification/Manual Seminar

- ☐ 3/4 Pasadena, CA
- ☐ 3/6 Sacramento, CA

Seismic Provisions/ Manual Seminar

- ☐ 2/5 Springfield, IL
- ☐ 2/7 Batavia, NY
- ☐ 2/26 Greensboro, NC
- ☐ 2/28 Dallas, TX
- ☐ 3/18 Columbus, OH
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NEW Listen to the Steel - Welding Seminar

- ☐ 4/15 Houston, TX
- ☐ 4/17 Denver, CO
- ☐ 5/6 Portland, OR
- ☐ 5/8 San Francisco, CA
- ☐ 6/3 Bozeman, MT
- ☐ 8/7 Anchorage, AK

NEW Building Design Seminar

- ☐ 4/15 Kansas City, KS
- ☐ 4/16 New York City, NY
- ☐ 4/17 Harrisburg, PA
- ☐ 4/17 Memphis, TN
- ☐ 4/29 Houston, TX
- ☐ 5/1 Atlanta, GA
- ☐ 5/6 Richmond, VA
- ☐ 5/6 Milwaukee, WI
- ☐ 5/8 Des Moines, IA
- ☐ 5/8 Charlotte, NC
- ☐ 5/14 Providence, RI
- ☐ 5/15 Portland, ME
- ☐ 5/20 San Jose, CA
- ☐ 5/20 Tampa, FL
- ☐ 5/22 Phoenix, AZ
- ☐ 5/22 Baltimore, MD
- ☐ 5/29 St. Louis, MO
- ☐ 6/3 Omaha, NE
- ☐ 6/5 Hartford, CT
- ☐ 6/10 Manchester, NH

www.aisc.org/seminars

LEADERSHIP TRAITS: A TOP 10 LIST FOR SELECTIVE INTERVIEWING

Look for these traits when interviewing potential employees. After all, they are tomorrow's leaders of your firm.

BY LORI OAKES-COYNE

MY DAD ALWAYS SAID that there are two kinds of people in this world: leaders and followers. In order to successfully develop strong leadership at your firm, you need to start at the beginning: When hiring, screen carefully for natural leaders. These are the take-charge people with lots of ideas who often think creatively. Look for these traits even when hiring junior or technical staff; they're tomorrow's leaders.

Here are some traits to look for when interviewing:

Taking charge. The ability to take charge and lead teams and projects is essential to your business. Look for evidence of taking charge in business as well as non-business situations. In school, was your candidate in student government, head of a musical group, or a resident assistant or teaching assistant? In business, I am always impressed with people who seem to have held more responsibility than typical for their years of experience. For example, look again if your prospect is only four years out of school but held the role of project manager in their last job. Someone else noticed their leadership skills, and so should you.

Academic leadership. People who work hard in school are the kind of people who are likely to work hard in the workplace. Take notice of academic achievement and think twice about mediocre performance. When I first interviewed with Mark Zweig, I was 12 years out of college, yet I remember him asking about my SAT scores, GPA, and GRE scores. And I remembered them all without hesitation because I worked hard to achieve them. I realize people test differently and people can change, but in all my experience with hiring, academic achievers have never let me down.

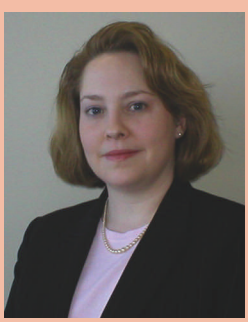
Work ethic. I'm all for work-life balance, and firms need to be cognizant of not overworking and burning out their employees, but a solid work ethic is really about the ability to be effective and productive while working. One way I like to evaluate recent grads on work ethic is to inquire how they paid for school. I am satisfied if I hear about summer jobs, work-study financial aid positions, and late nights of babysitting. For more experienced people, I like to hear stories about getting projects or tasks completed on time and/or under budget, as well as some bragging about utilization or how much overtime they earned.

Entrepreneurialism. If you look to the leadership of your firm, you are likely to observe entrepreneurs in action. These are people who recognize when there is a need or demand and strive to fill it. Whether it's for a gadget that keeps the fizz in your pop or an idea for a new business line, this type of forward-based thinking can be a great asset for any firm. Ask your interviewee if they've ever invented something or had an idea for a new product or service. If their eyes light up, you've got yourself an entrepreneur.

Risk-taking. I'll bet most firm leaders score pretty high on risk tolerance tests. Going into any business, especially one based on results—like consulting—is a risky venture. On the other hand, experience has shown me that the majority of employees at engineering and architecture firms are likely to be fairly risk-averse. You're probably familiar with the recent trend for personality profiling, which gives engineers a way to quantify something intangible, like personality. In the Myers-Briggs system, for example, most A/E/C staff fall squarely in the "ISTJ" profile, which describes an "introverted, detail-oriented, rational-thinking, planning personality." These folks don't generally care for change or risk. Unfortunately, for our businesses to thrive in today's dynamic, competitive marketplace, we need visionaries at the helm who are willing to take chances in order to leap ahead.

Problem-solving. If there's one thing that's true about almost every project in the A/E/C industry, it's that each one has a unique set of requirements and challenges. In order to complete projects successfully, you not only need those people who can apply standard rules, formulas, and models, but also people who can find new and better ways to get them accomplished, preferably methods that are faster and cheaper. Ask your prospects to illustrate how they've solved problems in the past. People and firms whose approaches center on the status quo will soon languish next to their problem-solving competition.

People people. You're not looking for Miss America, but you are looking for employees with a minimum of people skills. Every person in your firm, from the president to a CAD technician, will in one way or another be required to interact with other people internal and external to your firm. Many folks outside of your firm, including regulators, vendors, community members, and clients, will pass judgment on your company based on the interactions they have with your field or administrative staff. So look for people who aren't



Lori Oakes-Coyne is principal in charge of Zweig-White's Human Resources Advisory Services. She can be reached at lcoyne@zweigwhite.com.

painfully shy, who can speak articulately, who make eye contact, and who have basic manners.

Communication. The ability to communicate effectively is the key to success for most things in life: marriage, parenting, and yes, even business. It's not only about the ability to speak fluently, but also includes the capacity to write and listen actively. In fact, listening to the client and adapting your service to their needs is fundamental to consulting. Pose enough open-ended questions to your candidate to have a chance to observe their communication style, and either get writing samples or consider a brief writing test during the interview. And, if they are multilingual and have experience communicating using the most modern technologies, even better.

Career progression. Natural leaders usually demonstrate acceleration in their career progression that outpaces their peers. Even if it's that by the end of the summer, they were responsible for opening or closing the ice cream shop in addition to scooping, they've shown differential leadership. When asking your candidate about their experience in a particular job, be sure to ask them to describe for you how they progressed in that role over time. If they can't describe any advancement, move on to the next candidate.

Adaptability. In consulting, our business must continually respond to changes in the economy, new technologies, and the regulatory environment. And your employees will experience internal change via staff hires and departures, implementation of new procedures, and project turnover. However, most engineers I know strongly prefer the status quo. So when interviewing, ask your prospect to demonstrate some of their experiences with change and how they reacted. Your staff's ability to remain resilient and optimistic in the face of change is critical to your firm's and your staff's success.

This is certainly not an all-inclusive list, but if you consider these traits while conducting your next interview, perhaps you will be more successful at selecting for leadership—and reaffirm my dad's old adage. MSC

This article first appeared in The Zweig Letter, *Issue # 706, originally published April 2, 2007.*

Getting into the Details

EDITED BY GEOFF WEISENBERGER

The detailing industry is facing several challenges, not the least of which is a shortage of qualified detailers at a time when 3D and BIM are becoming the norm. MSC chatted with two detailing software companies about the current state of the industry.

What are some challenges or trends you've noticed in terms of steel detailing software use?

Keyack: The number one challenge is finding or training qualified people for the steel detailing profession. Using Tekla Structures and bringing 3D modeling to the detailing process allows next-generation detailers to visualize and understand how steel goes together much more easily. That next generation is growing up on 3D interactive video game environments. It is how they learn and understand the world around them, so 3D modeling in steel detailing matches the tools they are used to.

In the past, detailing trainees often spent five years before they were proficient enough to do projects on their own. Most of that time was spent learning how to visualize 2D design drawings in 3D in their minds, then transfering that information back to 2D detailing drawings for the shop. With 3D technology, detailing trainees are now able to become productive by themselves in closer to 1-2 years.

Tekla Structures has also created 2D drafter modules of the 3D modeling software to allow the more experienced traditional 2D detailers to comfortably become introduced into the 3D environment. They can visually review things, in 3D, created by other detailing team members, but then they can always reference, mark up, and even be involved in producing 2D shop and erection drawings as well.

Evans: The way in which a project is created, designed, and detailed is continuing to evolve with the help of technology. There is no one right answer to this process, but we do see an irreversible trend toward an environment of more collaboration and cooperation, and a blurring of duties in executing a project. Each organization is unique and the talents and resources they have allow them to be competitive. The most successful organizations encourage pooling their own talents with those of the project partners up front and throughout the project.

What are your thoughts on the switch from 2D to 3D and BIM?

Evans: Steel detailers continue to absorb the bulk of many technology advancements. Last year BIM was a key topic at all association meetings and a main focus for a lot of organizations. To detailers, this means having to create, track, maintain, and provide more information about the steel structure in many more formats than ever before. The 3D model emerged as a unique product in the early 2000s, and now the data associated with the model, along with historical information, is required. The model and project data also needs to be shared with many project partners in various forms. Those companies that adapt and welcome this responsibility will need the expertise on staff to successfully integrate themselves into the BIM movement. While this is more of a challenge, adopting BIM can enable the detailers to become a bigger part of the overall project.

Bottom line, involving steel detailers, fabricators, and erectors in the conceptual detailed design results in projects being completed faster and with higher profits. Organizations will continue to improve their ability to communicate and cooperate

PARTICIPANTS

Doug Evans, Vice President of Sales, Design Data

Chris Keyack, Product Manager for Steel, Tekla

GROCERY SHOPPING IN A FERRARI?

Too often, I see companies that buy our software hoping to make time gains over AutoCAD, and then these gains are not realized because they use 3D and try to emulate their 2D-based procedures.

This isn't a perfect analogy but I liken it to buying a Ferrari and using it to pick up groceries. You can certainly drive it to the grocery store and you will be able to do your shopping slightly quicker, but you will never be getting the full return on your investment because you are not pushing the car to its design limits.

This year, I am setting a personal goal to better educate our prospective customers into the ways of working in 3D/BIM. I'm hoping that as a result, they will be more positive towards our software during what I call the three-month depression (where the ROI isn't being realized because the expertise or experience hasn't been attained yet). Our tech team should see benefits in terms of reduced service calls, and our sales guys won't have to constantly apologize to dissatisfied customers.

—Ian Coats, Product Specialist, Tekla, Inc.

by jointly marketing the benefits of their teamwork to owners. These partnerships will win a majority of the projects.

The days of an organization going solo, without project partners dedicated to cooperating on all phases of a project, are numbered. Those companies not embracing BIM will find it increasingly difficult to compete.

Keyack: The 3D steel detailing model is becoming a deliverable to fabricators and erectors. Not only is it easier for the detailer to visualize the complex geometry and connections of today's projects via a 3D model, it is also beneficial for shop production, project managers, and field superintendents. We are finding that 2D drawings are just one portion of the deliverable. CNC-driven machinery is becoming more powerful and affordable, and feeding these machines with accurate fabrication information as early as possible in the design process is vital to shop production. More and more detailers are being instructed by fabricators to provide CNC files as well as an electronic bill of materials files for shop equipment and material management systems. What may have taken two weeks with shop personnel manually entering data is now being done in a day or two with information being directly downloaded to the CNC machinery from the 3D detailing model.

How is your software improving the workflow of structural steel jobs?

Keyack: We have a variety of fabrication and erection clients that utilize our viewer-only licenses to review the 3D steel detailing model for erectability and even site planning. The project managers and field superintendents can run reports on the number of erection picks in a sequence, generate field point-to-point bolt lists, open

drawings to find extra dimensions they may need in the shop, determine center-of-gravity locations and check weights on assemblies, and visually colorize the different sequences in the project. Some erectors and fabricators are even buying steel detailing licenses to model in job-site equipment like cranes, trucks, generators, temporary shoring, and lay-down areas to be used to communicate with general contractors as well as their own crews.

Additionally, in a changing market where there is more need for bilingual communication, having a 3D representation of what will be built out on the jobsite goes a long way. Traditionally, project managers have three or four different ways to find out out the submittal, production, shipping, or erection status on a project. They look at electronic spreadsheets and accounting reports or call up detailers to get an idea of what percentage of the project is complete. Today, our customers are starting to import or set those statuses directly on the beams and columns in the model so the project manager can visualize that information all in one place.

Evans: With the continued shortage of available quality steel detailers, it is critical that the software used by these individuals provides high productivity. None of the detailing software on the market is close to a finished product that needs no enhancements. This means each new enhancement provides solid productivity gains. Recent features from SDS/2 include the ability to edit multiple members and drawings at one time, grouped member details, automatic connection design to sloping columns, and curved beams. These enhancements, along with many others, allow customers to produce much more in a day, which in turn helps to accomplish projects on time. Many organizations are backlogged, and the more drawings they can produce, the more their profits can increase. MSC

We'd like to hear your thoughts on this article. Post your comments online at ***www.modernsteel.com*** *by clicking "Reader Feedback."*

Looking for a structural steel detailer? A directory of structural steel detailers now appears online at **www.modernsteel.com/products.** Search or browse under "Detailers."

New for 2008!

Just another reminder that MSC's product coverage has been revamped for 2008 to highlight a collection of exciting products each month. In general, these products have been introduced within the past six months. All products submitted are considered for publication, and we encourage submittals related to all segments of the steel industry: engineering, detailing, fabrication, and erection. Submit product information via e-mail to Keith Grubb (**grubb@modernsteel.com**) or Geoff Weisenberger (**weisenberger@modernsteel.com**).

We've also recreated the previous format of the products section online in a searchable database of product producers. You can browse producers by category or search for specific terms to find the products you need. Check it out at **www.modernsteel.com/products**. To be listed in the product directory, e-mail Lou Gurthet (**gurthet@modernsteel.com**). In addition, this online database lists contact information for all AISC-member detailers.

A Winning Combination

The Champion 10,000 welder/generator from Hobart Welding Products offers a two-for-the-price-of-one deal. Every buyer gets a generator and a welder for a price that some people pay for a generator alone. Powered by either a 20-hp OHV, twin-cylinder Kohler engine or a 22-hp OHV Subaru engine, this machine produces 10,000 watts of peak auxiliary power and a 210-amp constant-current DC weld output at 60% duty cycle.

The Champion 10,000 boasts 9,500 watts of continuous power (while not welding) from four 120-V (20-amp) receptacles and one 120/240-V (50-amp) receptacle. All receptacles feature push-button reset circuit breakers. Auxiliary power is not available while welding.

The unit provides excellent starting capabilities for motors in the 3- to 5-hp range. It can run for up to nine hours on one 10-gallon tank of gas under a steady load of 4,000 watts. Unlike competing units, the rheostat does not have to be set to maximum for full auxiliary output.

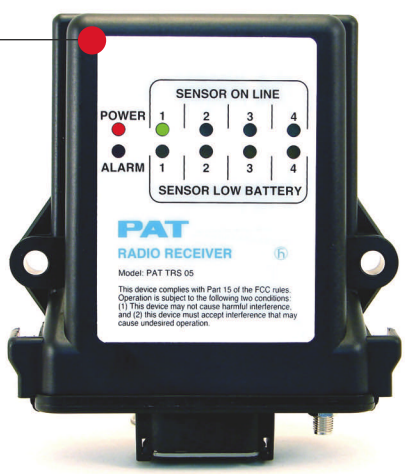
On the welding side, the Champion 10,000 features Hobart's patented Field Current Control (FCC) technology for smooth stick arc starts with minimal sticking of the rod. The FCC monitors feedback from the welding arc and continuously adjusts the current from the generator to maintain optimum arc characteristics.

The Champion 10,000 has a 50- to 230-amp output for welding with 6010, 6011, 6013, and 7018 rods up to $^{3}/_{16}$ in., and 7014 and 7024 rods up to $^{5}/_{32}$ in. The machine is also suitable for general scratch start DC TIG and limited flux-cored welding (CC flux-cored welding only). In addition, it can be used for MIG welding aluminum when paired with the optional Olympic 30A spool gun and HWC-115A weld control.

For more information, visit www.hobartwelders.com or call 877.HOBART1.

Keeping Tabs on Cranes

Hirschmann Automation and Control (PAT) has introduced the TRS 05 wireless system upgrade. The TRS 05 gives crane owners the flexibility to incorporate wireless sensors into existing hardwired systems. The TRS 05 is compatible with most Hirschmann/PAT systems on hydraulic or lattice boom cranes. The module will monitor up to four wireless sensors at one time and utilizes the existing console and hardware. Hirschmann's industry-proven wireless sensors install quickly and easily in the field and have an operating range of up to 1,000 ft. Sensor options include anti-two block, load, angle, and wind speed. Frequency Hopping Spread Spectrum Technology (FHSS) is utilized to ensure accurate and consistent reception of data and provides additional protection against interference common to construction job sites. The TRS 05 contains unique, serialized transmitter identifiers that are used to ensure proper operation when other cranes are working in the area. The TRS 05 is pre-wired for quick and easy installation and is also available with an optional repeater or as a standalone system.



For more information, visit www.hirschmann-usa.com or call 717.217.2216.

Make Cuts More Accurate

Pat Mooney, Inc. – The Saw Company's Pro Pegasus DS Mitre Semi-Automatic Saws include heavy-duty mechanisms for efficient operation. Featuring 1¼-in.-wide saw blades, these precision gear-drive saws provide 40% greater beam strength than saws with 1-in.-wide saw blades; greater beam strength results in faster, more accurate sawing. An electronic display of the cutting angle also enhances precision, as operator set-up errors are eliminated.

The Pro Pegasus performs semi-automatic operations, including positive hydraulic cutting control, hydraulic clamping, and auto return of the saw head after the cutting cycle. Its swivel saw head mitre cuts up to 60° both left and right. This saw head easily rotates via a rack-and-pinion system.

Further contributing to its precise performance are its solidly constructed machine base with locking cabinet, precision carbide blade guides with roller guides, and case-hardened and ground helical gears.

Infinitely variable blade speeds from 50 – 400 FPM are controlled via the saw's inverter. Cutting capacities for the Pro Pegasus DS are 12½ in. by 20 in.

For more information, visit www.patmooneysaws.com or call 800.323.7503.

Precision Lubrication

UNIST, Inc.'s LVSS (low-volume spray system) is designed specifically for metalforming die lubrication. The system provides precision spray to lubricate parts and tooling and addresses those with unique requirements or that need more lube than the coil stock lubrication process provides. The scalable, programmable system allows for complete control of air and fluid applied to metalforming dies. It is also effective in progressive, transfer, and secondary operations.

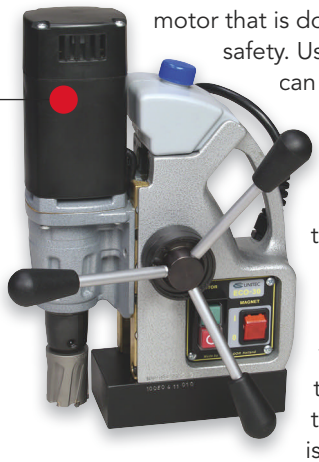
The UNIST SPR 2000 Programmable Lubrication Station is used to control the sequencing, duration, and frequency of nozzle actuation for the LVSS. The system can be programmed with up to 250 job set-ups. Once a setup is entered, it is simply recalled the next time it is needed. Fluid and air volumes are managed using separate needle valves located on the nozzle, providing control to direct the right amount of fluid to the desired surface. When using the LVSS, pressurized fluid is always available at the nozzle assembly, delivering the capability to apply fluids and lubricants in minute quantities at the exact rate and volume required by each job.

The LVSS can stand alone or be integrated with a Uni-Roller coil stock lubrication system, using a single SPR 2000 for both. One controller can operate up to 22 nozzles or a combination of rollers and nozzles. A retrofit kit can be added to SPR 2000 controllers already in service, or the complete system can be ordered from the factory. A UNIST representative should assist you in deciding whether the LVSS, a traditional SPR 2000 system nozzle, or the Uni-Roller is the best choice for your specific application.

For more information, visit www.unist.com or call 800.253.5462.

Drill Without Overheating

CS Unitec's new ECO-30/3P is a portable, compact, and lightweight magnetic drill with a patented power-assist mechanism to reduce both feed pressure and load on the cutter and motor to prevent motor burnout and cutter breakage. This allows the machine to maintain a maximum RPM under full load.



The ECO-30/3P has a strong 7.5-amp/110-volt motor that is double-insulated to increase operator safety. Using annular cutters, the operator can quickly drill up to 1 1/8-in.-diameter holes. Superior holding strength of 3,300 lb is provided by a high-density dual-coil magnet with TEMPTEC technology to ensure that the magnet does not overheat. When the magnet is switched on for long periods of time, the coils can overheat or even burn out. The TEMPTEC feature is standard with this model and reduces the power to the magnet when the drill motor is not active and, therefore, will not build up heat.

This ultra-compact drill is 12¼ in. high with a 2¾-in. stroke and weighs only 22 lb, making it portable and easily transportable between work areas. The unit's standard equipment includes an integrated auto lubrication system, carrying case, chip guard, safety chain, carabin hook, gloves, safety glasses, ear protection, and allen keys.

For more information, visit www.csunitec.com or call 800.700.5919.

ON RECYCLING

Moore

Bill Moore, Vice President, Brandenburg Industrial Service Co., Chicago, one of the largest demolition companies in the U.S. President, National Demolition Association. Degree in Safety, Indiana State University. Spent a decade in insurance and safety specializing in the construction of high-rise buildings, another in demolition safety, and another in marketing for Brandenburg.

CHANGES What you have to keep in mind is that getting rid of waste material is a big expense. The demolition industry is a lot more sophisticated than it used to be. There's new equipment. Government regulations are tighter...and harder to comply with. We've become more involved in recycling than ever before.

PROCESS First thing we do is gut the interior of a building as much as possible and do whatever handwork is needed. We remove all the hazardous materials – mercury bulbs, asbestos, that sort of thing. And if there's office furniture or architectural artifacts, et cetera, left in the building, we'll pull them out and re-sell that too. Then we'll tear out the drywall, glass and wood – basically strip the building down to its structure. Once we're ready to wreck, we use a crane to drop a big machine on the roof to hammer out the concrete floor by floor, crushing it, until we're at ground level.

REALITY We don't necessarily recycle for good "green press" – it's economics pure and simple. Anything we can salvage out of a building, we'll do it because there's a market for it. The more we recycle, the more we salvage and less we landfill, the more competitive we can be for our customers.

DELICATE Brandenburg does much more than complete demolition. One job we did – the Rookery building at the corner of Adams and LaSalle – is the oldest high-rise building in downtown Chicago. It's a landmark, more than 100 years old. So the owner decided that rather than tearing the building down, it should be completely gutted to make way for a modern interior. So we do work like that too.

COSTS If we go to a landfill with a load of concrete, it's going to cost three or four hundred dollars here in Chicago – and probably double that on the East Coast. Landfilling concrete is expensive, so we're always trying to find different things to do with it. We'll crush it, use it to fill basements, try to find other jobs that need fill – we even have portable crushers to make it into CA6-type material for road beds and parking lot bases. Anything to get rid of it.

WORTH Concrete, basically, has no value. Even when we recycle it, we still have the expense of crushing it, which is about 10 to 50 dollars a truckload. While that saves us from having to go to the dump with it, it doesn't have a positive value. You'll never break even. Steel, on the other hand, has always been valuable. And like other commodities, the price varies quite a bit – right now, we're in a very good position when we sell steel.

SHIPPING Let me explain something about the transportation of material. You have a tractor trailer and it weighs about 40,000 pounds. Well, the legal load limit on most highways is 80,000 pounds. So you're going to put 40,000 pounds of material into the back of the truck. It really doesn't matter whether it is filled with steel or concrete because you're not going to load that trailer to water level and still be legal. But because steel is so much lighter and less bulky, you get rid of a greater percentage of material each time you load a truck with steel. To ship material is expensive – you want to do it in the least amount of trips.

PLANNING Building owners and developers need to think about demolition someday – what's going to happen to the material when the building isn't useful anymore? There's a movement by the Green Building Council pushing owners to think about their building when it has to be torn down. If you make a building out of steel, it will always be recyclable. Steel will always have value.

MIXING Try to picture a pot of molten steel, it's kind of like a big pot of stew or soup. When you're cooking and you want to make it spicier, you just put an additive in. But instead of pepper, you might put in more manganese or chrome. That's what's called altering the chemistry of the batch. Basically, if you're making structural steel, the mill will put in a base of reclaimed structural steel – like a recipe. Now if we were making re-bar, the chemistry for that is completely different than structural steel.

STEEL We always factor the scrap price into a project. In fact, there are jobs valuable enough that we will actually pay to do the work just for the scrap material. We're even going back to bids from a year and a half ago where we said we'd wreck the building for a quarter of a million dollars. Now, we're calling them up asking to do the job for free. We might even give them 50 grand or something like that. That's the great thing about steel – it always has value.

ESTIMATOR, PROJECT MANAGER

Adams & Smith, Inc., a General Contractor specializing in steel erection and located in Lindon, Utah is looking for an estimator with fabrication and detailing experience. We are also seeking Project Managers. Degree and/or experience preferred.

Send resumes to:
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Attn: Tracie Greco
1380 W. Center St.
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AISC Engineering & Research Dept.
Staff Engineer

If you are looking for an entry-level position, have good people skills, and like new challenges, AISC has an opportunity available. AISC is now seeking applicants for a Staff Engineer position in the AISC Engineering & Research Dept. This is a unique opportunity to work with issues in structural research as well as steel fabrication. You will work with the top educators in the North American steel design and construction industry and will be in a position to establish yourself as an expert in steel design. The position will allow you to use your technical training to develop and promote research and industry issues that benefit the entire structural engineering community and structural steel industry.

Applicants should have a BS degree, with a structural emphasis, in architectural or civil engineering, and must be qualified to work in the U.S. AISC provides a great working environment offering professional development opportunities and a competitive salary and benefits package.

Send resumes to C. Becker at **becker@aisc.org**.

WHAT I LEARNED ON MY SUMMER VACATION

It's not too early to think about what you'll do on your summer vacation and how the office will survive without you.

BY MICHELLE LABROSSE

IT'S FEBRUARY, a time of year when many of us are already daydreaming about our summer vacation—that is, if we even take vacations at all. As busy as we all are, it's easy to get caught up in work and think that we can't take a vacation. There's too much going on at work. What will my team do while I'm gone? How will this place run without me? The answer to that last question is especially important: If you're a good project manager, your team should be able to run well without you. If they need you there 24/7, then you're doing something wrong.

This was a lesson I experienced a few years ago on my summer vacation when my daughter, our two dogs, and a cat drove together from Connecticut to Florida.

I knew about the trip a few months beforehand, so I spent a month getting ready for it. I delegated responsibilities to key people on my team and set up processes so we could easily keep track of projects. I made sure that my team members created Project Agreements before I got on the road so they had a clear road map for what they needed to accomplish and what the roles and responsibilities of each team member were. Other tools we used were the Wiki so team members could post documents and progress reports, and my blog as a key interactive communication conduit. I posted about where I was and what I was doing, and also about project management. Team members could comment and could also be part of the journey if they wanted to be—a kind of virtual post-card community.

During my sojourn, I also learned some important things about my team. I could clearly see those who could operate independently and accomplish tasks and goals with little oversight, and also those who needed more management. This gave me a lot of insight as a manager and let me know how I could manage my team even more effectively, who needed more coaching from me, and who had the capacity to take on more responsibility.

Michelle LaBrosse, PMP (Project Management Professional, is the founder of Cheetah Learning, a project management training services company. Visit www.cheetahlearning.com to learn more.

Consider the productivity aspects of vacation: According to a survey from Expedia, 33% of employed adults in the United States usually don't use all their vacation time, with the average worker surveyed giving back an average of four days to their employer. This translates to 574 million vacation days per year, worth $75.72 billion.

What that number doesn't capture is the lost productivity from fatigue. We all know that feeling when you haven't had time off in a long time and you are both physically and mentally tired. Your performance suffers, and even worse, I think your passion dwindles.

Passion is rejuvenated from the time that we spend away from our routine. For some people, it is the sound of the ocean that relaxes and soothes. For others, it's a hike in the mountains or in the desert. Vacation is the time when you can find your own "zone," that place where ideas, inspiration, and "Aha!'s" come from.

There's a reason that Thoreau's *Walden* stands the test of time. In it, he captures our relationship with nature and the importance of reflection, and poetically and philosophically explains to us the purpose of getting away from it all:

"Sometimes, in a summer morning, having taken my accustomed bath, I sat in my sunny doorway from sunrise till noon, rapt in a reverie, amidst the pines and hickories and sumacs, in undisturbed solitude and stillness, while the birds sing around or flitted noiseless through the house, until by the sun falling in at my west window, or the noise of some traveler's wagon on the distant highway, I was reminded of the lapse of time. I grew in those seasons like corn in the night, and they were far better than any work of the hands would have been."

If Thoreau were here today, he'd tell you that the only way to grow ideas, people, relationships, or businesses is to take a vacation and find your own private reverie.

As summer approaches (faster than you think), think about your vacation. How can you prepare for it so you can relax and come back to your office rejuvenated and ready to contribute new ideas?

Here's a vacation prep list to help you get the most out of your vacation:

- Review the status of all projects two weeks prior to leaving and delegate responsibility while you are away.
- Create project agreements for any new projects that will be in progress while you are away, and make sure your team is clear on what they should be accomplishing while you are gone.
- Set up clear communication boundaries for your vacation. Can you be reached on your cell phone? If so, is it for emergencies only? Will you be checking your e-mail at all or only at a certain times? Do you only want to be contacted about certain issues? Define these boundaries before you leave so you get some downtime and so your team knows when it is appropriate to contact you.
- Bring your favorite guilty pleasure that has nothing to do with work. Whether it's *Mad* magazine or a romance novel, indulge the part of your brain that may not get to stretch at work.
- Laugh. No matter where your vacation takes you, laugh as much and as hard as you can. Take that laughter yoga class that you've read about or just laugh at life. It reduces stress, lowers your blood pressure, lifts depression, and even boosts your immune system. Laughter is more than funny, it's healthy! Enjoy your vacation. MSC

Have an opinion you'd like to share in "Topping Out"? Send your feedback to Keith Grubb, managing editor for MSC, at grubb@modernsteel.com.

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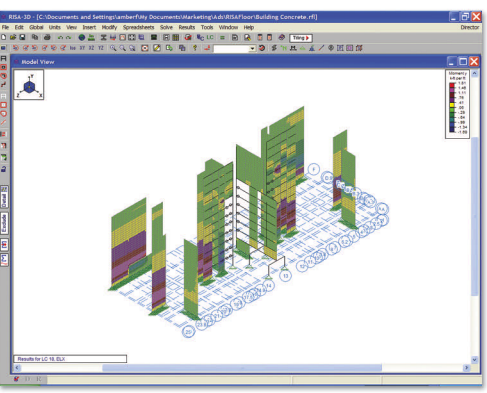

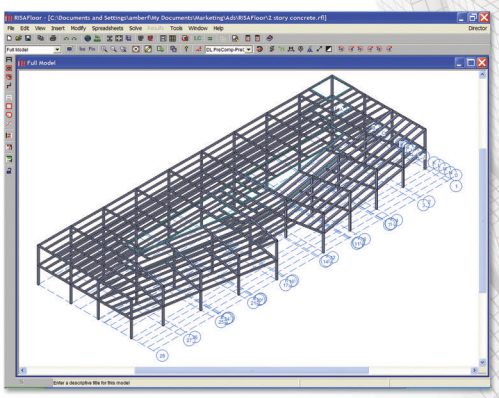

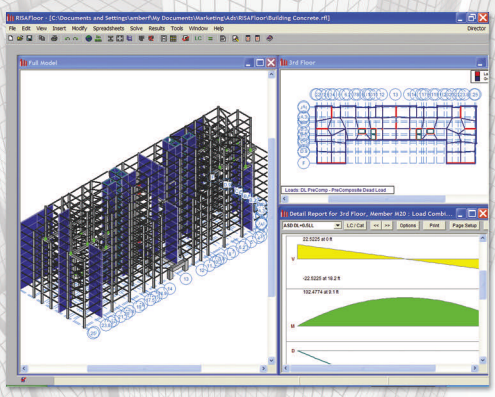

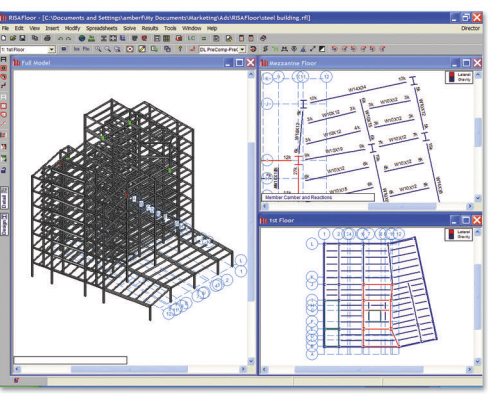

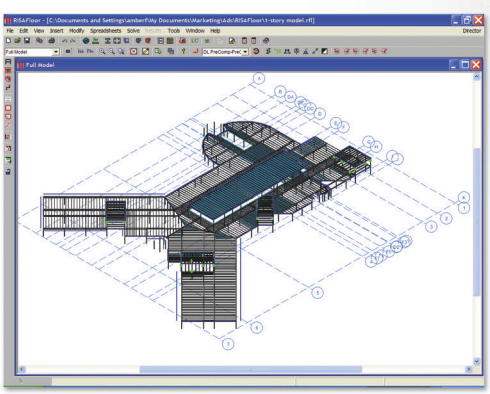

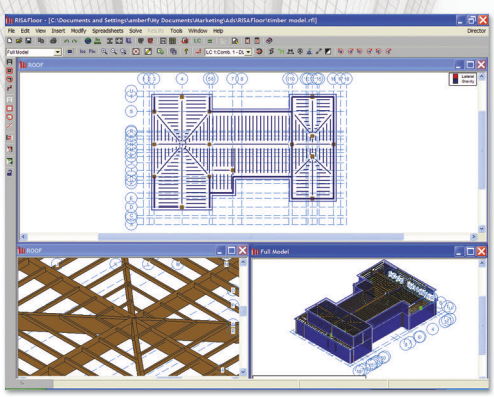

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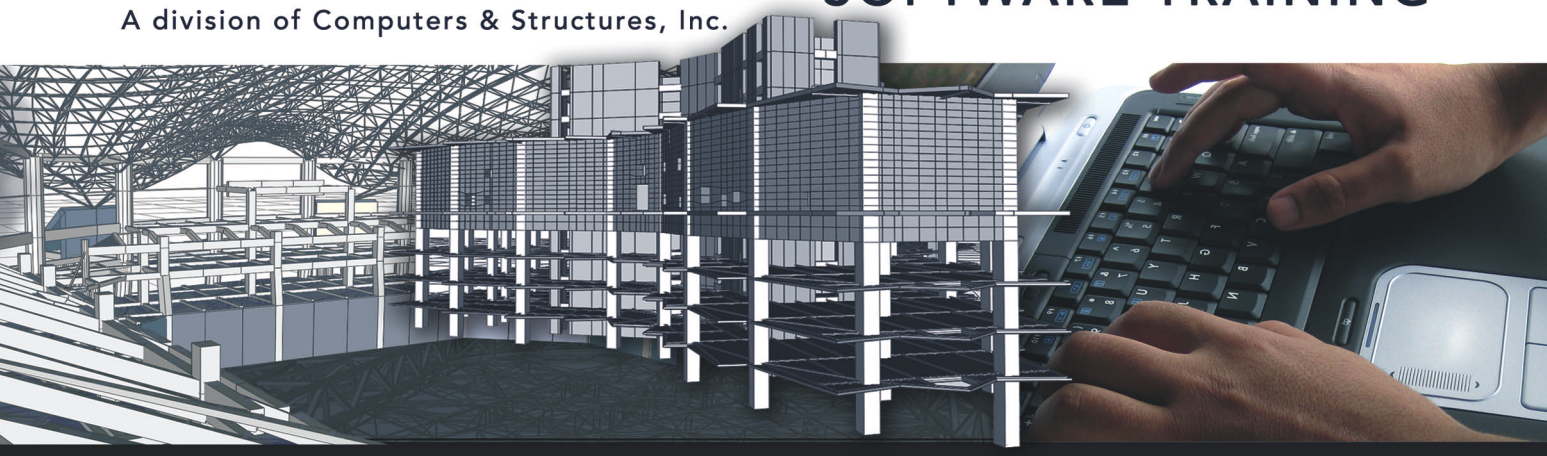

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