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features

24 Inside Job
BY JAMES SAVAGE, SE, PE
If you’re a global architectural and engineering firm, who better than you to design your own new, steel-framed office building?

32 Joist Cause
BY JAMES M. FISHER, PE, PhD
Designing single-story buildings with lateral load-resisting frames using joists and joist girders.

38 Streamlined Design
BY BRIAN VOLPE, SE, PE
There are plenty of design and detail issues that can unnecessarily add cost to structural steel projects. Here’s how to alleviate some of the more common ones.

42 NASCC: The Steel Conference 2020 Exhibitor List

columns

steelwise

16 Dipping Details
BY ALANA FOSSA
A brief look at resources and advice on detailing for hot-dip galvanizing applications.

field notes

20 Longtime Lion
INTERVIEW BY GEOFF WEISENBERGER
Lou Geschwindner has provided plenty of instruction and insight to students and professionals alike in his time as a Penn State professor and a vice president at AISC.

business issues

22 Thoughts on Excellence
BY DAN COUGHLIN
The Actions of Leadership Series, Part 3: Talk about big dreams and little details every day.
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Almost every year there’s a session at NASCC: The Steel Conference that generates heated controversy. This year there are two—and both caught me by surprise.

In the past, we’ve always included a detailing track within the main conference. This year’s conference, scheduled for April 22–24 in Atlanta (visit aiscc.org/nascc for more information and to register), is trying something a little bit new. We’ve worked with the National Institute of Steel Detailing (NISD) to create a full conference-within-a-conference (similar to how the Structural Stability Research Council holds the SSRC Annual Stability Conference each year in conjunction with The Steel Conference). Two of the sessions, “Detailing Contracts with Your Domestic and Offshore Partners—What’s in Yours?” and “Managing Offshore Detailing,” have drummed up controversy.

The gist of the concern about these sessions is the domestic detailing industry is hurting and there’s a declining number of young people entering the profession—so why is AISC promoting foreign detailing?

My response to those voicing this concern has usually included three points.

First, we’re not promoting foreign detailing. Rather, these sessions are designed to help detailers and fabricators deal with the reality of today’s world.

Second, AISC recognizes the issue and has worked with NISD to develop training programs and will continue to do so, especially through groups like the Skilled Trades Coalition.

Third, and more importantly, I ask them if they’ve contacted NISD or if they’ve considered getting involved with NISD. NISD is a volunteer organization dedicated to detailer education, certification, and training. I’ve attended their meetings off-and-on for nearly three decades and as much as I enjoy meeting with longtime friends, I’m also saddened that there aren’t enough new faces.

Depending on the size of your company, membership in NISD costs between $290 and $450—and NISD members get a substantial discount on registration to The Steel Conference, so you can recoup most of your cost almost immediately! And once you join, you should attend their annual spring meeting; it’s held at the Steel Conference on April 21. Join one of their committees (I know their education and certification committees would love to have you!). Get involved. Be part of the solution and help improve the industry.

And if you’re not a detailer, get involved with some other group that interests you—either professionally or personally. I don’t know of any volunteer organization that isn’t desperate for help. If you’re interested in sports, volunteer as a coach or referee (I recommend AYSO for youth soccer, but that’s a topic for another day). Or get involved with local STEM activities.

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If you’ve ever asked yourself “Why?” about something related to structural steel design or construction, Modern Steel's monthly Steel Interchange is for you! Send your questions or comments to solutions@aisc.org.

All mentioned AISC publications, unless noted otherwise, refer to the current version and are available at aisc.org/publications. Modern Steel Construction articles can be found in the Archives section at www.modernsteel.com, and AISC Design Guides are available at aisc.org/dg.

Plumbness and Straightness Tolerance

The general contractor (GC) for a current project has performed a plumbness survey determining that the columns are located at 10-ft intervals. Based on this survey, from top to bottom, the columns are within the overall 1/500 tolerance specified in Section 7.13.1.1 in the AISC Code of Standard Practice for Steel Buildings and Bridges (ANSI/AISC 303) but fall outside of this tolerance at some of the 10-ft intervals that were checked. Does the Code require column plumbness to be checked for tolerance at 10-ft intervals?

No. The GC’s plumbness survey interval check is not a requirement in the Code. Section 7.13 in Code states: “Erection tolerances shall be defined relative to member working points and working lines, which shall be defined as follows: (a) For members other than horizontal members, the member work point shall be the actual center of the member at each end of the shipping piece.”

Section 7.13.1.1 states: “For an individual column shipping piece, the angular variation of the working line from a plumb line shall be equal to or less than 1/500 of the distance between working points...”

The 1/500 tolerance should be checked based on the variation between work points located at the end of each shipping piece. The work points of the column would be located at the base and top of the columns and at the column splice locations, since these locations would define the ends of a shipping piece. If the 10-ft intervals do not match up with the shipping piece ends, then what is being proposed by the GC is not consistent with the Code.

One potential issue with checking column plumbness at locations between work points (between the ends of the shipping pieces) is that there are also straightness tolerances for straight compression members (1/1,000 per Section 6.4.2 (a) in the Code). As a result, it’s possible that a column could appear out of tolerance per the 1/500 criteria if checked at additional locations between the work points. This would look similar to Figure C-7.5 in the Code, although keep in mind that the work point for a column is not necessarily that same as the brace point shown in the figure.

Carlo Lini, PE

Moderate and Highly Ductile Member Requirements in the Seismic Provisions

When designing an special concentrically braced frame (SCBF) Section F2.5a of the AISC Seismic Provisions for Structural Steel Buildings (ANSI/AISC 341) states “Columns, beams, and braces shall satisfy the requirements of Section D1.1 for highly ductile members.” However, when beams are intersected by a V-brace, Section F2.4b states: “Beams shall be braced to satisfy the requirements for moderately ductile members in Section D1.2a.” When designing an SCBF using a V-braced configuration, does the requirement in Section F2.4b supersede the requirement in Section F2.5a? That is, would the beam only need to satisfy the requirements for moderately ductile members in Section D1.1 of the Seismic Provisions?

The requirement in Section F2.4b does not supersede the requirement in Section F2.5a. Both must be satisfied. However, a member satisfying both requirements may be a moderately ductile member.

The two sections provide two different requirements. The beam is required to satisfy the width-to-thickness ratio for a highly ductile member. The beam must also be braced to provide moderately ductile behavior. Keep in mind that Section F2.5a does not require the use of a highly ductile member; it only requires the beam to satisfy the width-to-thickness ratios for a highly ductile member for reasons that I will explain further. The result is that the beam is moderately ductile since by definition, a moderately ductile member is one “that meets the requirements for moderately ductile members in Section D1.” A member that satisfies both Sections F2.5a and F2.4b will satisfy D1.1 relative to both highly and moderately ductile behavior, but may only satisfy Section D1.2 relative to moderately ductile behavior.

Section D1.1 of the Seismic Provisions addresses the classification of sections for ductility (rotational capacity). It is based on width-to-thickness ratios of the various elements making up a section. Section D1.2 addresses the stability bracing...
of beams. This is similar to the situation that exists in the AISC Specification for Structural Steel Buildings (AISC 360) where:

- Section B4.1a addresses the classification of sections for local buckling
- Chapter F addresses lateral-torsional buckling

A member could have elements that are sufficiently compact to allow the member “to withstand significant plastic rotation of 0.04 rad or more” (the criterion described in the Commentary to the Seismic Provisions) while being braced only “to undergo moderate plastic rotation of 0.02 rad or less” (the criterion described in the Commentary for “moderately ductile”). This is what is required for the beams you are describing. It is similar to having a compact section, per the Specification, that could theoretically develop its full plastic section modulus, but which is only braced to permit elastic behavior—a fairly common condition.

Why might the elements of a member be required to only satisfy the width-to-thickness ratios for highly ductile members? Members that have “compact” (used informally) elements are likely to behave better than members that have less than “compact” elements when the members are subject to significant inelastic demands. Vertical braces are expected to undergo large inelastic rotations (likely larger than 0.04 radians) without fracture. Having small width-to-thickness ratios helps this happen. For example, the Commentary to the Seismic Provisions states: “Tests have shown fracture due to local buckling is especially prevalent in rectangular HSS with width-to-thickness ratios larger than the prescribed limits (Hassan and Goel, 1991; Tang and Goel, 1989). Even for square HSS braces designed to meet the seismic width-to-thickness ratios of these Provisions, local buckling leading to fracture may represent a limitation on the performance (Yang and Mahin, 2005).” This is why, somewhat counterintuitively, HSS members not subjected to bending (“used as diagonal braces”) have more stringent limits in Table D1.1 than HSS members subjected to bending.

It should be noted that vertical braces are not required to be (and likely could not practically be) braced to satisfy the requirements for highly ductile members. The vertical braces are therefore not highly ductile members. Similar situations occur throughout the Seismic Provisions.

V-braced and inverted V-braced frames are designed such that “an unbalanced vertical force must be resisted by the intersected beam, as well as its connections and supporting members.” The intersected beam is intended to remain elastic and therefore has little need to be ductile if it remains elastic in service. However, unexpected things can happen when structures are subjected to large inelastic demands. Enforcing tight width-to-thickness limits helps ensure reasonable behavior if the member experiences some unanticipated demands. Also, as stated in the Commentary: “Adequate lateral bracing at the brace-to-beam intersection is necessary in order to prevent adverse effects of possible lateral-torsional buckling of the beam. The stability of this connection is influenced by the flexural and axial forces in the beam, as well as by any torsion imposed by brace buckling or the post-buckling residual out-of-straightness of a brace. The bracing requirements in the Specification were judged to be insufficient to ensure the torsional stability of this connection. Therefore a requirement based on the moment due to the flexural strength of the beam is imposed.” In other words, there is a lot going on here, so it is best to take some additional steps to promote “good” behavior.

Larry Muir, PE
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1. Can you install powder-actuated fasteners (PAFs) in the casing of a buckling restrained brace (BRB)?
   a. Yes, PAFs are permitted to be installed along the full length of brace.
   b. Yes, but only in the middle third of the casing.
   c. Yes, but only as specifically directed by the BRB manufacturer.
   d. No, PAFs are never permitted in the casing of a BRB.

2. If a member with a thin-walled open cross section restrained against warping and subjected to a torsional moment will experience pure torsional and warping torsional behavior, which of the following is correct?
   a. The pure torsion will produce shear and flexural stresses in the member.
   b. The warping torsion will produce longitudinal and normal shear stresses in the member.

3. True or False: ASTM F3125 Grade A490 bolts are labeled as Group A, and Grade A325 bolts are labeled as Group B.

4. True or False: The AISC Specification for Structural Steel Buildings (ANSI/AISC 360, aisc.org/specifications) requires slip-critical connection faying surfaces to meet particular requirements to ensure an adequate coefficient of friction.

5. True or False: For structures in risk category III or IV, nondestructive testing (NDT) is required by the AISC Specification for all complete-joint-penetration (CJP) groove welds subject to transversely applied tension loading.

6. Which of the following backing materials are permissible for prequalified CJP welds found in AWS D1.1?
   a. Steel
   b. Copper
   c. Ceramic
   d. All of the above
   e. Both “a” and “b”

7. What type of weld could be used to connect structural members that are aligned in the same plane?

8. What year was the first AISC Steel Construction Manual (aisc.org/manual) published?

TURN TO PAGE 14 FOR THE ANSWERS

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1. **c.** The core steel is considered the protected zone. From the outside of the brace, the core configuration cannot be verified, so there is a possibility of damaging the core steel if using a fastener that penetrates the casing, such as a PAF. This configuration can be coordinated with the manufacturer to allow certain sizes or locations of PAFs. **Submitted by Shauna Kean, Coughlin Porter Lundeen.**

2. **b.** Warping torsion will produce longitudinal and normal shear stresses. **Submitted by Madelleine Grimmer, Simpson Strong-Tie.**

3. **False.** Section J3.1 in the Specification categorizes ASTM F3125 Grade A325 bolts as Group A and A490 bolts as Group B. **Submitted by Tracy Donoghue, KPFF.**

4. **True.** The Specification states, in Section M3.3: “For slip-critical connections, the faying surface requirements shall be in accordance with RCSC Specification Section 3.2.2.” Depending on the class of surface required, a slip coefficient is determined. (The RCSC Specification is available at [www.boltcouncil.org](http://www.boltcouncil.org).) **Submitted by Nazereth Galecia.**

5. **False.** The Specification, in Section N5.5b, states: “For structures in risk category III or IV, UT shall be performed by QA on all complete-joint-penetration (CJP) groove welds subject to transversely applied tension loading in butt, T-, and corner joints, in material 5/8 in. (8 mm) thick or greater.” **Submitted by Andy Tomiczek, Jezerinac Group.**

6. **e.** Steel backing is “prequalified” by AWS D1.1, but in AWS D1.1:2015 an alternative was introduced that allowed copper backing to be used with prequalified welds if the following conditions were met: The prequalified joint detail does not contain steel backing or spacers, the joint is back-gouged, and the back-gouged joint is back-welded. Ceramic backing may be used for CJP welds, but they are not prequalified and require qualification by testing per AWS D1.1. More information can be found in AISC Design Guide 21: Welded Connections—A Primer for Engineers ([aisc.org/dg](http://aisc.org/dg)). **Submitted by Rick Overgard, Atlantic Steel Detailing Services.**

7. Members to be connected that lie on the same plane can be butted up and welded together using a groove weld. Splice plates with fillet welds are also a possibility. **Submitted by Matthew Webb, CLC Engineering.**

8. **The First Edition Manual was published nearly a century ago, in 1927. All historic manuals and standards are available for download for members at [aisc.org/publications](http://aisc.org/publications). **Submitted by Matthew Shuler, McDermott.**
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A brief look at resources and advice on detailing for hot-dip galvanizing applications.

GALVANIZING WORKS.

Hot-dip galvanized steel has helped combat steel corrosion in aggressive environments for more than a century, but it continues to evolve as markets emerge and change. Over time, improvements in design and detailing practices for batch hot-dip galvanizing have allowed for superior corrosion protection, optimized aesthetics, lower initial cost, and increased longevity. Reviewing and understanding the most up-to-date steel details and best design practices will help improve the quality and performance of hot-dip galvanized coatings whether specified for long-term corrosion protection, painting or powder coating after hot-dip galvanizing, architecturally exposed structural steel (AESS), fireproofing, and more.

Optimal corrosion protection is primarily achieved by referring to the recommendations provided in the specification ASTM A385 Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip). This specification outlines recommendations for steel selection along with a variety of design details and fabrication best practices to optimize quality. Because trace elements in the steel chemistry affect the structure and appearance of the galvanized coating, recommended ranges are provided for silicon, phosphorus, carbon, and manganese to achieve a coating of typical appearance and thickness. Steels containing elements outside these ranges (known as "reactive steels") are also successfully galvanized, but produce thick, dark, rough, and/or brittle coatings. The specification also identifies design issues such as overlapping surfaces, different thickness of material in an assembly, moving parts within an assembly, and through-holes, which require special attention if the galvanizing is to deliver a coating according to expectations. Additionally, all designs must consider the need for venting and drainage details such as holes and cropped corners on gusset plates to accommodate the free flow of pretreatment solutions, air, and zinc to achieve a smooth and uniform coating.

Beyond the recommendations in ASTM A385, recent industry research has influenced the design and specification of hot-dip galvanized structural connections. In the 8th Edition of the AASHTO LRFD Bridge Design Specifications for Class C slip-critical connections, the requirement to wire brush galvanized faying surfaces is no longer required. This is presently being evaluated for inclusion in the RCSC Specification for High Strength Bolts. If needed, slip testing and tension creep testing of zinc-rich paints applied over galvanized faying surfaces have been performed through the American Galvanizers Association (AGA) in accordance with Appendix A of the RCSC Specification to achieve improved slip coefficients of 0.45 and 0.50 without impact to corrosion resistance. In the past, there was some concern that galvanizing a connection would cause a standard hole to become small enough that it would be impossible to insert a bolt. The actual zinc coating thickness on a galvanized member can often range from 3 mils to 8 mils. If a member is galvanized the hole may get smaller by up to 16 mils. The standard hole clearance of 3/32 in. is equivalent to 62.5 mils, which is a large allowance for these coatings.
Steelwise

For Structural Steel Buildings (ANSI/AISC 360-16, aisc.org/specifications) and the LRFD Bridge Design Specifications (8th Edition) both include increased standard hole dimensions for nominal bolt sizes 1 in. and larger, which will alleviate this perceived concern for bolt hole clearance when galvanizing.

In addition to current industry standards, additional steel details and elevated quality standards are required for AESS to be galvanized. There is a common misconception that it is not possible to obtain AESS-quality galvanized steel because many surface conditions normally acceptable in the primary galvanizing standards (i.e., runs, skimmings, roughness, excess zinc) are not acceptable for showcase or feature elements. To address these concerns, AGA provides supplemental guidance when using the AESS Custom (C) category to facilitate communication regarding additional steel details required to maximize aesthetics for hot-dip galvanized AESS members (for details on the various AESS categories, see “Maximum Exposure” in the above: Improvements in design and detailing practices for batch hot-dip galvanizing have allowed for superior corrosion protection, optimized aesthetics, lower initial cost, and increased longevity.

Below: Venting is a crucial step for steel elements that will be put through the galvanizing process, particularly hollow pieces. When moisture trapped inside an element becomes super-heated, it can generate 3,800 psi of pressure and blow a steel piece apart. Galvanizers typically check steel for proper venting before putting it through the process. And in cases where steel isn’t vented properly, they contact the fabricator and either have them add venting holes or perform the work themselves on-site using torching or drilling, charging the fabricator accordingly.
These recommendations include but are not limited to: optimize steel selection with favorable chemistry, use low-silicon welding electrodes, grind thermally cut edges up to 1/16 in., increase and/or optimize vent and drain hole placement, and provide designated lift points for galvanizing.

To achieve a desired color or aesthetic, many projects involving hot-dip galvanized AESS also specify a duplex system, where paint or a powder coating is applied over the zinc coating. ASTM D6386: Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting provides the necessary practices to prepare galvanized surfaces for painting, while ASTM D7803: Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating contains similar practices for powder coating. Many of the same details required for AESS members such as optimized steel selection and venting/drainage details will apply in order to avoid surface conditions that present challenges to coating adhesion.

In a similar fashion, additional details and surface preparations are often required prior to the application of passive fireproofing materials. Where intumescent fire-
resistive materials (IFRMs) require a specific primer to promote adhesion over galvanizing, the surface should be prepared identically to a duplex system. On the other hand, when spray-applied fire-resistive materials (SFRMs) are applied over galvanizing, bonding agents or mechanically fastened galvanized metal lath may be required.

Incorporating the above steel details and best practices for hot-dip galvanizing applications can go a long way to ensuring that a coating meets project expectations. In the meantime, industry updates continue to improve the specification and detailing of hot-dip galvanized steel for a variety of industries and uses.

This information will be covered in the presentation “Successful Detailing for Hot-Dip Galvanizing” at the 2020 NASCC: The Steel Conference, taking place April 22–24 in Atlanta. For more information and to register, visit aisc.org/nascc.

And for more on the hot-dip galvanizing process, see “Galvanizing Illustrated” in the August 2014 issue, available in the Archives section at www.modernsteel.com.
Lou Geschwindner has provided plenty of instruction and insight to students and professionals alike in his time as a Penn State professor and a vice president at AISC.

Was there a specific building that you looked at and said, “Ah, that’s what I want to do! This is what got me into buildings.”

I think what got me into buildings was that my dad was a masonry contractor. He had a small company with three or four people working for him, so the building industry was something I was involved in from that perspective. The thing that probably had the most influence on me in the beginning was Mies van der Rohe and the architecture in Chicago. I had initially planned to go to the Illinois Institute of Technology (IIT), and that was because of Mies van der Rohe. I was accepted at IIT, but I ended up going to Rensselaer for architecture. And along the way, I realized that I really didn’t think like an architect. I thought like an engineer.
You taught at Penn State for about 40 years. We like to separate people into generations. In teaching from the 1960s to the 2000s, did you pick up on any distinct differences between the generations?

I don’t think I saw the distinct differences where I would say, “This generation does this and this generation does that.” Rather, I would see more differences from one class to the next. Every class had a personality, and you would interact with that class in different ways depending on the personality.

Are students today different than they were at the beginning of your career?

Absolutely, but a lot of that is because of what we have available to us today. One of the first things I did as an undergraduate student working for a faculty member was taking photographs out of magazines and books for him to use in his lectures. And not too long ago, I had a student who was doing a project at Penn State on the football stadium. And I said, “I can get you some slides.” So I got her a whole carousel full of slides on what she was working on. And she had no idea what they were. Students today can use their tablet or their iPad. I see all sorts of people taking photographs of the screen as their way of taking notes. A lot has changed, and you get different attitudes toward learning; some want to learn, some don’t. I was very fortunate at Penn State because our program was limited in enrollment. And so we always got good students who wanted to learn, and we never had to deal with quite the same breadth of academic preparation as a lot of people do today.

Can you tell me a little bit about your early experiences with getting up in front of a group as a professor?

I can tell you that when I was in grade school and high school, there was no way I perceived that I would be in front of a class. I had more than my share of difficulties in an academic sense. But what I found as an undergraduate student in architecture who enjoyed structures was that I could help my classmates to understand the principles that we were studying, and that is what got me to the point where I wanted to teach because I found that by helping my classmates learn the material, I learned it better. So when I first got to Penn State, it was just sort of an extension of what I had been doing as an undergraduate student with my classmates.

Switching from education and work, I understand that you enjoy reading biographies. Are there certain people or stories that have been particularly inspiring?

I haven’t been reading as much as when I was a vice president at AISC. I would travel three to four times each month, and I would always have a book. One book that I’ve read that I want to recommend to my grandchildren is Tom Brokaw’s The Greatest Generation because it helped me to understand my father—not that he was hard to understand—but as I read it, I could see the kinds of things that my dad and his brothers and his sisters and my mother’s family saw. I have an interest in genealogy, and I really want my grandkids to read it to help them understand their great-grandfather. I think everybody ought to read it and understand what the culture of service was with those people and how they gave so much for our country.

Speaking of genealogy…

It’s something that I’ve had a long-term interest in, so I’ve been doing research for quite a while. I had an uncle who was very much interested in it but was never able to make much progress. He did have all of the living family and the recent history pretty well put together. Now we have the Geschwindner family tracked back to the 1500s in Germany, and my mother’s family back to the 1500s in England, so that’s kind of neat.

Any surprising or interesting findings?

I would say the most interesting thing is that in Germany, the Geschwindners were masons and built the wall around a city. And in England, in my mother’s family, there were bricklayers. And I find it so interesting how that has carried through to now. I knew how my father became a mason because I knew that his father-in-law was a mason. But taking it back multiple generations was very interesting.
PEOPLE NEED TO KNOW what to do and why to do it.
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they need to understand the story they are stepping into and why it is important—and
they need to know what to focus on in order to be successful.

Theater—and Business—Arts
My daughter, Sarah, is a junior in college, and she is a theater major.
Now that I’ve learned what the theater arts field is all about, I think every aspiring
business executive should have at least a minor in theater.

Theater is about the creation and delivery of a meaningful story in a three-dimen-
sional, human way. There are so many parts to the creation and delivery of a story. A
script needs to be written with a purpose, a plot, and characters. Those characters need
to be selected and directed by certain types of people who can bring out the best in
each person to generate scenes that are worthy of the story being told. Sets need to
be designed that serve as the art that the actors step into (this is Sarah’s particular skill
and passion). Lighting needs to be guided. Costumes and props need to be made. And
of course, profits need to be produced so you can do it all over again.

Business is about the creation and delivery of a meaningful story in a three-dimen-
sional, human way. There are so many parts to the creation and delivery of a business.
A strategy needs to be written with a purpose. A plan needs to be written for certain
types of employees to deliver certain types of products and services to certain types of
customers. Managers need to be cultivated who can guide those employees effectively.
Relationships need to be developed with certain types of suppliers. A culture needs
to be established to sustain the business and help build the desired brand. And, you
guessed it, profits need to be produced in order to do it all over again.

Notice that there is the business of theater and the theater of business. They
are intertwined.

The Big Picture
If a producer and a director do not know what the end picture is supposed to look
and feel like, they can invest a lot of time, energy, and money in creating something
meaningless and worthless (not something you want to do all over again). Knowing
what the end result is supposed to look and feel like, and how it connects to the
purpose of the story, is essential to creating a great theatrical production, TV show,
or film.

If a business executive doesn’t know what the end picture is supposed to be like for
customers in terms of the value they receive and the experience they go through in
receiving it, then they can invest an enormous amount of time, energy, and money in
creating and delivering something that is meaningless and worthless. (Are you noticing
a pattern here?)
Once the producer and director know the desired end result, they need to talk about that big picture, that big dream, every day so that all of the people working on the show can see what they are working toward.

Once the business executive sees the desired end result for customers and for his or her organization, then he or she needs to talk about it every day, over and over and over (and over) so that employees can see what they are working toward creating and delivering.

The Little Details

However, vision alone does not make a great show. Along the way, there are countless details that have to be executed over and over in every part, from the script to the set to the acting and lighting and so on. Details matter in theater, TV, and films. They matter a lot.

And yes, vision alone does not make a great business. There are thousands of details that need to be focused on and executed properly. Every detail matters. They all matter a great deal.

A beautiful example that shows the importance of talking about the big dream and the little details was the creation of Disneyland in the early 1950s (you may have heard of it). Walt Disney created a television show, called Disneyland, where he talked over and over about a theme park that would become the happiest place on earth. He showed blueprints and drawings of the park, and there are plenty of iconic photos on the internet of him standing on a pile of dirt and explaining what it would become. And then every day, he talked about the details of all of the different parts of Disneyland and what needed to be accomplished.

This is what you need to do in your work. Every day, talk about the vision and the purpose and why the end result is so incredibly important. And every day, talk about the details that need to be executed in order to make the vision a reality.


Dan will present multiple sessions at the 2020 NASCC: The Steel Conference, taking place April 22–24 in Atlanta. To check out the advance program for the conference, which includes a schedule and descriptions of all sessions, visit aisc.org/nascc.

If you don’t know what the end picture is supposed to look like for your customers, then you may be investing an enormous amount of effort into something that is meaningless and worthless.

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**WHEN HDR SET OUT** to create its new global headquarters—with its own designers—it didn’t just want a new office building; it wanted one that could set new standards.

The Omaha-based architectural and engineering firm created a design that reflected how its architects, engineers, and planners sought to push new boundaries, and steel framing—including the state of Nebraska’s first implementation of a SidePlate system—played a significant role in doing so.

The project consists of a steel-framed 264,000-sq.-ft, ten-story office building (using roughly 1,700 tons of structural steel) connected to a 1,000-stall parking garage via a steel-framed pedestrian bridge. The latter element is framed with two W36×150 bridge beams tied together with W10×45 infill beams, with a tapered beam canopy covering the walkway. The garage is located 50 ft away from the office tower, creating a plaza lined with retail on both sides. Retail space is also provided on all four sides of the tower, which means there is no “back door” to the building.

The building also features multiple sets of communicating stairs. Starting at level four, every other set of floors is connected by one of these staircases, encouraging employee collaboration between floors. The stairs are composed of exposed HSS12×4×¾ stringers and steel plate treads topped with wood.

**Chamfer Challenge**

To encourage pedestrian flow around the building and into the plaza area, the architects carved out the northwest and southeast
corners of the building, resulting in tapered chamfers at the base of the building, which created a challenge for the structural engineering team. At the top of the chamfered corners, the upper floors cantilever 30 ft beyond the base of the building, supported by sloping steel columns—consisting of spliced W14×120s and W14×90s to support a W14×90 corner column—placed on both sides of the chamfer. These columns converge at a common point at level six in the northwest corner and level seven in the southeast corner. This places the sloping columns 18.6° out of plumb.

Where the floor framing meets the sloping columns, a horizontal force is generated from the vertical gravity reaction acting on the columns. The structural team quickly realized that there were only two ways to resist these horizontal forces: either provide horizontal framing at each floor to drag the horizontal reactions back to a lateral system located at the core of the building, or provide a lateral system along the faces of the building in line with the sloping columns. In addition to resisting the horizontal forces from the gravity load reactions,
the selected system would need to provide stability to the columns during erection, eliminating the need for temporary shoring.

The idea of providing horizontal framing at each floor to drag the forces back to the core was abandoned due to the increased number of steel members, as well as the additional connections it would require. As such, the structural team opted to align the lateral load-resisting system with each of the sloping columns. Although the moment frames were designed to resist the lateral loads and horizontal forces from the gravity reactions on the sloping columns, these columns also resist lateral loads due to their incline.

HDR selected moment frames using SidePlate’s (an AISC associate member) all-bolted moment connection as the lateral load-resisting system, since shear walls or bracing located adjacent to the exterior walls were considered objectionable both functionally and aesthetically. SidePlate is a proprietary connection that uses a shop-welded plate at the girder’s top flange and shop-welded angles at the bottom flange. In the field, the girder slides between plates that are welded to both sides of the column. The plate and angles on the girder are bolted to angles at the top and bottom of the column plates to transfer the tension and compression components of the moment out of the girder and into the column plates, and then into the column. The ease of installation quickly frees up the crane to move on to the next framing member while the erection crew continues with connection bolt-up, greatly speeding up steel installation.

There are a total of 375 SidePlate connections in the building. Due to the accelerated schedule, HDR created a RAM Structural System model to share with SidePlate. Concurrently, HDR focused on finalizing the gravity framing design while SidePlate located and optimized the moment frames. Six moment frames resist forces on the long faces of the building while two resist forces on the short faces of the building. The moment frame columns are W21 shapes, and the girders vary in size from W30s at the second level to W21s at the roof level. The building’s floor-to-floor height is typically 14 ft but is 20 ft from the first to the second floor in order to provide taller ceilings in the retail spaces. This taller floor-to-floor height at the base required cover-plated W21 columns to provide the required capacity.

As this was the first use of the SidePlate system in Nebraska, steel fabricator Paxton
above: The sloping columns converge at a common point at level six in the northwest corner and level seven in the southeast corner.

left: A 3D framing model of the building, which uses approximately 1,700 tons of structural steel in all.

below: The office tower was built in 23 months, with steel erection lasting four months.
and Vierling Steel (PVS) built a mock-up SidePlate connection in its shop to review constructability with the general contractor, erector, HDR, and owner prior to construction. The SidePlate moment frames ended up saving an estimated 70 tons of steel compared to a conventional moment frame due to their increased stiffness. In addition, the all-bolted connection system accelerated the construction of the steel frame, bringing the erection time down to only 120 days, and also reduced inspection costs. Once the erection crew erected the first few SidePlate columns and figured out how best to remove the temporary channel that kept the connection plates on the sides of the column spread apart, each SidePlate member became just another piece of steel to erect.

Gravity Framing

The building’s interior spaces have open ceilings with the steel framing prominently displayed. The beams are protected with spray-applied fireproofing that, to save cost, was painted and left exposed. The framing bays are typically 30 ft wide by 37 ft long (purlins span the short direction and girders span the long direction). To help achieve the architects’ desire for the space to feel as open as possible, the floor slabs are constructed of 4½-in. normal-weight concrete fill on 3-in. composite metal deck. The deeper deck allowed the floor purlins to be spaced at 12 ft, 4 in. on center, resulting in a more open feel. The typical floor purlin is a W16 and the typical girder is a W24. In areas where the purlin spans were different, or the beam span...
above: As this was Nebraska's first SidePlate system, steel fabricator Paxton and Vierling Steel (PVS) built a mock-up of a SidePlate connection in its shop to review constructability issues.

below: One of the building's 375 SidePlate all-bolted connections. The connection is now included in Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications (ANSI/AISC 358, aisc.org/specifications.)
loading differed, beam weight was varied and the W16 depth was maintained so that the purlins have the same visual depth. While the majority of the structural steel was delivered to the site unpainted, the pedestrian bridge was shop painted with a graffiti-resistant finish coat.

The mechanical system uses chilled beams for heating and cooling the building. As the ducts for a chilled-beam system are significantly smaller compared to a forced-air system, 8-in. square penetrations were provided through the girder webs to route the ductwork, allowing the mechanical system to be placed higher in the ceiling space.

The facility was delivered as a phased, fast-track project with an early foundation and mill order package, followed by a structural steel frame package, and finally a core and shell package. It was built in 23 months, and steel erection lasted four months. Although erector Topping Out did not perform a specific study on erecting the SidePlate system, it estimated that it was about 10% faster to erect than a traditional braced frame steel building.

With so much of the steel exposed as part of the architecture, close coordination between the architects and structural engineers was required to ensure the steel designed in the early structural packages worked with the final architectural design. The end result is a modern, open piece of architecture in which structural steel and engineer-architect collaboration are prominently on display.
The modern, open interior serves as an example of the collaboration between the architects and engineers that now inhabit the building.

**Owner**
Noddle Companies, Omaha

**General Contractor**
Kiewit Building Group, Omaha

**Architect and Structural Engineer**
HDR, Omaha

**Collaboration Stair Engineer**
Thompson, Dreeson and Dorner, Inc., Omaha

**Steel Team**

**Fabricator**
Paxton and Vierling Steel Company, Carter Lake, Iowa

**Erector**
Topping Out, Inc. (Davis Steel Erection), Gretna, Neb.

**Detailer**
H & R Steel Detailing, LLC, Liberty, Mo.

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SELECTING THE BEST FRAMING SCHEME for a building depends on several considerations, not the least of which is the owner's requirements.

It’s not possible to give a specific list of rules by which the best scheme can be assured, as every project is different. If “best” means low initial cost, then the owner may face major expenses in the future for operational expenses or problems with expansion. Extra dollars invested at the outset can reduce potential future costs.

Again, every project is different. Here, we’ll focus on single-story lateral load-resisting frames using open-web steel joists and joist girders. Of course, both can be used for multistory projects, but single-story buildings comprise most projects. Preliminary design considerations are briefly discussed, as these decisions are paramount to the success of the framing system. As a colleague once told me, “You cannot do just one stupid thing in the design, because once you use bad judgment, additional bad decisions will have to be made.”

Early Decisions

Let’s start with some of those early building geometry decisions that must be made in order to get a project started off on the right foot.

Roof slope. Roof slope is a major factor in roofing performance. For membrane roofs, ¼ in. pitch per ft is generally recommended. For structural steel roofs, the minimum pitches are on the order of ¼ in. per ft for standing seam roofs and ½ in. per ft for through-fastener roofs. The International Building Code (IBC) requires a minimum slope of ¼ in. per ft except for coal tar roofs, where a slope of ½ in. may be used.

Free drainage. All roofs should be designed and built so that water is not retained on the roof surface. Even in roofs that are constructed with ¼ in. per ft slope, there are instances where free drainage may not occur. A classic example is a roof with no interior drains that drains to an eave gutter. This situation occurs when the first upslope joist or purlin deflects under snow load more than the eave member deflects. Often, the eave member does not deflect as it is supported by the building siding. A check can be made by the specifying professional for ponding stability using the Steel Joist Institute’s (SJI) Roof Bay Analysis Tool (read on for more on that tool).

Bay size. The designer may or may not have the opportunity to select the bay size for a proposed project. Owner requirements and functional requirements often dictate a certain bay size. In addition, the building footprint, which is often dictated by the building site, has an impact upon the bay size selected. In general, for single-story buildings, bay sizes ranging from 30 ft × 30 ft to 60 ft × 60 ft have proven economical, and square bays have been shown to provide greater economy than rectangular bays. Gravity loads have the greatest impact on the optimum bay size if the size is not dictated by one of the aforementioned items. Also, lighter roof loads allow larger bays without cost penalty.

When the structure has a high ratio of perimeter length to enclosed area—e.g., a long, narrow building—then a 30-ft by 40-ft or a 30-ft by 50-ft bay, where the 30-ft
dimension is parallel to the long building dimension, often proves to be the most economical. This is because economy is heavily influenced by the wall system when it comes to long, narrow buildings. For example, if a metal wall system is to be used, then the most economical girt system is one in which light-gauge/cold-formed steel girts are used, typically C or Z girts. The maximum span of such girts is approximately 30 ft. If a bay spacing larger than 30 ft is required, then wind columns are required to laterally support the C or Z girts at mid-bay. The wind columns and their attachments to the structural steel at the roof have a significant impact on the cost of the framing system. For metal wall structures with bays larger than 30 ft, the designer should investigate the use of steel joists for the girt system as an alternative to wind columns and cold formed purlins.

For structures with a low ratio of perimeter length to area—e.g., square buildings of significant size (200 ft × 200 ft)—the percentage of steel that would be contained in the wall framing is less of a cost factor, and thus a 40-ft × 40-ft bay often proves to be the most economical system. Larger bays of 40 ft × 50 ft, 50 ft × 50 ft or 40 ft × 60 ft are also economical.

In general, soil conditions will not have a major impact on the selection of the bay size when shallow foundations can be used. However, if very poor soils exist and deep foundations are required, larger bays will tend to be more economical because of the reduced number of deep foundations.

SJI’s Roof Bay Analysis Tool. This tool assists the specifying professional with optimizing roof bay size as well as determining joist and joist girder depths, spacing, etc. It can also be used to determine whether it is best to span the joist in the long direction or in the shorter direction when a rectangular bay has been selected. The tool can be downloaded for free at www.steeljoist.org under the Design Tools tab. The user can input various scenarios to arrive at the least weight or the least cost bay size. Cost data can be input by the user along with other design data. Bays can be evaluated using either ASD or LRFD. In addition, the bay can be evaluated for roof ponding stability, using an iterative analysis. Pull-down menus allow for easy selection of steel deck, joist (K, LH, DLH- Series) and joist girder selections.

Columns. Interior columns can normally be braced only at the top and bottom, thus square hollow structural section (HSS) columns are often desirable due to their equal stiffness about both principal axes. Difficult connections with HSS members can be eliminated in single-story frames by placing the joists and joist girders over the tops of the HSS. Other advantages of HSS columns include the fact that they require less paint than equivalent W-shapes and are aesthetically pleasing. W-shapes may be more economical than HSS for exterior columns for the following reasons:

• The wall system (girts) may be used to brace the weak axis of the column.
• Bending moments due to wind loads are predominant about one axis.
• It is easier to frame girt connections to a W-shape than to an HSS section.

Serviceability. The design of the lateral load envelope (i.e., the roof bracing and wall support system) must provide for the code-imposed loads, which establish the required strength of the structure. A second category of criteria establishes the serviceability limits of the design. These limits are rarely codified and are often selectively applied project by project based on the experience of the parties involved.

In AISC Design Guide 3: Serviceability Design Considerations for Steel Buildings (aisc.org/dg) several criteria are given for the control of building drift and wall deflection. These criteria, when used, should be presented to the building owner as they help establish the quality of the completed building.

Joist and Joist Girder Braced Systems

Now let’s take a look at some elements of single-story buildings using joists and joist girders.

Roof diaphragms. Roof diaphragms used in conjunction with vertical wall bracing is typically the most economical bracing system. Diaphragms are most efficient in relatively square buildings, but an aspect ratio of three to four can be accommodated economically.

Vertical bracing. In braced buildings, the roof diaphragm forces are transferred to a vertical braced frame, which in turn transfers the loads to the foundation level. In most cases the vertical bracing is located at the perimeter of the structure so as not to interfere with plant operations. The vertical bracing configuration most frequently used is a X-braced system using angles or rods designed only to function as tension members. However, in areas of high seismicity, a vertical bracing system that incorporates tension/compression members is often required. In these cases, other bracing forms may be used, such as chevron bracing or eccentrically braced frames.
A typical vertical bracing using joists or joist girders is shown in Figure 1. The top chord extension is used to eliminate the bending in the top chord caused by the eccentricity of the shear at the joist seat.

In buildings with large aspect ratios, bracing may be required in internal bays to reduce the brace forces and to reduce foundation overturning forces. The joist girder details shown in Figures 1 and 2 are ideally suited for diaphragm shear collectors (drag struts). Similar details can be used for joists. And Table 1 shows a typical schedule that can be used to convey loading criteria to the joist manufacturer.

<table>
<thead>
<tr>
<th>JOIST GIRDER SCHEDULE</th>
<th>1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girder Mark Number</td>
<td>Designation (Total Load/ Live Load)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>G1 56G 7N</td>
<td>12.5K/5.8K</td>
</tr>
<tr>
<td>G2 56G 7N</td>
<td>14.4K/5.8K</td>
</tr>
</tbody>
</table>

1 Manufacturer to design joist girders using ASD. Nominal design loads shown are to be used in the applicable ASD code load combinations.
2 Deflection criteria: Live load deflection ≤ L/240.
3 See net wind uplift diagram for uplift loads on girders.
4 See framing plan for additional loads to be included in joist girder design, including mechanical loads.
5 See framing plan for joist spacing along girder.
6 Top chord axial load, tension, or compression load.

There are several situations for which ordinary moment frames are likely to be superior as compared to braced frames.

- Braced frames may require bracing in both walls and roof. Bracing frequently interferes with plant operations and future expansion. If either consideration is important, ordinary moment frames may be the answer.
- The bracing of a roof system can be accomplished through X-bracing or a roof diaphragm. In either case the roof becomes analytically a large horizontal beam spanning between the walls or bracing which must transmit the lateral loads to the foundations. For large span-to-width ratios (greater than 3:1) the bracing requirements become excessive. A building with dimensions of 100 ft by 300 ft with potential future expansion in the long direction may best be suited for moment frames to minimize or eliminate bracing, which would interfere with future changes.
- Consideration must be given to future expansion and/or modification, where columns are either moved or eliminated. Such changes can generally be accomplished with greater ease where simple-span conditions exist.

However, I would caution designers on the following points:

- The design loads (wind, seismic, and continuity) must be given on the structural plans so that the proper design can be provided by the joist manufacturer. The procedure must be used with conscious engineering judgment and full recognition that standard joist girders are designed as simple-span members subject to concentrated panel point loads (see the SJI Specification). Bottom chords are typically sized for tension only. The simple attachment of the bottom chord to a column to provide lateral stability will cause gravity load end moments that cannot be ignored. The designer should not try to select member sizes for these bottom chords since each manufacturer’s design is unique and proprietary.
- It is necessary for the designer to provide a well-designed connection to both the top and bottom chords to develop the induced moments without causing excessive secondary bending moments in the joist chords.
- The system must have adequate stiffness to prevent drift related problems such as cracked walls and partitions, broken glass, leaking walls and roofs, and malfunctioning or inoperable overhead doors.
Chicago Metal created 16 reverse curves of W33x169# beams, cold bent on the x-x axis, each without a $1,500 weld splice. A total of 310 tons of curved beams form the wavy roof of the Ratner Athletic Center at the University of Chicago, winner of the AISC Engineering Award of Excellence.

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SJI TD 11: Design of Lateral Load Resisting Frames Using Steel Joists and Joist Girders suggests analysis models that can be used to determine the required joist girder moments. Tables 2 and 3 include schedules that can be supplied to the joist manufacturer for designing the joist girders.

Table 2. Joist Girder Moment Schedule

<table>
<thead>
<tr>
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<th></th>
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<tbody>
<tr>
<td>J2</td>
<td>1300</td>
<td>0.5</td>
<td>5</td>
<td>0.375</td>
<td>4</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Additional Requirements*

- Design Joist Girder Webs to transfer Axial loads from Top Chord to Bottom Chord

SJI provides six different spreadsheets to assist in the design of moment conditions. Each spreadsheet can be used to calculate the strength of connections based on the necessary limit states, includes a reference manual explaining the calculations, and provides for the design of joist girder framing into one side or both sides of the column. The six connection spreadsheets provided are:

- Connection to the Strong Axis of Wide Flange Columns
- Connection to the Strong Axis of Wide Flange Columns—Intermediate Levels
- Connection to the Weak Axis of Wide Flange Columns
- Connection to HSS Columns—Top Plate
- Connection to HSS Columns—Knife Plate
- Connection to Wide Flange Columns—Knife Plates

Table 3. Joist or Joist Girder Additional Requirements

<table>
<thead>
<tr>
<th>Girder Mark Number</th>
<th>Girder Mark Number</th>
<th>Dead Load Moment D (kip-ft)</th>
<th>Roof Live Load Moment L₉ (kip-ft)</th>
<th>Snow Load Moment S (kip-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td></td>
<td>34.0</td>
<td>30.7</td>
<td>30.7</td>
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</table>

<table>
<thead>
<tr>
<th>Girder Mark Number</th>
<th>Girder Mark Number</th>
<th>Rain Load Moment R (kip-ft)</th>
<th>Wind Moment 1.0W (kip-ft)</th>
<th>Seismic Moment 1.0E (kip-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td></td>
<td>-</td>
<td>±105</td>
<td>±105</td>
</tr>
</tbody>
</table>

End Moment Sign Convention, Positive moments: + ———— +

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Although the spreadsheets are specifically written for designing moment connections, they can also be used for cases where joist girder chord axial load transfer is required. As with the Roof Bay Analysis Tool, all of these resources can be downloaded from www.steeljoist.org under the Design Tools tab.

Seismic Joist Girder Frames

The AISC Seismic Provisions for Structural Steel Buildings (ANSI/AISC 341, aisc.org/specifications)—which apply when the seismic response modification coefficient, $R$, (as specified in the applicable building code) is taken greater than 3—require that the joist-girder-to-column moment connections in an OMF be designed for a moment equal to $1.1 R M_p$ of the girder, (see Chapter E, Section E1). The limit associated with the maximum moment level in the girder assumes that the columns have more flexural capacity than the girders (i.e., strong column, weak beam). In this system, where the joists typically have more flexural strength than the columns, the fuse in the system would be the column, and the maximum force that can be developed by the system is that force which generates the maximum expected moment ($M_{pe}$) in the column. Note that this is only required for Seismic Design Categories D, E, and F. The Seismic Provisions requires that the girder- (joist girder in this system) to-column connection has the capacity to resist forces generated in the connection when the column develops this moment. The premise of the OMF frame design for this type of system (strong beam, weak column) is that all columns participating in the lateral load-resisting frame have hinged (or developed $M_{pe}$) just below the bottom chord of the joists.

Want to learn more about key considerations when using open-web steel joists and joist girders in lateral load-resisting systems for wind and seismic loads? Attend the session “A Primer on Lateral Load-Resisting Frames Using Steel Joists and Joist Girders” at the 2020 NASCC: The Steel Conference, presented by Bruce Brotherson with Vulcraft–Nucor and Walter Worthley with Valley Joist. This year’s conference takes place April 22–24 in Atlanta. For more information and to register, visit aisc.org/nascc.
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Upcoming Sessions:
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3/10 Stability Analysis and Design Part 1
3/24 Stability Analysis and Design Part 2
3/31 Design of Composite Flexural Members
There are plenty of design and detail issues that can unnecessarily add cost to structural steel projects. Here’s how to alleviate some of the more common ones.

**LET’S FACE IT:** There are plenty of usual suspects in the form of inefficient or unnecessary steel details that can add cost to projects.

Luckily, there are also plenty of ways to improve details from a cost perspective without compromising safety. Here, we’ll look at some examples, including specifying stiffeners only where required, being overly restrictive about specifying bolt types, proper use of complete joint penetration (CJP) welds, when to require full capacity connections, and others. In addition, we’ll also discuss the importance of communication between professionals from both the design and construction sides of a project, the obstacles to this communication, and strategies to assure that essential technical communication is not avoided for commercial or other reasons.

**Fabrication Efficiencies**

First, let’s take a look at some shop-related advice for avoiding inefficiencies.

**Avoid specifying stiffener locations where not required.** When stiffeners are required for a job, it is important that they are properly specified. Adding stiffeners in locations that are not required can significantly add to the final cost of the steel solution. While this might seem like a no-brainer, it is fairly common for unnecessary stiffeners to be added to designs. In these instances, the column may never be checked for stiffener requirements and then project documents, not calculations, are driving their inclusion.

As an example, consider a 22-ft, two-story W\text{14}\times90 column with two beam moment connections at two different levels—with four (unrequired) stiffeners at each location required by a design detail. Assume the W\text{24}\times55 beams are part of a frame with end moments of 200 kips, an axial load of 50 kips, and a shear load of 50 kips. Also assume these members are connected to the W14 column flange. These forces would not require column stiffeners. The W\text{14}\times90 would constitute about $1,300 of cost whereas the eight stiffeners would incur a cost of $1,200—a large percentage of the total cost. With this in mind, the cost of stiffeners that are not required could have a drastic effect on the final cost of the put in place structure.

A good tool for selecting a cost-efficient column size that doesn’t require stiffeners is “Clean Columns,” an interactive spreadsheet available at steeltools.org/column.php. After selecting your column and beam size, simply input the moment loads at the end of the beams, and the spreadsheet will calculate whether stiffeners and doubler plates are required—and will also suggest a column size that doesn’t require stiffening.

**Use bearing bolts whenever possible.** Bolt shear values are important to the economy of steel structures. Reducing the number of bolts not only reduces the field labor but also reduces the amount of material, as the joints are more compact. As an example, consider a 1-in.-diameter F3125 Grade A325 bolt. This bolt has a shear strength, with threads included (N value), of 31.8 kips in standard holes and an equivalent shear strength in a standard hole of a slip-critical Class A bolt of 17.3 kips. This 183% reduction in equivalent bolt strength will require the joint to have almost twice the bolts. The increase in bolts will yield an increase in connection material because of the required geometric modifications. All of these issues will increase the cost of the
structure, not to mention incur the ire of the project’s architect, as these joints can become large. Most bracing connections are allowed to use bearing bolts to resist bracing forces subject to load reversal. An alternative to requiring a slip-critical joint is to use pretensioned bolts with bearing bolt values. This keeps these joints performing with limited slip for most normal demands.

Specify welds required to meet demand and do not specify CJP welds needlessly. Specifying efficient welds is, of course, crucial to creating efficient steel framing systems. It’s also important to understand the demand at key non-redundant critical joints in the structure, as well as the fact that certain joints may require extra capacity to satisfy the design requirements. In practice, it is important to limit the CJP welds to the locations required by stress or certain non-redundant joints. Providing the actual demands will empower the fabricator to provide the most cost-effective and safest solution.

Allow single-sided standard and extended shear tabs. Single-sided connections are a well-tested simple shear system used in steel construction. Oftentimes, they are not allowed by the engineer of record (EOR). It would be most useful if this type of system selection was left to the fabrication industry. A proposed improvement to omitting their use altogether on a project would be for the EOR to allow these connections while also denoting specific locations where there may be technical concerns.

Allow “finish to bear” joints for heavy axial connections. Heavily loaded compression joints for columns and trusses can often be spliced most easily using a “finish to bear” joint. The splice is generally configured with an end plate or flange plate for heavily loaded truss-type compression connections. Column connections may just have the two column sections bear onto one another with nominal connectors to hold the column sections together. This load path is an economical method to transfer compressive forces and reduces the amount of bolts or welds. Alternative methods to connect these compression elements using only bolts or welds, and without material bearing, will require the connection to be configured to resist the entire force through the connectors. This can create a connection solution that can be costly to fabricate and construct. Section J1.4 of the AISC Specification for Structural Steel Buildings (ANSI/AISC 360, aisc.org/specifications) outlines the proper procedure to be followed.

Make every attempt at using single-pass fillet welds. It is commonly known that fillet welds are the more preferred method of welding for most fabrications. Fillet welds require limited material preparation, especially for 90° joints, and quality control of these joints is simpler in practice. Specifying engineers should also differentiate between multi-pass fillet welds and single-pass fillet welds. The most eco-

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nomic fillet welds are those that can be made in a single pass. Most often, stretching the weld out so that a single-pass weld can be accomplished is more economical than bumping the weld throat. As an example, per Figure 1 (on page 39), increasing a weld from a $\frac{5}{16}$-in. single-pass weld to the $\frac{3}{8}$-in. multi-pass weld requires three times the weld metal volume and labor for a 20% increase in strength. And a $\frac{5}{8}$-in. weld requires six times the weld metal and labor for twice the strength.

Communication Improvements

Now that we’ve highlighted some efficiency tips from the shop floor, let’s look at some communication advice that can improve projects.

**Provide adequate design information to complete delegated scope of work.** Delegated connection design is an important part of the steel construction process in much of the U.S. The AISC Code of Standard Practice for Steel Buildings and Bridges (ANSI/AISC 303, aisc.org/code) dedicates a portion of the text to guidance on how connections are delegated and the required information to adequately perform that scope of work. It is incumbent upon the EOR to ensure there is adequate design information at the start of the project to complete the delegated scope of work. Key to this effort is for the EOR to produce design documents that contain the information outlined in Section 3 of the Code. It is also incumbent upon the delegated design professional to review the provided information and define RFIs early on in the project to clarify any and all information that may be missing.

As the EOR, take the opportunity to draw adequate indicative design details of the most critical structural joints. Complicated structures often have joints with critical load paths that require focus and understanding from many different perspectives. These joints require adequate force documentation and often fabricator involvement to fully develop the detailed solution. Crucial to developing these complex joints, especially when the final details are delegated to the fabricator, is for the fabricator’s engineer to understand the design intent. It is often not critical for the final design to exactly match the initially prepared indicative details. The EOR’s effort in developing these design details will assist the fabricator and their engineer in completely understanding the EOR’s design intent. See Figures 2a and 2b for an example progression of a well thought-out EOR indicative detail to the final delegated design solution detail, and then Figure 2c for an image of the fabricated product.

**Limit the specification of full capacity connections to only required locations based on analytical demand.** Full-capacity connections specified where not required add costs to a project without adding much value. As an example, if the EOR specifies a full capacity connection for a joint with a demand of $0.5 \phi M_p$, it may drive this connection to have field-welded CJP flanges or potentially a bolted connection with flange reinforcement. Providing the actual forces will allow for a proper connection to be developed by the delegated design professional, reducing needless reinforcing and extraneous cost.
Keep communication open between design and construction team members. There are times in today’s project marketplace where it seems a “virtual Great Wall of China” is placed between professionals on the design and construction sides of the project. The goal of this is to make sure that a third party can manage the scope of work or communication. While managing project change is an important task for general contractors, construction managers, and owners, over-managing important technical discussions between professionals or worse, eliminating the opportunity for these discussions to occur at all, can be a hazard to the project. The previous discussion on indicative engineering information presents a project success where the EOR and the delegated design professional were able to discuss the direction of some major nodes on a project to find a cost-efficient fabrication solution. The efficiencies weren’t due to material weight but rather to welding access, volume, and placement. In this case and often in general, the delegated design professional will find a concern and request a discussion with the EOR. These discussions are important even if nothing becomes of them. It offers the two professionals the ability to discuss critical parts of the structure so that both have a firm understanding of the outcome. Guessing in these situations, especially when communication is intentionally inhibited, just extends the approval process or, worse yet, runs a major risk of having something technically important get missed, creating an unsafe condition.

Structural steel is a dynamic material and specifying it properly, including the forces, connection material, and bolting and welding strategies, is an integral part of assuring cost effective steel solutions. Equally critical is ensuring that efficient and effective technical communication continues to occur so that the structures we design and build are safe for use.

Want to learn more about improving communication and avoiding unnecessary costs? Attend the session “Design and Detail Issues that Add Cost to Structural Steel Projects and Suggestions to Improve” at the 2020 NASCC: The Steel Conference, taking place April 22–24 in Atlanta. For more information and to register, visit aisc.org/nascc.
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booth 1634
Chicago, Ill.
ph: 312.285.5344
www.dotqs.com
DOT Quality Services is a specialized firm that develops standards of performance and creates and conducts supplier audit programs. Whether you need assessments for your entire supplier base or an audit for a single contract, DOTQS provides quantifiable information. DOTQS utilizes experienced quality professionals and engineers with technical and quality system credentials to assure an effective assessment service.

DuraFuse Frames
booth 1324
West Jordan, Utah
ph: 801.727.4060
www.durafuseframes.com
DuraFuse provides innovative steel moment frames for resisting wind and earthquake forces. Our field-bolted moment frames use replaceable fuse plates to prevent beam and column damage during severe earthquakes, and our optimized connection geometry reduces material and construction costs. We provide complimentary design assistance to engineers and have a competitive license fee. DuraFuse frames are code-approved (IBC, CBC) for beams up to 40 in. deep and 309 lb/ft (see ER-610).

EDSCO Fasteners
Booth 1712
Denton, Texas
ph: 866.443.3726
www.edsco.com
EDSCO is the leading supplier of foundation anchoring systems for critical infra-structure installations such as power transmission poles and substation structures as well as anchoring systems for Department of Transportation (DOT) structures, communication towers, and heavy industrial construction applications. Anchoring systems provided by EDSCO range from specialty fabricated bolts to highly-engineered anchoring cages, fabricated in a wide variety of configurations, and nearly always to custom specifications. Served from five locations in Utah, Texas, Tennessee, North Car-olina, and Indiana.

Engineering Ministries International
booth 1945
Columbus, Ind.
ph: 719.633.2078
www.emiworld.org
By means of short-term mission trips, eMi offers a technical design service to Christian organizations in developing countries. In last 35 years has worked on 1,400+ projects in 91 countries. Offices in Colorado Springs, Canada, England, Nicaragua, Middle East, South Africa, Uganda, Senegal, India, and Cambodia.

Ercolina – CML USA, Inc.
booth 125
Davenport, Iowa
ph: 563.391.7700
www.ercolina-usa.com
CML USA, Inc. is the North American supplier of Ercolina tube, pipe and profile bending and metalworking machinery. CML has experienced sales, service and support staff ready to offer positive application solutions for today’s fabricator. Ercolina’s affordable tubing benders and fabricating machinery reliably and accurately produce your applications increasing profit and improving prod- uct quality and finish.

Exact Detailing
booth 1430
Victoria, British Columbia
Canada
ph: 250.590.5244
www.exactedetailing.com
Exact Detailing Ltd. is quickly becoming Canada’s premier specialist in steel detailing, 3D modeling and BIM survey services. Exact provides timely, accu- rate, and affordable detailing services. The Company prides itself in producing shop drawings that are fully compliant with ABC and CISC standards. Exact also provides a full suite of other services including proj- ect management/coordinating, connection design, data management, and state of the art surveying through one of its strategic partners.
Freedom Tools LLC has successfully had their EZ J O I S T  R E L E A S E  T O O L S on the market for 11 years. Our tools have been proven to save our customers a tremendous amount of money on every job site. Not only are they faster they are safer. Our EZ BEAM RELEASE TOOLS works on the same principle with “T” beams. Faster and Safer. This year we are introducing the Special EZ Beam Release 8 in., 5 in. and 4 in. beam tools. Proven to set an “I” beam every 2 minutes 10 seconds. Our tools meet OSHA Standards. “Safety is our #1 Goal”

Fujian Tenlead Advanced Material Co., Ltd.
booth 1631
www.ten-lead.com

G & J Hall Tools
booth 1841
www.gjhalltools.com

GERB Vibration Control Systems
booth 1406
www.gerb.com

Gerdau
booth 931
Tampa, Fla.
ph: 813.367.8144
toll free: 800.237.0230
www.gerdau.com

Girder-Slab Technologies, LLC
booth 1721
www.girderslab.com

Giza
booth 1039
St. Louis, Mo.
ph: 314.656.4615
www.gizasteel.com

Giza provides connection design software that covers more than 300 different connection types in the shear, moment and vertical brace categories. Compliant to AISC 14th, 15th editions—ASD and LRFD methods, Giza provides a comprehensive set of calculations with references to all applied codes. We have full integration with Tekla Structures, Tekla Structural Designer and can be used as a standalone option. GIZA has been in use for over eight years and has successfully designed thousands of connections on thousands of projects over that time. Try it yourself free for 15 days!

Glentec-Endeavor Engineering Inc.
booth 1061
Hillsboro, Ore.
ph: 503.966.1340
www.endeavoreng.com/glentec

Glentec, an Indian based global engineering services provider with a U.S. focus, offering includes structural steel detailing, and Building Information Modeling (BIM); also having the following domain expertise: infrastructure, energy, process control, manufacturing, and general heavy industry. Endeavor Engineering Inc., a 20+ year history creating intelligent systems and fueling them with data, big and small, to create new cyber-physical value in a global setting. Together Glentec and Endeavor Engineering Inc. provide broad hard and soft engineering capabilities with a local hands-on touch.

Grating Fasteners
booth 1953
New Orleans, La.
ph: 504.361.3471
toll free: 800.227.9013
www.gclips.com

Grating Fasteners specializes in producing the G-Clip line of fastening fasteners. G-Clips are used to attach grating to structural members using simple hand tools. The entire G-Clip line of fasteners are noted industry-wide as being a cost-effective, fast, and dependable way to fasten grating.

Greenbrook Engineering Services
booth 1427
Middlesex, N.J.
ph: 732.412.8000
www.greenbrookengineering.com

Greenbrook Engineering specializes in Steel Detailing, 3D Modeling, Connection Design and B.I.M. coordination services for the steel industry. With offices in New Jersey and a production center in Bangalore, India, we serve the Structural Designers, Steel Fabricators and Architects. We have in-house engineering capabilities to design connections in several states across the country.

GRM Custom Products
booth 1629
Conroe, Texas
ph: 936. 441.5910
www.grmcpc.com

For over 50 years, GRM Custom Products has worked with engineers, fabricators, and contractors to provide structural products and solutions on a wide variety of projects. As the exclusive fabricator of Fluorovgold Slide Plates in North America, we manufacture our products to meet your project’s specifications and schedule. Any design with connections needing expansion can benefit from using slide plates. With our experience in manufacturing a wide variety of structural bearings, we can help you design your handle rotation, vibration and thermal expansion using a variety of materials.

Grupo Cano
booth 1625
www.grupocano.com.mx

Gsource Technologies, LLC
booth 1852
www.gsourcedata.com

June 2023
HARSCO IKG
booth 1827
www.harscoigk.com

Haydon Bolts, Inc.
booth 1239
ph: 215.557.8700
www.haydonbolts.com

Haydon Bolts manufactures headed bolts, threaded rods, anchor bolts, u-bolts and swedge bolts, in plain and galvanized finish, with full mill cert traceability. Haydon also carries the largest inventory of A325 and A490 Heavy Hex Head, Tension Control (TC) bolts, weld studs and wrenches, on the east coast.

Hercules Bolt Company
booth 923
www.herculesbolt.com

Hercules Bolt Company provides tube bending, bending of pipes, bar bending, beam bending, structural steel bending and plate rolling for OEMS and construction projects. We feature fabrication of structurally formed alloys, including tank manufacturing, plate rolling, angles, bars, brick lintel, pipe and tubes.

HRV Conformance Verification Associates, Inc.
booth 1529
Moon Township, Pa.
ph: 412.299.2000
www.hrvin.com

Leading experts in materials QA/QC inspection, coatings inspection, ND/T, and CM/CI focused on transportation, rail and transit, oil and gas, power, commercial, and water/wastewater markets, with the capacity to provide AWS CWI, NACE, SSPC, ACI, PCI and API inspections in materials fabrication plants and on project sites. We excel by maintaining high standards of technical training, leveraging deep industry knowledge and experience, practicing ethical conduct, applying innovative technologies, and communicating openly with our clients. We are Quality Assured.

Hypertherm, Inc.
booth 1049
Hanover, N.H.
ph: 603.643.3441
toll free: 800.643.0030
www.hypertherm.com

Hypertherm designs and manufactures industrial cutting products for use in a variety of industries such as shipbuilding, manufacturing, and structural steel construction. Its product line includes cutting systems, in addition to CNC motion and height controls, CAM nesting software, robotic software and consumables. Hypertherm systems are trusted for performance and reliability that result in increased productivity and profitability for hundreds of thousands of businesses worldwide.

IAPMO Uniform Evaluation Service
booth 1147
Ontario
Canada
ph: 909.472.4100
toll free: 877.443.7778
www.uniform-es.org

IAPMO Uniform Evaluation Service is a not-for-profit, public benefit company that evaluates building products, components, methods, materials and systems for conformance to codes and standards and certifies continued compliance. Upon completion of the evaluation, IAPMO UES publishes reports that summarize conformance, which are available free of charge to users, regulators, and specifiers. Current steel related activities include steel deck, steel wall and roof cladding, structural steel members, cold-formed steel framing, steel connectors, and steel fasteners.

IDEA StatiCa
booth 1717
Brno
Czech Republic
ph: 420.725.078.287
www.ideastatica.com

IDEA StatiCa Connection is a revolutionary software for structural design of steel connections/joints. It is based on a new CBIFEM method and allows structural engineers to design and check connections of all topologies in minutes. IDEA StatiCa is improving workflow of engineers all around the world by linking to FEA and CAD software they use.

IES, Inc.
booth 1623
Bozeman, Mont.
ph: 406.586.8988
toll free: 800.707.0816
www.iesweb.com

For over 25 years, Integrated Engineering Software (IES) has been developing user-friendly structural software that helps you efficiently solve a wide range of real-world problems. While our most versatile product, VisualAnalysis, can be used to analyze and design almost any three-dimensional structure, we also offer a variety of task-specific programs: ShapeBuilder, VisualFoundation, ConcreteBending, ConcreteSection, VMConnect, and more. Discover why thousands of engineers worldwide depend on Integrated Engineering Software.

Infasco/Ifastgroupe
booth 1322
www.infasco.com

INFASCO is a leader in the development and manufacturing of innovative technologies for improved productivity and profitability in the industrial marketplace. INFASCO designs and manufactures the highest quality industrial bolting systems and power tools, with a focus on ease-of-use and intuitive operation.

HYTORC
booth 1514
Mahwah, N.J.
ph: 201.512.9500
www.hytorc.com

HYTORC makes industrial bolting safer and simpler. With 50 years of experience focused entirely on developing the highest quality industrial bolting systems, HYTORC is the most trusted name in the industry. From steel mills and mining equipment to refineries, power plants, and wind turbines; we have developed solutions for every bolting application imaginable. For custom projects, our highly experienced engineering team is at your service to design the most efficient solution for your job with simple operation and economical pricing in mind.
InfoSight Corporation
booth 1720
Chillicothe, Ohio
ph: 740.642.3600
toll free: 800.642.3600
www.infosight.com
Since 1993, InfoSight has been providing solutions to marking and labeling dilemma that fit a wide range of budgets. Our solutions include providing preprinted metal tags to track a single job from start to finish, a tag and laser printer systems that print our durable metal tags on-site, and custom engineered automated marking systems that mark plates, blooms, billets, pipes, and more as they are being formed. A great identification system can reduce costs, eliminates waste and, quite possibly, give you a leg-up on the competition.

Infra-Metals Co.
booth 821
Langhorne, Pa.
ph: 215.741.1000
toll free: 800.899.3432
www.infra-metals.com
Infra-Metals Co. is one of the largest structural steel service centers in the United States. We are well-positioned to satisfy your needs in New England, Mid-Atlantic, Midwest, Southwest and Florida. As a subsidiary of a leading international company, Infra-Metals is provided with secure financing and has a strong commitment to steel distribution and processing. Infra-Metals offers unparalleled service with on-time delivery and a substantial lineup of processing equipment. Anyone can quote a price, Infra-Metals can quote it from stock.

Inovatech,
A Lincoln Electric Company
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Vankleek Hill, Ontario
Canada
toll free: 877.453.0516
www.inovatechengineering.com
Inovatech is in the business of providing integrated robotic solutions for manufacturing. We work continuously to improve production speed, productivity and customer profitability. Our CNC engineers take the time to understand your business concerns and develop fabrication solutions that fit your company’s unique requirements.

International Design Services, Inc.
booth 1039
St. Louis, Mo.
ph: 314.872.1791
www.ids-inc.net
IDS is committed to delivering the highest quality of detailing and connection design services. Our over 600 team members, including connection design engineers, detailers, and supporting staff provide ample manpower to support any project type and schedule. Our shop drawings and calculations are produced under the direct supervision of licensed professional engineers. In addition to 3D and BIM Models in SDS/2 or Tekla, IDS provides NC1, CNC, DXF, DSTV, and other production file formats.
Interstate Gratings
booth 1359
Lindon, Utah
ph: 801.922.4700
toll free: 888.499.8494
www.interstategratings.com
Interstate Gratings operates in a 120,000 SF fully-integrated manufacturing and fabricating facility, ideally located in the hub of the west. We have a highly experienced in-house detailing and project management team. Our custom automated CAD solutions provide seamless integration with our shop processes and our advanced CRM solution accurately tracks jobs from start to finish. With an expert team of grating professionals, state-of-the-art equipment and integrated technology, Interstate Gratings is prepared to take on any job of any scope or schedule.

Ironworkers/IMPACT
booth 1713
Washington, D.C.
ph: 202.393.1147
toll free: 800.545.4921
www.impact-net.org
IMPACT is a labor management partnership designed to provide a forum for union ironworkers and their signatory contractors to address mutual concerns and encourage reasonable, balanced solutions. Our primary mission is to expand job opportunities through progressive and innovative labor management cooperative programs, providing expertise in ironworker and contractor training, construction certifications, safety, marketing, and construction project tracking and bidding.

Irys Global, Inc.
booth 1842
Rodney, Ontario
Canada
ph: 519.652.6625
toll free: 800.711.IRYS
www.irysglobal.com
We are a company that offers customers immediate access to a professional virtual desktop solution. If you always wanted to continue your work when you go home but found it hard to do that due to technical limitations, look no further. There are many benefits that come from using our virtual desktops. For example, we provide concurrent user logins, which means each desktop has 2 login accounts that can be accessed one at a time. This way you can cut the licensing costs in half while also extending your productivity and taking it to the next level. It's the ultimate remote office solution.

ITT Endine
Bridge Pavilion
booth 1451
Orchard Park, N.Y.
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Our highly engineered structure protection components and custom solutions are built to take on whatever Mother Nature can dish out. With over 20-plus years of experience, Endine offers a diversified portfolio of energy absorption products for infrastructure and equipment protection. Endine offers the fastest service in the industry, the highest-quality products and in-house product development. No matter what seismic protection solutions you need, we get the job done.

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ph: 610.944.8840
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Cheap Detailing Ain’t Cheap! J.B. Long, Inc. has supplied structural steel and miscellaneous iron detailing to the fabrication industry for 35 years.

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booth 1239
Joliet, Ill.
ph: 815.726.5885
toll free: 800.888.5885
www.jhbotts.com
As specialists in manufacturing anchor bolts from raw material emphasizing ASTM F1554 and ASTM A449 material, we stock many ½ in. to 3/8 in. diameter round bars in 20 ft-0 to 40 ft-0 lengths. Additionally, we can manufacture using many different grades of material including ASTM A615 rebars, Stainless Steel rods and other assorted carbon steel grades. Our ability to produce within the tolerances prescribed by the American National Standards Institute (A.N.S.I.) make us a valuable asset to our customers.

JMT Consultants, Inc.
booth 1630
Atlanta, Ga.
ph: 204.510.1547
www.jmtconsultants.com
JMT Consultants Inc. is an innovative structural consulting firm that specializes in steel detailing, rebar detailing, panel book detailing, connection design, fabrication estimates, estimate models and providing consulting specifically related to the use of Tekla Structures and Tekla PowerFab. We are also committed to providing a quality design and detailing service in both the Commercial and Industrial sectors while maintaining a reputation for excellence both in services provided and as a place to work.

Kinetic Cutting Systems, Inc.
booth 331
West Burlington, Iowa
ph: 319.754.5040
toll free: 800.606.2954
www.kineticausa.com
Kinetic manufacturers a variety of precision CNC plasma and flame cutting machinery, as well as multi-process machines that combine machining operations such as drilling, tapping, milling and interpolation with cutting operations. One Machine—Complete Parts—Start to Finish. Kinetic offers a complete solution for the Structural Steel Industry. Featured at the show will be the K5200XMC with Automated Material Handling system.

Kobelco Welding of America, Inc.
booth 601
Stafford, Texas
ph: 281.240.5600
www.kobelcowelding.com
Kobelco, your best partner for structural steel fabrication, including seismic application is proud to be one of the few companies that develops all of its own original welding materials, welding robots, and welding power sources.

Kottler Metal Products, Inc.
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Willoughby, Ohio
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www.kottlermetal.com
Structural steel bending and fabricating specialists. Kottler Metal Products is proud to have one of the largest pipe, tube, and structural steel bending capacities in the Midwest, bending up to 10 in. angle, 20 in. pipe and tube, and 40 in. channel and I-beam, both easy-way and hard-way. Family owned and built on a 100+ year legacy, our business philosophy is based on a dual commitment to quality and service. For five generations we have maintained the tradition of producing the highest quality of metal fabrications throughout the world.

KTA-Tator
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ph: 412.788.1300 | toll free: 800.245.6379
www.kta.com
KTA provides government, facility owners, engineers and contractors peace of mind that the integrity of steel and concrete structures are properly assessed and protected. KTA provides professional consultation and support during any phase of a project—design, construction, post-construction and maintenance. KTA specialties include steel and concrete fabrication inspection; NDT; coatings and corrosion engineering and inspection; field and lab coatings failure analysis; and coatings training. KTA also distributes a complete line of field inspection instrumentation.

LAP Laser, LLC
booth 401
Erlanger, Ky.
ph: 859.283.5222
www.lap-laser.com
LAP is one of the world’s leading suppliers of systems that increase quality and efficiency through laser projection, laser measurement, and other processes. Our laser projectors accelerate manual setup by up to 50 percent. You deliver the CAD data, we project it true to scale onto your production tables and pallets—for the precise, flexible, and fast display of cut-outs, formwork parts, and mounting elements. Our laser systems support quality assurance so you can precisely adhere to the exacting demands in the production of wall elements, prefabricated ceilings, or double walls.

Lapeyre Stair
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www.lapeyre-stair.com
LARSA, Inc.
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www.larsa4d.com
LARSA 4D analysis and design software addresses the specialized needs of cable-stay, suspension, curved, skewed, and other bridge forms, as well as structures requiring geometric nonlinearity or a staged analysis. Standard in leading underground utilities for bridge design and construction analysis, LARSA 4D continues to lead innovation in analysis and support.
LeJeune Bolt Company  
booth 1022  
Burnsville, Minn.  
ph: 952.890.7700  
toll free: 800.872.2658  
www.lejeunebolt.com

LeJeune is the leading international supplier of structural fasteners and installation tools as well as inventor of the ASTM F3148 TNA Fastening System. Our TNA Fastening System is changing the way the steel construction industry engineers and implements bolting best practices. The Torque + Angle Installation Method is the most accurate, reliable, and repeatable of all the existing methods. The 14ksi tensile strength bolts provide simplicity and cost savings unmatched by legacy bolt strengths. Online purchasing is fast and easy.

Lincoln Electric Company  
booth $10  
Cleveland, Ohio  
ph: 216.481.8100  
www.lincolnelectric.com

World leader in the design, development and manufacture of arc welding products, robotic arc welding systems, plasma and oxy-fuel cutting equipment and has a leading global position in the brazing and soldering alloys market. Headquartered in Cleveland, Ohio, Lincoln has 48 manufacturing locations, including operations and joint ventures in 19 countries and a worldwide network of distributors and sales offices covering more than 160 countries.

Lindapter  
booth 1139  
Leander, Texas  
ph: 866.566.2658  
www.lindapterusa.com

Over 85 years, Lindapter has pioneered the design and manufacture of Structural Steel Clamping Systems and HSS Blind Fasteners, enabling faster steel construction. Products include the Hollo-Bolt, the HSS expansion bolt approved by ICC-ES for all Seismic Design Categories (A through F); while the Girder Clamp is approved for quickly connecting W & S beams. Lindapter connections eliminate the need for time-consuming drilling or welding in the field and reduce time and labor costs.

Linders Specialty Company, Inc.  
booth 1749  
St.Paul, Minn.  
ph: 651.488.0528  
www.lscmetalfab.com

Linders Specialty Company specializes in Structural Steel Rolling, Plate Rolling, Tube Bending, Flat Plate and Tube Plasma Cutting, Brake Forming, Sawing and Fabrication. With over 50 years of high quality craftsmanship specializing in industries such as Agriculture, Food Processing, Military, Mining, Construction and Art, we have become one of the most experienced fabricators in the upper Midwest.

LNA Solutions  
booth 1743  
Buffalo, N.Y.  
ph: 714.677.3035  
toll free: 888.724.2323  
www.lnasolutions.com

LNA Solutions is the premier supplier of steel-to-steel connection products including Seismic-Approved BoxBolt® Blind Fasteners and Beam-Clamp® Structural Steel Connectors. Our wide range of pre-engineered connectors deliver safe, cost effective solutions that never need field drilling or welding, installing easily with basic hand tools, saving you time on the job. High quality LNA products, services and warehouses are based in North America. Trust LNA Solutions for every structural application wherever steel connects to steel.

LS Industries  
booth 1325  
Wichita, Kan.  
ph: 316.267.9977 x328  
toll free: 800.835.0218 x328  
www.lsinustries.com

From design and manufacturing, to parts and service LS Industries is committed to providing the highest levels of performance in addressing your metal cleaning needs. LS Industries engineers, designs and manufactures metal cleaning equipment. We are a fully integrated manufacturer of airless shot blast cabinets using conveyor and monorail systems. LS also has complete product lines of cleaning systems for rebar, pipe and tubing; dust collectors; parts washers and vibratory tubs.

LTC, Inc.  
booth 1246  
Onalaska, Wis.  
ph: 608.786.0893  
www.ltcloftsanddetailers.com

LTC is an innovative structural steel detailing company that has been producing quality shop drawings since 1985. We have production teams at both of our office locations in the U.S. and the Philippines, allowing us to provide exemplary service at a competitive price. We exclusively use Tekla and are proud to have worked on some of the largest projects in the industry, including professional stadiums and high-rise towers. Additionally, we have in-house software teams that provide custom business software applications for clients, including customized scripts using the Tekla and FabSuite APIs.

LUSAS  
booth 1457  
New York, N.Y.  
ph: 646.837.8756  
toll free: 800.97.LUSAS  
www.lusas.com

LUSAS finite element analysis software provides accurate and cost-effective analysis, design and load rating of steel and concrete bridges. Used widely by Consultants and DOTs for frequency, seismic, dynamic, nonlinear, buckling, fatigue, staged construction, creep and shrinkage, prestress/post-tensioning, soil-structure and rail track-structure interaction modeling and many other forms of analysis. Vehicle-load optimization facilities provides worst-case traffic and rail loading patterns. AASHTO and other design codes supported. Extensive results viewing and reporting options.

Mac-Tech  
booth 1059  
www.mac-tech.com

Mac-Tech is the world leader and rotating and heavy lift telehandlers. ELIMINATE THE NEED TO RENT A CRANE! Mac-Tech offers 15 rotating models with lift heights from 37–150 feet and lifting capacities from 11,000–28,600 lbs. There are 100 attachments which allow the machine to serve as a telescopic forklift, RT crane, work platform and more. Mac-Tech is the safest, most productive and efficient machines in their class. Mac-Tech also offers eight heavy lift models with lifting capacities from 22,000–110,000 lbs.

Manni Sipre S.p.A.  
booth 1161  
www.mannisipre.com

Manni Sipre, together the American subsidiary Manni Green Tech USA, represent the leading European service and fabrication center with over 70 years of market presence. Our specialization is welded girders, plates/beams cut, and drill to size and finished steel structures. We process yearly 450,000 tons and we keep available stock level in our plant of approximately 30,000 ton/month. We are an AISC certified building fabricator.

Max Weiss Co., LLC  
booth 1750  
Milwaukee, Wis.  
ph: 414.355.8220  
toll free: 888.649.3477  
www.maxweiss.com

Our unique structural rolling/forming process and skilled craftsmen provide exceptional quality and tight radius bending with very minimal distortion of the finished steel. We have the capability of rolling and forming a wide variety of sizes of structural steel sections and tubing easy way, hard way, and off-axis to accommodate the most difficult and unique projects. We also offer many value-added fabrication services including splitting, notching, straightening, trimming, drilling, certified welding and much more.

McCann Equipment, Ltd.  
booth 1522  
Salem, N.H.  
ph: 603.893.7662  
toll free: 800.356.5624  
www.eptools.com

EPIH specializes in Steel Erector and Torque Tools such as: Tone, Electric; TorqFusion, Pneumatic, Electric and Battery; Torcup, SPF Power Team Hydraulics; Cylinders and Pumps; Skidmore-Wilhelm Bolt Tension Calibrator; Kabo Torque Wrenches and Torque Testers; Klein Drift Pins up to 1% in., Structural Wrenches and Accessories. We operate an ISO 17025:2005 Accredited Calibration Facility for Repair, Calibration and Certification with NIST Traceability. We also have the capability to service virtually any make and model torque tool.

Magni Telescopic Handler  
booth 1733  
Roselle, N.J.  
ph: 908.280.8899 x110  
toll free: 833.624.6487  
www.magnith.com

Magni Telescopic Handlers is the world leader and rotating and heavy lift telehandlers. ELIMINATE THE NEED TO RENT A CRANE! Magni offers 15 rotating models with lift heights from 37–150 feet and lifting capacities from 11,000–28,600 lbs. There are 100 attachments which allow the machine to serve as a telescopic forklift, RT crane, work platform and more. Magni’s are the safest, most productive and efficient machines in their class. Magni also offers eight heavy lift models with lifting capacities from 22,000–110,000 lbs.

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www.mannisipre.com

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Mac-Tech  
booth 1059  
www.mac-tech.com

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www.magnith.com

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Modern Steel Construction magazine
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www.modernsteel.com
Modern Steel Construction magazine is the official publication of the American Institute of Steel Construction. By focusing on innovative and cost-effective steel designs and applications, Modern Steel Construction brings its readers in-depth information on the newest and most advanced uses of structural steel in buildings and bridges. Modern Steel Construction is the leading magazine for professionals involved in the design and construction of steel-framed buildings and bridges. Advertising in Modern Steel Construction is the best way for you to reach your customers directly.

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We offer Structural Steel Detailing and Engineering services, Connection Design Certification and Sealing with BIM Coordination for all the major Steel Fabricators in the U.S. Our company is a public corporation with HQ in India and our U.S. HQ in Atlanta, GA. We have a strong team of 400+ Detailers, Project Managers, Checkers and Connections Engineers in India in addition to PEs and project oversight from one of our four U.S. offices.

National Institute of Steel Detailing, Inc.
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Cheshire, Conn.
ph: 925.294.9626
www.nisd.org
The National Institute of Steel Detailing (NISD) is an international association that advocates, promotes and serves the interests of the steel detailing industry. We are comprised of company owners and professionals in the steel industry and offer membership to steel detailing firms and associated companies and individuals. By fostering a professional approach to business and advocating improved quality through member networking, education and certification, our members are highly regarded by fabricators, architects, engineers and contractors.

National Steel Bridge Alliance
booth 1557
Chicago, Ill.
ph: 312.670.2400
www.aisc.org/nsba
The National Steel Bridge Alliance (NSBA), a division of AISC, is a national, non-profit organization dedicated to the advancement of steel bridge design and construction. NSBA functions as the voice of the bridge fabricators and steel mills while also partnering with the bridge design and construction community. NSBAs partners include AASHTO, FHWA, state DOTs, design consultant, contractors, and academia. With these resources, NSBA is uniquely positioned to find solutions to the toughest bridge challenges, including those related to cost, sustainability, and performance.

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New Millennium engineers and manufacturers steel building systems ranging from standard steel joists and deck to architecturally unique steel joist and deck systems, including long-span composite slab floor systems, for dramatic cost savings to the building owner. The company also manufactures steel stay-in-place forms for steel and concrete bridge deckings. New Millennium is a leader in BIM based design for steel joists and deckings.

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www.nickelinstitute.org
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The Nickel Institute (NI) is the global association of leading primary nickel producers. Our mission is to promote and support the use of nickel in appropriate applications. Stainless steels account for about two-thirds of nickel produced. The International Molybdenum Association (IMOA) is a similar organization, representing the worldwide molybdenum industry. NI and IMOA have been actively involved in the Architectural, Building and Construction industries, and instrumental in the writing of the ASC Design Guide 27 and the new ASC Specification for Stainless Steel.

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Nucor and its affiliates manufacture steel and steel products, with operating facilities in the U.S., Canada & Mexico. Products produced include carbon and alloy steel in bars, beams, sheet and plate; hollow structural section tubing; electrical conduit; steel piling; steel joists and joist girders; steel deck; fabricated concrete reinforcing steel; cold finished steel; precision castings; steel fasteners; metal building systems; steel grating; and wire/wire mesh. Nucor is N.A.’s largest recycler.

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Short Span Steel Bridge Alliance
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www.shortspansteelbridges.org
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Southern Association of Steel Fabricators
booth 400
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The Southern Association of Steel Fabricators, a not-for-profit corporation, incorporated for the purpose of promoting the use of Structural Steel and Allied Products, to meet and discuss better methods of design, shop practice, field practice, and any other appropriate matters of general interest to the Steel Fabricating Industry.

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and Rail Division
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Steel Founders’ Society
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SFSA, akin to AISC, is a technical association. Members of SFSA are steel foundries who supply a range of cast steel products for demanding environments such as railroad, mining, construction, military, and nuclear. SFSA can assist you in utilizing steel castings for building construction. Steel castings offer performance, aesthetics, design freedom, and green manufacturing.

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www.steeljoist.org
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Structural Stability Research Council
booth 1642
Chicago, Ill.
ph: 312.670.7015
www.sssrcweb.org
The Structural Stability Research Council is a technical organization that focuses on the state-of-the-art understanding of the impact of stability related issues on the analysis, design, and behavior of metal structures. SSRC is comprised of engineers, educators, and industry members with an interest in stability related issues.

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New Hampshire Governor Visits AISC Member Fabricator

New Hampshire Governor Chris Sununu showed his support for American-made fabricated steel during a recent visit to Novel Iron Works. Governor Sununu spent time with workers and their families at Novel’s holiday luncheon and toured the plant.

Novel Iron Works is a third-generation, family-owned company that, along with sister company Rose Steel, employs 140 American workers, part of the 115,000 fabricated steel jobs nationwide. The Governor’s visit isn’t the only cause for celebration at Novel Iron Works, which was recently named one of the top women-led New Hampshire businesses.

“We were honored to have Governor Sununu join us at Novel Iron Works for our holiday luncheon and have him meet with our workers and their families,” said Hollie Noveletsky, CEO of Novel Iron Works. “As one of New Hampshire’s top women-led businesses, Novel Iron Works plays an essential role in the construction of America’s critical infrastructure. With more than 115,000 fabricated structural steel jobs across the United States, facilities like ours are truly the backbone of local communities in New Hampshire and beyond.”

“It was a great privilege to meet with New Hampshire’s fabricated structural steel workers yesterday at Novel Iron Works,” said Governor Chris Sununu. “Novel Iron Works serves as a jobs engine for our entire state. What Hollie and her team have built in Greenland is a New Hampshire success story—and something we are all proud of.”

The visit came during a critical moment for America’s fabricated structural steel industry, which has been injured by a surge of unfairly traded imports from China, Canada, and Mexico—resulting in almost $4 billion in lost sales and revenue since 2015. The industry, which supports hundreds of thousands of jobs across the country, filed trade cases earlier this year to stem the injury caused by these imports. Final determinations are due in January 2020.

“In September, Commerce issued its preliminary determinations, with troubling results,” said AISC Director of Communications & Public Affairs Brian Raff. “The Canadians and some of China and Mexico’s biggest offenders got a free pass to dump and subsidize fabricated steel into the United States with no penalty. If these results don’t change for the final determination, fabricators in New Hampshire and across the country are at risk.”

The domestic fabricated structural steel industry consists of approximately 1,700 employers throughout the country, many of which are small, family-owned businesses servicing local construction markets. The industry directly supports 115,000 jobs in fabrication and hundreds of thousands more suppliers, designers, and construction professionals and their families. Fabricated structural steel manufacturers play an essential role in the construction of America’s critical infrastructure, serving as the intermediary between steel mill producers and construction projects.

People and Companies

• Margaux Burkholder, SE, PE, has joined Walter P Moore’s Los Angeles structures practice as a senior associate. She specializes in seismic retrofit and performance-based design projects and has worked on a variety of project types including multi-family residential, commercial, mixed use, and retail. In addition, she is actively involved in the Women in SE committee of the Structural Engineers Association of Southern California (SEAOSC) and the National Association of Women in Construction (NAWIC).

• Thornton Tomasetti has launched Beacon, an embodied carbon measurement tool designed to provide structural engineers with the ability to measure embodied carbon, allowing for more informed decisions throughout the design process. An Autodesk Revit plugin, Beacon was developed through Thornton Tomasetti’s CORE studio, a firm-wide virtual incubator focused on innovation through computational modeling and research. “We decided to make Beacon an open-source and easy-to-use tool, so it can be shared at a global scale,” said Robert Otani, PE, principal and chief technology officer at Thornton Tomasetti. “We hope this unique and comprehensive tool will push the industry forward into developing innovative strategies that result in more sustainable and efficient structures.” (Otani is the speaker for the upcoming NASCC: The Steel Conference session “Artificial Intelligence: The New Frontier in Structural Design.” Find out about it in the Advance Program—and register for the conference—at aisc.org/nascc.) You can download Beacon at core.thorntontomasetti.com.

November president Josh Noveletsky (left) and N.H. Governor Chris Sununu (right) at Novel’s shop.
Welcome to our first monthly Safety Matters section, which highlights various safety-related items. This month’s edition focuses on ladders, poison, hazard communication, fall protection, and a safety session at NASCC: The Steel Conference.

Monthly AISC Safety Committee Notes

**Ladders.** According to the World Health Organization, the United States leads the world in ladder deaths. Each year, there are more than 164,000 emergency room-treated injuries and 300 deaths in the U.S. caused by falls from ladders. Most ladder deaths are from falls of 10 ft or less. There are plenty of ladder safety tips out there. For example, see the list of Basic Ladder Safety advice at [www.americanladderinstitute.org](http://www.americanladderinstitute.org) (under the Safety & Training tab).

Also, the design requirements for fixed ladders changed recently, and any fixed ladders that you add to your operation must meet new the requirements. One of the main requirements: Fall-arrest systems replace cages for new fixed ladders.

AISC presented a webinar on ladder safety, “One Rung at a Time,” in March 2018 (you can access it via the Safety Webinars link at [aisc.org/safety](http://aisc.org/safety)).

And remember, “While on a ladder, never step back to admire your work!”

**Poisons.** Poisons are all around us and can affect anyone, anywhere, at any time of life. Protect yourself and others from being poisoned by learning what a poison is, who is at risk, and how to prevent a poisoning from happening. In 2008, 2.5 million people called a poison center because someone had been exposed to a poison. Children under age six accounted for half of all human poison exposures reported to poison centers. However, adults are also at risk. That year, more than three-quarters of all poisoning deaths reported to poison centers occurred among people ages 20 to 59.

**Hazard communication.** The OSHA Standard for Hazard Communication is 1910.1200. The purpose of this section is to ensure that the hazards of all chemicals produced or imported are classified, and that information concerning the classified hazards is transmitted to employers and employees. The requirements of this section are intended to be consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS), Revision 3. The transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, safety data sheets and employee training. While there is much more to the regulations two requirements that can be problematic are assuring that Safety Data Sheets are available to employees and assuring that secondary containers are properly labelled.

**Fall protection.** The OSHA Standard for Fall Protection is 1926 501. Some form of fall protection appears on the list of frequent citations multiple times. This may be appropriate because falls are such a significant hazard in construction.

Safety at The Steel Conference

A this year's NASCC: The Steel Conference, taking place April 22–24 in Atlanta ([aisc.org/nasce](http://aisc.org/nasce)), Vicki O’Leary and Kathy Dobson will present “Work is Making Me Sick,” a discussion of health in the workplace. We’ve all been sick of work, but it can be a real issue when the things we expose our workers to make them sick. The costs associated with worker illness and workers compensation can make or break a company, depending on how they are managed. Fabrication shops and general office settings are full of hidden hazards that affect worker well-being and can impact the bottom dollar, from paints and solvents to an environment that is not conducive to a welcoming and safe work culture. This session will look at some of the more obvious hazards we expose our workers to, and also review other less common issues. This presentation will be helpful for people who work in offices as well as those who manage steel fabrication and erection facilities.

**Dates to Note**

- March is Ladder Safety Month. Find out more at [www.laddersafetymonth.com](http://www.laddersafetymonth.com).

**Management Challenge**

Have you looked at your Safety Data Sheets recently to see that your employees have all the information they need for the various hazards they are exposed to? Email safety@aisc.org and tell us the most recent change to your safety program.
Construction Employment Ends 2019 on High Note

Construction employment increased by 20,000 jobs in December and by 151,000, or 2%, in all of 2019, according to an analysis of new government data by the Associated General Contractors of America (AGC). Association officials noted that its recent survey found three out of four contractors expect to keep adding workers in 2020, but even more respondents found it difficult to fill positions in 2019, and a majority anticipate it will be as hard or harder to do so in 2020.

Officials called on the federal government to increase funding for career and technical education and expand employment-based immigration for workers whose skills are in short supply.

“More than four out of five respondents to our survey said they were having a hard time filling salaried or hourly craft positions in 2019,” said Ken Simonson, AGC’s chief economist. “Nearly two-thirds of the firms say that hiring will be hard or harder this year. In light of those staffing challenges, costs have been higher than anticipated for 44% of respondents and projects took longer than anticipated for 40% of them. As a result, 41% of respondents have put higher prices into their bids or contracts and 23% have put in longer completion times.”

Association officials said the optimistic outlook for projects depends on having an adequate supply of qualified workers. The officials urged the Trump administration and Congress to double funding for career and technical education over the next five years, pass the JOBS Act to expand opportunities for students seeking alternatives to college, and enable employers who demonstrate an unfilled need for workers to bring them in from outside the U.S.

“Construction can play a major role in sustaining economic growth, but only if the industry has an expanding supply of both qualified workers and new entrants to replace retirees,” said Stephen E. Sandherr, AGC’s CEO. “Construction firms are working hard to overcome labor shortages, but federal officials must do their part by adequately funding career and technical education, making it easier for students to qualify for loans for short-term technical education programs and putting in place needed immigration reforms.”
Quality Management Company, LLC (QMC) is seeking qualified independent contract auditors to conduct site audits for the American Institute of Steel Construction (AISC) Certified Fabricators and Certified Erector Programs. This contract requires travel throughout North America and limited International travel. This is not a regionally based contract and a minimum travel of 75% should be expected.

Contract auditors must have knowledge of quality management systems, audit principles and techniques. Knowledge of the structural steel construction industry quality management systems is preferred but not required as is certifications for CWI, CQA or NDT. Prior or current auditing experience or auditing certifications are preferred but not required. Interested contractors should submit a statement of interest and resume to contractor@qmconline.org.

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BIG, BLUE

WHEN IT RAINS, it pours.

And when it rains on the new vibrant blue canopy for the entrance to the Chicago Transit Authority’s (CTA) Belmont Station in the Avondale neighborhood on Chicago’s Northwest Side, the effect is that of a waterfall.

This is the exact intent of Ross Barney Architects and Simpson Gumpertz and Heger, whose design for the canopy was inspired by a waterfall from the bygone nearby Olson Park. The project is the most visually stunning element of CTA’s ongoing initiative to re-envision and improve 14 stations along the train system’s Blue Line.

EXP completed the structural work under the Walsh Group’s design-build construction team, and steel was fabricated by AISC member King Fabrication. The canopy’s structure is formed by five petal-shaped, architecturally exposed structural steel (AESS) frames that cantilever 68 ft over the station’s plaza and 28 ft in the other direction. The primary framing members that form the outline of the petals are built-up rectangular tube sections, which support hollow structural section (HSS) purlins that connect to the blue polycarbonate panels. The petals frame into a horizontal spine at the low point of the slope with custom castings supported on three 38-in. steel-encased concrete pipe columns, which conceal the drainage downspouts. In addition, cast steel nodes provided by AISC member Cast Connex navigate the complicated moment connections where the petal loops meet the spine, as a means to adequately resist the forces, simplify construction, and meet aesthetic requirements.
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