Correspondence

Quality Assurance

I have the following questions regarding the Quality Assurance Checklist on page 42 of the November 1996 issue.

All braced frames:

1. "Bracing checked for l/r per 2710(h)2." What does 2710(h)2 reference?
2. "For angles use r_z" What is r_z?
3. Chevron Bracing designed for 1.5 times other prescribed forces." Why is it necessary to multiply by 1.5?

In other respects this is an excellent checklist.

Thank you,

Dan Engel
Minneapolis, MN

Author's response:

1. 2710(h)2 is a reference from the 1991 Uniform Building Code. The equivalent 1994 reference is 2211.8.2.1.
2. r_z is cited in the AISC Manual of Steel Construction as the radius of gyration about the z axis.
3. 1.5 is a UBC requirement (reference 2211.8.4.1).

Painting Steel

I read your article, "Getting More Bang For Your Buck On Steel Projects," in the January 1997 issue of *Modern Steel Construction* with considerable interest. The comments about painting are quite valid and even being employed by a paint manufacturer are ones that you cannot totally argue with. I also concur with your overall sentiments about "Fast Track Construction" and the need for various entitites to work together. The purpose of this letter is to detail that the paint manufacturer also has a legetimate role to play.

I realize that coatings are seen as a necessary—or perhaps an unnecessary—evil by the steel fabrication industry. There is, however, a significant percentage of steel where coatings are undeniably required for corrosion protection. What a paint manufacturer can contribute are systems that can meet the fabrication process—without slowing production.

Fast dry, rapid handling coatings are now available for fast track construction. Over the last 10 years, progress has been made with coatings, with materials now available that have the following features:

- 1 -2 hour recoat (allows two to three coats to be applied in one day)
- 1-2 hour handling (steel can be moved quickly)
- damage resistance (early true cure can reduce damage to less than 1-3%, reducing site costs)
- low-temperature cure (materials that can cure down to 20°F to allow steel to be processed for all 12 months of the year)
- surface tolerant (suitable for the "Blast Fabricate Coat" process, where the fabricator can get all the benefits of working on blasted, millscale-free steel; these coatings include zinc rich materials for high-performance requirements)
- high solids, low VOC (essential requirements as fabricators are prime targets for regulators; using a high solids coating can reduce emissions by 20-30% without sacrificing productivity)

To summarize, I reiterate that coatings are not necessary on a considerable number of structures. However, on those where coatings are required, correct selection of materials can be comparable with the fabrication process, and can help fabricators meet schedules—without the worry that coatings usually cause fabricators.

Developments in this area are continuing. In the coming years you will see instant handling systems and thin film coatings that can provide one-, two- or three-hour fire protection. These advances will make "ultra fast track" a reality and enable buildings to open sooner.

Regards

Ian S. Rowell
Vice President
Courtaulds Coatings Inc.

Credit Where Credit Is Due

Thank you so much for publishing the article about Boston University MERC project in the January issue of MSC. Unfortunately, I inadvertently failed to provide adequate information about the preparers of the article. My colleague, Garen Gregorian, P.E., has contributed more than myself in the design of the project and the preparation of the article. The authors of the article "Steel Bracing Stabilizes Concrete Building" should have been Zareh Gregorian, P.E., and Garen Gregorian, P.E.

Sincerely,

Zareh B. Gregorian, P.E., FASCE
Consulting Structural Engineer
Belmont, MA

More On Monorails

I found the article "Flying On The Ground" (November 1996) regarding the new monorail system at Newark International Airport to be quite interesting. However, I would like to provide you with some information concerning the involvement of Thornton-Tomasetti Engineers with this exciting project.

While the article correctly points out that the ability of the current monorail vehicles to fit the existing "notch" saved extensive costs associated with reconstructing the air-side of the terminal, this was certainly not a "given" in the original request for proposal. In fact, Von Roll Transport Systems was the only bidder having a vehicle that would fit into the existing notch. (Even though the original notch was based upon a 1960s Westinghouse vehicle, the current Westinghouse vehicle was bigger and no longer able to fit, and Westinghouse was an unsuccessful bidder.)

As Von Roll's structural engineering consultant during the bidding stage, we were faced with two major challenges regarding the existing terminal structure at the notches. First, some of the design loadings for the current vehicles were greater than those specified in the original structural design criteria generated in 1967. Second, current fatigue criteria are more stringent than those upon which the original design was based. Using the current design loadings and fatigue criteria for standard detail classifications, the existing structure would not be able to sustain over 2 million cycles of loading, and would require extensive modifications. Therefore,

our firm, in conjunction with our metallurgical consultant Lucius Pitkin, Inc., performed a fracture mechanics analysis in order to determine the likelihood of crack propagation, based upon the current loading spectra and the specific details used in the existing construction. As a result, and after submittal of a formal static and fatigue structural analysis report to the Port Authority in December 1989 during the bidding stage, we concluded that the existing support structure at the terminals could be used without major modifications.

Needless to say, our determination that the existing terminal structure at the notches would not require major modifications was a key factor in Von Roll's winning of the project.

After Von Roll was awarded the project, Thornton-Tomasetti Engineers continued its involvement as Engineer-of-Record for the passenger terminal areas of the project. In addition to the final analysis and modification design of the existing terminal structures, we also designed new columns, bents and beam extensions where the external guideway beam alignment leaves the existing building notch at station approaches, as well as reviewed existing foundations for new loadings in the "courtyard" areas between passenger terminals. Along the main guideways, our involvement led to revised locations of expansion joints and slide bearings in order to distribute guideway longitudinal loads in patterns that the existing foundations could accommodate. In performing our work, 36 static and dynamic load combinations were analyzed, taking into account dead, live, impact, centrifugal, acceleration/braking, wind, thermal, friction and seismic loadings.

Best Regards,

Daniel A. Cuoco, P.E.
Principal, Thornton-Tomasetti
New York City

Structural Software Review

I enjoyed your January issue review of structural analysis software; however, I was disappointed that you didn't include my personal favorite, VisualAnalysis (VA).

VA has an easy-to-use windows interface. Creating a model is a simple matter of drawing, selecting members or joints and editing their properties. If you draw a new member framing into an existing one, a dialog pops up and asks if you want to connect the two. If you do, the existing member is automatically split and a joint is added at the intersection. Or, you can use the built-in templates to generate your model, then modify it to suit. Regardless, you never have to concern yourself with the minutia of joint or member numbering. As for the results, the graphics of deflections, moments and stresses are worth a ream of text reports.

Yes, VA does have weaknesses. Printed report formatting leaves a lot to be desired. I get around this by pasting results into a spreadsheet, where I can sort, filter and format them as I like. Analysis and report generation is fast enough for most problems but bogs down on really huge ones. I would guess that about 2500 members in a 3D model is a practical size limit, at least on my machine (486/100). Nevertheless, VA is well suited to the vast majority of problems that a majority of structural engineers encounter. This is particularly true of the new version (3.0), which incorporates second order (P-delta and p-delta) analysis, tension and compression only members, hydrostatic plate loading, and other goodies I haven't used yet (thermal loading, rotational dynamic lumped masses…).

One other feature sets VA apart from the analysis programs I'm familiar with: price. A full-featured program with an interface second to none for less than $600.

Yours truly,

John Bryan, P.E.

More Structural Software Review

I just received my January issue of Modern Steel Construction with Mr. Cattan's review of six of the structural programs presently on the market. While I may not be knowledgeable in all of the programs, I have or am currently using three of the programs, and have used Multiframe. As a company, we have reviewed demos of the others.

I can imagine Mr. Cattan's duties limit how deeply he can investigate each program, but I am concerned he may be placing too much importance on if the program runs in Windows or not. I also think it is critical that he concern himself more with the software accuracy and not just with the ease of input. Garbage in is still garbage out.

Of all the programs I have been looking at over the last two years, RISA3D is by far the best. One can actually match the results against the code. It is so easy to use you don't need the manual. I can build a large model in RISA within hours, which would have taken me days to build with some of the other programs. I was surprised Mr. Cattan did not mention some of the great features, such as P delta, moving loads, coping of loads with the members, etc., which he thought were so great in some of the other programs. By the way, it now has a graphical input mode, but for most structures I think the spreadsheet mode can't be beat. The program does have two problems, however, both of which the developer says will soon be fixed. The text graphics are too coarse and the program requires too much free RAM.

Michael D. Hubbarb, P.E.
Tyler, TX

Still More Structural Software Review

We were disappointed to see that Mr. Cattan had chosen to include in his review a version of ETABS V6.0 that was discontinued in August of 1995. We are always happy to receive press about our products as we feel that they are quality and productive pieces of software, as evidenced by the thousands of loyal firms around the world using our program. However, we also fee that a review of an outdated product has the potential of doing great harm.

In Mr. Cattan's review of ETABS, he makes numerous mentions of the DOS-based programs PLOTTER and TIMER, including two screen captures (Figures 2.3 and 2.4). This implies that ETABS is primarily a DOS-based program, which, given Mr. Cattan's pro-Windows stance, paints a negative image of the program. In reality, PLOTTER and TIMER were replaced by a Windows program called ETABSOUT in V6.1, released in August of

1995. When doing an analysis, the only portion of the program that is DOS-based is the underlying solver, which is activated through a Windows dialogue box, both the pre- and post-processors are Windows programs. We opted to keep the solver DOS-based because as a Windows 3.1 application, a DOS solver offered much faster solution times for large analyses than a native Windows 3.1 application.

Currently, we are shipping V6.13, which as release in May of 1996. The prior version, 6.12, added other Windows-based utilities. A quick check of our advertisements in your magazine, or a look at our brochure, would have shown that our current graphics programs are all Windows applications.

Although we realize that the graphics and interface are only one aspect of a structural analysis program—an aspect that is certainly of no consequence if the numerical solutions are not valid or if the program is not sophisticated enough to perform the needed analysis—it was the primary focus of Mr. Cattan's review. Because he dealt only with "ease of use", we feel that in the critique, ETABS was at a distinct disadvantage by not using the latest version with the added Windows applications. We have already received telephone calls from potential customers confused by the difference between what they saw in our brochures and the information in the review. Our disappointment was magnified by the fact that for other products Mr. Cattan extends the courtesy of discussing the very latest products, products that have been in the marketplace for a far shorter time than our current versions, and even goes so far as to mention for one program that a later version had been released after his review!

Unfortunately, once a review has been released, there is little that can be done to change the perspective of the reader, and in this case, we feel that your readers will be left with the impression that we are sorely outdated with regard to Windows. In reality, we have been programming for Windows longer than anyone else in our business, having started with Windows 2. We continuously work to enhance our products and to provide productive and useful programs, and we feel that Mr. Cattan's review did both us and your readers a great disservice by not reviewing our current offering.

Very truly yours,

Randall C. Corson, S.E.
Computers & Structures, Inc.

Additional Correspondence

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T.R. Higgins Award

Subhash C. Goel, Ph.D., a noted expert on the seismic design of braced structures, has been named the T.R. Higgins Lectureship Award winner for 1997. Goel, a professor of civil engineering at The University of Michigan in Ann Arbor, is well known for his work on seismic design and his studies have provided the basis for a new generation of seismic design codes for steel structures.

Named for Theodore R. Higgins, former AISC Director of Engineering & Research, the T.R. Higgins Lectureship Award is the steel industry's most prestigious annual honor. Each year, the Award recognizes an outstanding lecturer and author whose technical papers have made an outstanding contribution to the engineering literature on fabricated structural steel.

Goel's studies on seismic design have spanned nearly three decades, beginning with an early paper demonstrating that while braced frames had widespread use and popularity due to their inherent efficiency in resisting lateral forces due to wind or earthquake, the design codes heavily penalized them for their lack of ductility. His work demonstrating the merits of braced frames were ultimately recognized by

Subhash C. Goel

the design profession and national code bodies and the 1994 UBC and NEHRP Seismic Provisions both contain his proposed design procedures for concentric braced frames. These procedures, known as "Special Concentric Braced Frames" (SCBF), refine the design of bracing elements that have dimensional properties.

"These new limits on dimensional properties result in increased cyclic fatigue life during severe earthquake ground motions, which result in brace buckling and ensure ductile braced frame behavior," explained Robert D. Hanson, now with Federal Emergency Management Agency and formerly one of Goel's colleagues at the University of Michigan. Following the Northridge earthquake, Special Concentric Braced Frames are now allowed. Ordinary braced frame systems have never been allowed.

The T.R. Higgins Lectureship Award includes a $5,000 cash prize. In addition, the recipient is expected to present a paper on his work on at least seven occasions, with the first being the National Steel Construction Conference in May. As additional lectures are scheduled, they will be posted on AISC's home page on the World Wide Web (http://www.aiscweb.com).

The jury for the 26th annual Award consisted of: Kurt Gerstle, professor emeritus, University of Colorado (Boulder); Tim Fraser, division chief engineer, Canron Construction-Fabrication West; Lawrence G. Griffis,

senior vice president, Walter P. Moore & Associates, Inc., John Gross, research structural engineer, National Institute of Standards & Technology; William McGuire, professor emeritus, civil engineering, Cornell University; and William G. Zimmerman, president, Zimkor Industries.

Recent award recipients include: Donald R. Sherman for his paper on tubular connections; William A. Thornton for the Art & Science of Connections; Lawrence Griffis for composite frame construction; Roberto Leon for semi-rigid composite connections; William McGuire for computers & structural steel; and Thomas M. Murray for building floor vibrations.

Short Course On HSS Connections

In association with the American Iron & Steel Institute and the Steel Tube Institute, AISC is publishing a new manual on hollow structureal section (HSS) connections. The book, which is expected to be the definitive work on connecting wide flange sections to HSS members, as well as HSS members to other HSS members, is also the basis for a short course following this year's National Steel Construction Conference.

The Short Course, scheduled for May 10, will review and cover all aspects of HSS design and connections, including both simple and moment connections. The morning portion will include discussion on the material and the new design specifications for HSS members that the AISC Specification Committee has produced. Shear and moment connections also will be discussed.

The afternoon portion will include detailed information on many complicated connections that are used every day when designing with HSS members, including base plates and truss connections. Erection also will be covered.

Among the speakers preliminarily scheduled for the program are: Don Sherman of the University of Wisconsin-Milwaukee, who heads the AISC Specification Committee Task Group that prepared the manual and who also won the 1996 T.R. Higgins Lectureship Award based on his work with HSS connections; Jim Fisher of Computerized Structural Design, who is spearheading the writing of the manual; Larry Kloiber of LeJeune Steel Company; and Jeff Packer of the University of Toronto.

Registration for the course costs $275 ($225 for AISC members) and includes a copy of the new HSS Connections Manual. Educational credit for the course is 0.7 CEUs or 7.0 P.D.H.s.

Short Course Schedule

8:00 - 8:30 a.m.
Registration/Coffee & Rolls

8:30 - 8:45 a.m.
Welcome & Introductory Remarks

8:45 - 9:15 a.m.
Specification Highlights

9:15 - 10:00 a.m.
Materials, Welding & Bolting

10:00 - 10:15 a.m.
Refreshment Break

10:15 - 11:00 a.m.
Simple Shear Connections

11:00 - 11:45 a.m.
Moment Connections

11:45 a.m. - noon
Question/Answer Panel

Noon - 1:00 p.m.
Lunch

1:00 - 2:00 p.m.
Base Plates and Column Splices

2:00 - 3:00 p.m.
Tension and Compression Connections

3:00 - 3:15 p.m.
Break

3:15 - 4:15 p.m.
Truss Connections and Examples

4:15 - 4:45 p.m.
Constructability Issues for HSS Connections

4:45 - 5:00 p.m.
Question/Answer Panel

For more information, contact: Robert Lorenz, AISC Director of Education, at 312/670-5406 or fax 312/670-5403.

National Steel Construction Conference

With today's economic climate and the fast and furious pace of advancing technologies and resources, questions mount seemingly faster than they can be answered. AISC's National Steel Construction Conference is a once-a-year opportunity to delve into the rapidly changing and advancing world of steel design and construction and surface with practical information to help your practice today. The conference and exhibition, May 7-9 in Chicago, includes more than 25 problem-solving technical sessions as well as a comprehensive product exhibit.

This year, sessions are offered in five areas: erection; fabrication; engineering management; engineering technical; and welding. Following the conference there will be a separate short course on HSS Connections.

Some of the papers to be presented at NSCC '97 include:

- Bracing and Stability. This session will focus on new methods of analysis and design for stability that have become possible and practical as computers have become more powerful and more affordable. Included will be a look at simple energy methods of stability and analysis and their applicability to practical stability problems.
- Cladding on Multistory Steel Frames. This session will discuss a variety of different cladding systems and their effects on frame design.
- Moment Connections. This session will address current alternative details for SMRF connections in regions of high seismicity; implications of Northridge SMRF connection failures for wind-controlled moment connection designs; and new developments in extended end-plate moment connection design-use in seismic applications and the use of snug-tight bolts.
- Erection of Large Scale Projects. This session will focus on two large projects (International Terminal Building at Vancouver International Airport and the Rose Garden Arena in Portland, OR) to illustrate innovations in the design and construction and their effects on erection.
- Detailing for the Shop. A detailed discussion of detailing issues, including software concerns.
- Structural Welding Code Requirements. An in-depth look at changes in the 1996 ANSI/AWS D1.1 Structural Welding Code.
- What an Engineer Should Know About Welding Procedures. This presentation will discuss the capabilities and limitations of the welding processes commonly used for structural work.

- Innovations in Cutting, Burning and Welding. Emerging developments will be discussed in terms of their applicability to the fabrication of structural shapes.

For more information on NSCC '97, point your favorite Internet browser at AISC's web page at http://www.aiscweb.com or use the NSCC faxback service at 800/787-0052 x110.

Self-Inspecting Bridges

A highway bridge in the desert city of Las Cruces, NM, could revolutionize the way bridges across the country are inspected. The bridge, which leads motorists from University Avenue—and a nearby burger joint—onto Interstate 10 westbound is one of the nation's first large-scale bridges that can report its structural health to a remote location—minimizing the need for on-site inspections.

"Being able to monitor bridges from far away has great implications," explained Rola Idriss, the New Mexico State University civil engineering professor conducting the experiment. "The question is how to maintain aging bridges so we don't have to build new ones," Idriss said. "We can repair them if we know where and how they're damaged." An experiment similar to Idriss's but on a smaller scale was conducted in 1993 by engineer David Prine of Northwestern University. Prine installed a remote monitoring system of eight strain gauges on a Wisconsin bridge over Sturgeon Bay.

The Las Cruces interstate bridge is rigged with 30 sensors. It is a typical highway bridge from the 1970s and consists of eight 100' steel spans, including an on-ramp. One span of the bridge is wired underneath with instrumentation including a computer, sensors and a cellular phone—all too small for motorists to notice. The phone is used to transmit data to NMSU.

"The sensors report the stress in the bridge and give information on the level of the load and how many trucks are going by," Idriss said. "From the data we will now the stress level at which it's working and how far we are into the fatigue life of the bridge."

Rola Idriss, a professor at New Mexico State University, installed 30 sensors on a bridge in Las Cruces, NM, to test a remote-monitoring system.

Before the data can be analyzed, Idriss must develop a system to evaluate the information. "You have baseline data for the structure, which gives a pattern of behavior. A change in it could indicate damage or deterioration and should be evaluated."

The monitoring system will be a valuable tool for bridge engineers, allowing them to make better decisions when evaluating older bridges. Engineers may decide to strengthen a bridge rather than replace it, which could save millions of dollars, Idriss said.

"Maybe you need to reinforce the bridge a bit and it will be fine—or maybe it is unsafe," she explained. "The monitoring system gives the engineer the data so she can make the assessment."

Before she took her research to the field, Idriss conducted tests on a 40'-long bridge built for experimentation in the laboratory. She wired it with 48 optical sensors that detect movement, stresses and damage. Prior to that, she conducted stress tests on an Interstate 40 bridge near Albuquerque that was slated for demolition.

Idriss received a $50,000 grant from the Federal Highway Administration to conduct the I-10 bridge study. Her research also is supported by the National Science Foundation and the New Mexico Highway Department. State highway engineers have been vital partners in many of her projects, she added.

Seismic Design of Bridges

ASCE's continuing education department is offering a course on the "Seismic Design of Highway Bridges." The course is designed to teach participants how to apply AASHTO's seismic specification to design or retrofit a highway bridge.

The two-day course will be held in Chicago on March 19-20, in Charleston, SC on April 23-24 and in St. Louis on May 14-15.

For more information, call 800-548-2723.

Non-Destructive Testing

The American Society for Non-Destructive Testing has announced a new certification program for NDT personnel.

The program is designed to establish uniform minimum levels of competencies and to assess NDT proficiency.

For more information on the program, contact: ASNT's Technical Services Department at 800/222-2768 or fax 614/274-6899 attn: Rita Baker.