

The Devil is in the Details

By Ron Yeager, based on a list by Ron Francis

Checking detail drawings is more an art than a science—it's the give and take between detailers and checkers that results in the best final product.

Structural steel detailing is a demanding profession. Detailers are required to scrutinize design drawings with a fine tooth comb (and frequently a magnifying glass), condense them down to bite-size chunks that fabricators and erectors can deal with, piece by piece, and do it quickly and accurately. Fast, cheap, and accurate—and no, you don't get to pick two out of three. Detailers understand that we are the only people on the job who are not permitted to make mistakes.

Detailers take pride in the fact that over the years we have done our jobs well. Somewhere there is (or was) a detailer who knows how many bolts, nuts, and washers it took to erect the World Trade Center. There is a detailer who knows just how "alike" the twin towers were. A person with that mindset will always strive for perfection and will accept nothing less.

An indispensable factor in producing accurate details is good checking of drawings. Every detailer knows that at some point his checker earned his keep by catching "the big one." Every day the checker puts a shine on the finished product by catching the little ones. These are the things that are not necessarily wrong, but they are just "not right." These are the things that earn a detailer his reputation, good or bad.

So how does a person become a checker? It is obvious that a checker should be at least equal to the detailer in ability and experience, and preferably superior. The more the checker knows about the fabrication and erection of structural steel, the better.

The give and take between a detailer and checker is what hammers the finished product into its accurate state. It is important for a checker to be correct in his notations because he is likely to meet resistance from the detailer who resents all that red on his drawing. Arguing the

point, and looking it up to prove one's position, is the most valuable training tool detailers have. If the process is done correctly, both the detailer and the checker stand to learn something new. Lessons learned this way are likely to make an indelible impression on the detailer and stick with him for life. The detailer starts thinking like a checker and catches his own mistakes. Before you know it, he has become a checker. It has been this way for a good many years and has kept steel detailing alive.

In this age of automatic detailing software and different ways to train (or often not train) detailers, there are those who don't understand the dynamics of the detailer-checker relationship.

The proper way for a shop drawing to be made is for a detailer to produce a shop detail using whatever means he chooses, be it by hand, AutoCAD, or one of the fine add-on or standalone systems on the market today. The checker—a person other than the detailer—then reviews that detail, certifies that it is complete and accurate, and affixes his initials to the "checked by" block. If the checker does a "pan and scan" in the computer or takes a quick look and then signs his initials, it is his own reputation on the line.

If this process is to be abandoned by some revolution in the industry, it should not be abandoned lightly. Under no circumstance should it be abandoned without placing an equivalent system in place.

In order to help checkers and detailers produce more complete and accurate drawings, I have assembled the following list with the help of AISC's Committee on Steel Detailing. It is not my list, but rather a compilation of two lists that have been in circulation among detailers for several years. Ron Francis is the author of the original list and I thank him for allowing me to take liberties with it. It is certainly not exhaustive, as each job is unique and has special requirements, but

it does cover the basics. Most experienced checkers would look upon this list with disdain, noting that they could compile a "better" list, or ask why someone would need a list in the first place.

This list might help detailers understand why there is so much red on the check print. It might also help checkers who have not personally experienced the detailer-checker interaction either to see they have been doing it right or enable them to correct any deficiencies in their checking process.

I should note that the last item in the list refers to the "checker's opinion." Most of us are defensive when it comes to criticism and don't want someone's opinion of our work unless it is positive. At the same time, the checker is responsible for all information on the drawing. If the shop calls, they ask to speak to the checker, not the detailer. My checker says, "If you don't want my opinion, get someone else to check it." I tend to agree.

However, insofar as the information is correct and complete as detailed, the checker need not be overly critical of the detailer. It is wasteful and divisive and not a constructive element of the detailer-checker dynamic. On the other hand, incorrect presentation is a mistake and should be corrected by the detailer as soon as it is pointed out to him. Those among us who may not be doing it "just right" should realize that perfection is in the details and appreciate that achieving it is a lifelong goal.

Correct presentations of steel details may be viewed in *Detailing for Steel Construction*, Second Edition and *The AASHTO/NSBA Steel Bridge Collaboration*, Document G 1.3 - 2002. ★

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A Checklist for Checkers

- 1.** Do I have all the correct documents (prebills, take-offs, weld procedures, specifications, addenda, RFI's, etc.) along with the latest design drawings?
- 2.** At some point determine whether the drawing can be saved or if it should be redrawn. The sooner this is determined, the better.
- 3.** Is all the information in the title block correct and spelled correctly?
- 4.** Are the details presented in an "easy to read" manner?
 - a.** All necessary sections and views are present and projected properly.
 - b.** All necessary dimensions are present.
 - c.** Are there any ambiguous dimensions?
 - d.** All necessary annotations are present and legible.
 - e.** Are details in accordance with AISC guidelines, job specs, and fabricator policy?
 - f.** Is there redundant or excessive information on the detail?
 - g.** Could the piece be built from the information shown on the detail?
 - h.** Nonstandard hole sizes and slot direction are clearly indicated.
 - i.** All welds are present and properly specified.
- 5.** Did I check ALL the dimensions? Are extension dimensions required?
- 6.** Did I check the member sizes?
 - a.** If size is substituted, did I consider impact on adjoining members?
 - b.** Did we obtain the required approval for any substitutions?
 - c.** Did we provide the required camber?
- 7.** Did I check the connections for:
 - a.** Fit
 - b.** OSHA
 - c.** Equilibrium (capacity)
 - d.** Erection clearance
 - e.** Match mating members
 - f.** Whether framing faces of shear tabs have been indicated or marked on shop drawings
 - g.** Whether bolts can be entered and properly tightened/tensioned
- 8.** Did I read the specs?
 - a.** Is the grade of the material noted correctly for all material?
 - b.** Is Charpy testing required?
 - c.** Are there special SSPC cleaning and painting requirements?
 - d.** Is shop inspection required (NDT, Radiograph, MagParticle, etc.)?
 - e.** Are weld procedures required?
 - f.** Should any members or parts of members be noted "no paint"?
 - g.** Is special testing required for the bolts (Ro-Cap, etc.)?
 - h.** Are load indicator washers required?
 - i.** Is shop assembly required?
 - j.** Is galvanizing required on any members? Have we provided proper venting?
 - k.** Is punching disallowed or reaming required?
- 9.** Is each shipping piece shippable? Overweight? Over width? Over length?
- 10.** Are all quantities correct?
- 11.** Does the bill of material match the billing on the picture?
 - a.** Special remarks have been indicated, such as "ROLLED," "BENT," "Camber=XX," etc.
 - b.** Material ABM information has been properly applied.
- 12.** Are the erection drawings presented in an "easy to read" manner?
 - a.** Are the marks in the proper location?
 - b.** Do the columns have the correct direction orientation?
 - c.** Is there a "North Arrow" on the plan?
 - d.** Are all necessary dimensions shown correctly on the plan/elevation views?
 - e.** Are all member sizes shown correctly for each member?
 - f.** Is all required field welding shown correctly?
 - g.** Are elevations at the top of floors, roofs, landings etc. shown correctly?
 - h.** Are all necessary "Furnish" or "Verify" items shown and clouded?
 - i.** Is the erection sequence shown correctly?
 - j.** Are any special instructions to the erector required?
 - k.** Are non-standard bolt sizes and types are clearly indicated?
- 13.** Are the bolts sizes, grades, and quantities correct? Did I check for two washers or plate washers where required (slots, A490 bolts)?
- 14.** Did I thoroughly study all the design drawings to see if all the members in the in the scope of the fabricators contract have been detailed?
 - a.** Lintels
 - b.** Deck support angles
 - c.** Embedded plates
 - d.** Ships ladders, trash gate frames, bollards, stairs, railings
- 15.** Is there a better, less expensive way to fabricate any of the pieces?
- 16.** Are any pieces detailed beyond the capabilities of the shop equipment or galvanizer?
 - a.** Are bend lengths and thickness within machine capacity?
 - b.** Are shop splices shown where required due to machine/material limitations?
 - c.** Are punch sizes available for the slotted and round holes shown?
 - d.** Are any pieces beyond lifting capacity of the shop?
- 17.** Are all pieces erectable?
- 18.** Did I coordinate interface with other trades (holes for owner machinery, holes for wood, match holes in existing members)?
- 19.** Have I prepared a field bolt list? A field bolt summary for purchasing?
- 20.** Have I consulted with the detailer if I'm finding a lot of errors? He may have some information that I lack.
- 21.** Have I checked for complete compliance with all OSHA requirements?
 - a.** Safety cable holes
 - b.** Special joist connection requirements
- 22.** Did I miss anything? Are all required pieces detailed and billed out?
- 23.** Did I put a lot of my unwanted opinion into marking up the detail (did I mark it up the way I would have detailed it) or did I check to see only if it was right or wrong (if it works let it go)?