

# Reducing Fabrication Costs

**E**very fabricator and erector has a long list of ideas on what design engineers can do to reduce the cost of building a steel structure. What follows are some thoughts gathered in the field:

*From John E. Quinn, Vice President/Operations, Zimkor Industries, Inc.:*

- Structural drawings should be fully checked for completeness, dimensional accuracy, layout geometry closure etc prior to issuance. The "second set of eyes" review check should be done by the preparing firm, not the end users.
- Reactions should always be listed per member and identified as service or factored loads.
- Use of two or three story tiered columns is more economical than "stacked" columns of only single floor height.
- Wherever appropriate, limit amount of welding at baseplates to the two flange faces as suggested in the *AISC Manual of Steel Construction*.
- Consider 1/4" fillet as the largest single pass weld, not 5/16" as traditionally thought. Unless a shop's standard welder setup is aimed at large welds, 1/4" is the largest practical size for all setups and all welders.
- Don't require paint on framing enclosed in building envelope.
- Don't specify camber to be "in-place" camber. Call for camber only if 3/4" or more.
- Specify that the fabricator can select the standardized AISC connection type (single plate, single angle, seated, end plate etc) that meets the reactions listed on the plans and best suits the fabricator's equipment and his erector's preference.
- Limit stiffener welding to what's needed. Two stiffeners in a W24x55 will require 10ft of weld if called to be all around both sides.
- When sloped secondary angle kickers are used from beam to beam or to a joist, call for the length of weld required rather than showing the angle fitted into the web/flange fillet and welded all around.

- Resist the use of W8's, and certainly W6's, as structural columns. W10's are the smallest column size offering any hope of reasonable room for connections and minimizing expensive blocks, etc. W12's are better still.
- Call for partial pen column splices, don't automatically indicate full pens.
- Design in sufficient gaps or adjustments between structural framing and the finish materials to accommodate the frame's dimensional tolerance before telegraphing into finish.
- Wherever possible, involve the fabricator and erector early in the design process so they can help develop the most economical details. This will save the engineer's time as well, particularly in developing the secondary framing details.
- Size columns receiving moment connections to avoid or minimize expensive continuity plates and doublers.
- As always, keep the specialty details to a minimum; full pens, slip critical, milled surfaces etc

*From Ken Saucier, Cives Steel Company:*

- Clean up generic specifications to make them more project specific.
- All connections should be Engineer mandated and available at bid.
- Specifically locate painted/galvanized steel on structural drawings similar to the manner studs or camber are identified.
- Eliminate references to architectural drawings; provide information on structural drawings.
- Provide floor and roof openings information early on in steel detailing stage.
- If specialty item (davits, widgets, etc) provide manufacturer and catalog information.
- Be specific of slab edge requirements at roofs as well as floors.
- Show deck support requirements, especially at depressed slab areas.

*From Keith Landwehr, Quality Control Manager, Schuff Steel Company:*

- Specify A992 for wide flange members.
- Do NOT specify a material with requirements outside of ASTM. This will increase project costs and will also

create questions about acceptable fabrication and erection techniques (for example, what welding procedures are compatible with the non-standard material?).

*From Mike N. Wagoner, P.E., Vice President of Engineering, Contract Steel Sales, Inc.:*

- Eliminate full penetration welds on stiffeners by oversizing stiffeners and using partial penetration welds.
- Show beam and column sizes on the plan and not a schedule on another sheet; show dimensions on all drawings, not just foundation drawings.
- Allow the fabricator to use the structural drawings as an erection plan.
- Be realistic when specifying camber.
- Use one-sided connections when possible.
- Use field applied screed and shelf angles. Clearly show on the drawings what weld is required.

*From Brett R. Manning, S.E., Chief Engineer, The Herrick Corporation:*

- Complete and coordinate design documents.
- Special details should be referenced where applicable on design drawings—davits, bent plate, screen walls, precast connections, etc.
- Allow the fabricator to suggest connection alternates; seek fabricator input on complicated framing issues.

*From Ted Totten, Cives Steel Company:*

- Allow single angle/shear plate connections where these connections satisfy the design requirement.
- Eliminate column web doublers at moment connections, where possible, and if required show on the bid drawings.

*From Terry M. Zwick, Vice President/General Manager, Atlas Iron Works:*

- Show loads on connections
- Only use "weld all around" symbols when necessary.
- Do not specify Gr. 50 material for any-

- thing other than wide flange. Specify A992 for wide flange shapes.
- Consider using HP sections for columns where the thicker webs could eliminate the need for web stiffeners and/or doubler plates.
- Try to avoid moment connections to HSS columns; they tend to be very expensive.
- Use duplication whenever possible. With mill requirements on bundle quantities you may be increasing costs when you design for minimum weight by having different sizes.
- Do not specify any non-standard paint for bar joists. The cost of special cleaning and painting can almost double the cost.
- Do not specify a primer coat on steel unless necessary.
- Show the required uplift, snow and ponding loads on roofs so the joist engineers can easily identify them and include the necessary forces in their member designs.
- Do NOT issue “canned specs” listing requirements, conditions or work that does not exist on a particular project.
- Always consult a local fabricator or AISC regional engineer with questions on material availability.

*From Eric Tessmer, Cives Steel Company:*

- Coordinate systems attaching to the structure to work with fabrication/erection tolerances. All too often the fabricator is asked to include attachments from the shop, and later faces charges from another contractor because his connections did not allow for fabrication/erection tolerances. Per section 7.11.3 of the "Commentary on The Code of Standard Practice for Steel Buildings and Bridges", Ninth edition, these connections should provide for 3" of adjustment.

*From Morgan L. Steele, Sr. Vice President/COO, Globe Iron:*

- Locate all members with dimensions to column grids or reference points and provide elevations for both ends of members.
- Coordinate between the architectural and structural drawings below releasing them for construction.
- Respond quickly and completely to RFIs.
- Provide adequate details, sections, etc., to show intent.

*From Ron Baskins, President, Chesapeake Bay Steel, Inc.:*

- Provide all calculations to the detailer.
- Include any steel components from the architectural drawings on the structural drawings.

*From Tony Auciello, Auciello Iron Works:*

- If beams are used for lintels (technically, loose lintels), note if the structural or the miscellaneous metals subs should include them in their bids.
- Spec out standard gratings (and avoid special fabricated grating) whenever possible.

*From Robert J. Petroski, P.E., Vice President, General Manager/Chief Engineer, Hercules Steel Co., Inc.:*

- Rolling to a tight radius can result in some member distortions under normal curving processes. More sophisticated curving is very expensive.
- Don't require pretensioning of connection bolts when “snug tight” will suffice.
- The lightest beams for composite construction with substantial camber is not necessarily the most cost effective.
- Be aware of availability and costs when using a small quantity or a uncommon member size. Check with a local fabricator about availability.
- When possible, use a heavier member to eliminate the need for column web doublers and/or continuity plates.
- Use “thru plates” for HSS only when absolutely necessary.

*From Terry Valley, President, General Steel Fabricators:*

- Columns should be spliced as infrequently as possible—shop and field labor costs associated with splicing can be excessive - particularly splices designed to transmit moment.
- Columns should be sized to minimize web stiffeners and doublers—the cost to develop a three level system typically allows significant column upsizing.
- Use deep profile decks to maximize beam spacing.

*From Dominic Centofanti, Cives Steel Company:*

- Complete the structural steel drawings before going out for bids.
- Get input from a fabricator before releasing bid drawings to review the design, details and welding procedures.
- When acceptable, consider galvanizing in lieu of multi-coat paint system.

- Consider zinc-rich paint on exterior brick relieving angles in lieu of galvanizing. This would allow the shop attachment of the angle and hanging system instead of a more costly field installation. Edge conditions at the perimeter of the building should be kept as simple as possible.
- Structural drawings should not be released for construction until coordination has been completed for the elevators and mechanical openings.
- Loads for bracing should be shown on the bid drawings.

*From Edward Fink, Jr, Drake-Williams Steel, Inc.:*

- For wide flange and channel shapes rolled the easy way, lighter is not better. Thicker webs help hold the cross sectional shape better while rolling; i.e., the flanges stay perpendicular to the web and the web bows less.
- HSS, particularly the square and rectangular sections, also benefit from thicker walls. Architects don't like all those ripples and bulges from using sections with walls that are too thin.
- Find out what the minimum radius is for the required section. If the HSS member is shown with too short a radius then the member will be fabricated from four plates. The magnitude of the extra expense of cutting to radius two side plates and rolling the top and bottom plates to two different radii and of four continuous welds and the associated grinding/finishing is usually unbelievable to the Architect/Engineer. Getting those welds finished to the comparable HSS shape are not always easy. And the appearance is not always acceptable. WF, S, C, and MC shapes have similar caveats.

*From Walt Willard, Cives Steel Company:*

- Structural revisions should not be made during the approval process of shop drawings. If there is a required design change noted on the approval returns, it should always be followed up with a revised structural drawing, with the revisions clearly noted. Similarly, if an RFI response revises or adds a detail, this too should be followed by a revised structural drawing.