It doesn't have to be that way!

Part 2 of 3

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In this three-part series, Andy Johnson, AISC's vice president of marketing, examines traditional project delivery methods in light of the many unknown variables that can enter into the project delivery process. He offers suggestions for how project team members can work together more effectively—especially by bringing fabricators on board in the early phases of project design.

Part 1 (January 2003) takes a close look at the different roles and responsibilities of individual project team members. Each player faces different tasks and obstacles, but it is only when team members understand each other's challenges that the group can communicate and work together effectively.

Part 2 (February 2003) examines fabricator design-assist prior to bidding in design-bid-build projects. If you're working on a design-bid-build project, get fabricators involved early in the game to assist in the design process—and avoid costly delays and change orders.

Part 3 (March 2003) looks at how to implement the design-build project delivery method. Design-build is a time- and money-saving way to design and manage a project. Bring fabricators on board at the earliest project stages to make them an integral part of the design and planning process.

Is there a way to minimize problems on steel jobs? Can all stakeholders be satisfied? Ultimately their goal is the same—to get the project completed on time and in budget, so they can move on to the next.

Design-bid-build as a project-delivery method works best in a near-ideal world scenario, where project requirements are well defined and relatively fixed: designs, specifications and drawings are complete and accurate, and schedules are "normal." All that is required is to choose the lowest responsible bidder.

Nonetheless, in the real world, owners' requirements are neither completely defined nor fixed. Drawings are inaccurate and incomplete. Owners have little assurance that their buildings will be completed on time and within the budget. Today's unpredictable world still uses traditional contracting methods that rely on predictability for success. Design-bid-build becomes design-bid-dispute-design-re-bid-build-dispute-re-design-re-bid-build—sue. Is there a way out of this insanity?

The answer lies in a more intelligent way to involve and work with steel fabricators, not just as suppliers of a commodity product but as key specialty subcontractors. Even though the in-place steel cost might be a minor part (10 percent to 15 percent) of the project, the fabricator has a major impact on the ultimate cost and schedule of the entire project. The qualified steel fabricator, if engaged early on, can smooth out the process of designing and constructing steel projects. This translates to the fabricator's involvement in one of three ways:

- Fabricator design-assist prior to design-bid-build
- Design-build with fabricator as a member of the design-build team, working with the team structural engineer
- Design-build with fabricator responsible for structural design

THE USUAL STORY

The typical scenario in the development of a project where all the activities are strung end-to-end is as follows: building program development, conceptual design, design-bid-award, shop drawing preparation, fabrication

and erection. The owner or developer meets with the architect to develop the building program. The structural engineer designs the structure according to the architect's concept. The architect continues to refine details that require the structural engineer to modify the structural design. After much back-and-forth the structural drawings are ready for bid.

After award of the steel to a fabricator, the fabricator, general contractor and engineer discuss details to be settled before the fabricator can order material or prepare shop drawings. For example, in preparing a mill order there might be questions regarding trusses. The overall length shown on the drawings could exceed the maximum allowable shipping length. Where can the splice points be located? The location and the resulting shipping lengths vary with the mode of transportation, which might affect cost. The fabricator submits an RFI for missing dimensions to the general contractor, who forwards it to the architect and engineer. The architect and engineer, after an additional delay, determine the changes and verify that they meet both the architect's program and the engineer's intent. The RFI is returned to the general contractor and finally to the fabricator. The process can take weeks to resolve, especially if there are cost implications of changes.

Another scenario involves questions about connection types and designs that affect the type of material to be ordered. Such questions must be answered before a mill order can be placed or shop drawings prepared. In this traditional way of doing things it is not unusual to have hundreds of RFIs to resolve issues.

BREAKING WITH TRADITION

A good alternative to the traditional way is to involve the qualified fabricator early as a critical subcontractor who will compress the schedule and control costs while the structure is still being designed. This is up-front-value engineering when it can have the most favorable impact. Such input is different from traditional engineering that occurs after contract award, when design fees have been spent and professional egos get in the way.

Early involvement of the qualified fabricator can help during two phases of a project:

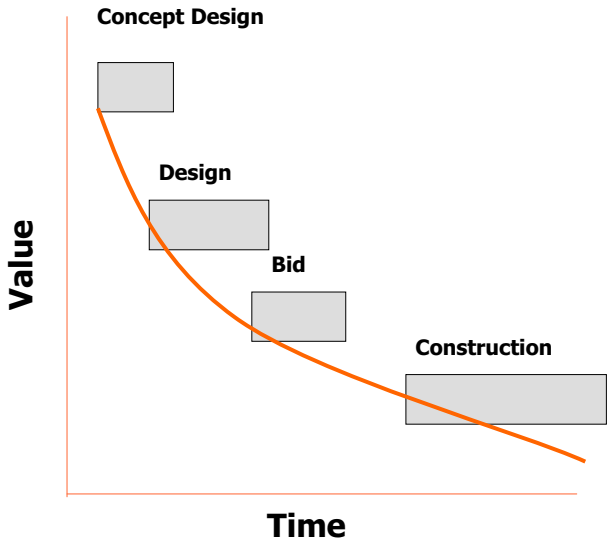
1. Program development and conceptual design; and
2. Design.

During program development and conceptual design, fabricators can provide the following information critical to saving time and money:

- Material availability: fabricators have access to mill-rolling schedules, stocking-mill inventories and service-center inventories. Using available shapes in designs can save considerable time.
- Cost vs. availability studies by weighing mill vs. service center purchases.
- Assistance in checking designs for economies, such as bay sizes, elimination of column splices, repetition of member sizes, rationalization of framing (e.g., large members framing into small members) and elimination of stiffeners and web doubler plates.
- Assistance in analyzing cost vs. weight economies (least weight does not equal least cost).
- Indication of standard shop details and connection choices to use.
- Information on suitable connection types for complicated buildings such as those with special slopes, hip and valley roofs or atria.
- Recommendations for attachment of cladding and means of handling eccentric loads.
- Recommendations regarding construction sequencing or breaking large projects into staged releases.
- Identifying design holes and the best way to work around them to minimize cost impact and schedule delays.
- Recommendations for expedient and cost-effective ways to accommodate future changes—architectural, mechanical, etc.
- Recommendations for ways to "decouple" structural steel from the other trades so that structural-steel shop-drawing preparation and fabrication can proceed uninterrupted.

The purpose of decoupling the trades is to keep critical-path activities independent of design input, work, or performance of peripheral construction activities. In some cases this could require calculated compromises to gain time. With regard to the structural steel, the objective is to allow the fabricator to complete shop details with minimal modifications once underway. Here are some examples:

- Select a curtain-wall system that does not require special holes, angles or channels to be affixed to the steel frame during fabrication or,
- Specify a predetermined curtain-wall anchoring system at the outset such as an L6 × 4 × 5/16 projecting to the face of the exterior columns. Make sure there is some method of making field adjustments to the attachment of façade materials to allow for the different tolerances between the structure and the façade.



Value of fabricator involvement: by involving the fabricator at the earliest possible phase of a project, the fabricator is able to add the maximum value.

- The mechanical engineer and contractor should establish and hold the location of horizontal runs and vertical risers.
- Bring the structural steel down to footings rather than a foundation wall, or vice-versa, depending upon which material is more critical from a critical-path standpoint.
- Make foundation designs conservative so that foundation work can proceed before steel design is complete (e.g., use 30"-diameter piers when 24" would be required).
- Separate masonry façades from the steel structure as far as vertical loads are concerned—make the building skin self-supporting. This allows the two systems to proceed independently and simplifies the detailing and erection of the steel frame.
- If schedule is paramount, avoid mixing materials (e.g., structural steel, load-bearing masonry and pre-cast concrete) in the primary framing. The coordination required between these trades can add considerable time to a schedule.
- If roof-mounted equipment and roof penetrations cannot be located or sized exactly, rather than holding up the job, allow the erector to assemble and install framing in the field. There are "tricks of the trade" to handle such conditions.

During final design, fabricators can accomplish the following:

- Submit sketches of preferred details for special conditions and assumptions.
- Continue to advise on shape selection and standardization based on availability and economical design.
- Continue to provide pricing information.
- Place mill order for first section release(s) or entire project as appropriate.
- Continue to advise the engineer regarding connections, and the relative economics of adding stiffeners and doubler plates or increasing member sizes (including shop preferences for typical details).

When a design-bid-build project delivery system is applied to an unpredictable situation, benefit is gained when fabricators provide design, cost and schedule assistance prior to bidding. Many fabricators are reluctant to provide up-front value engineering or design assistance for fear of being exploited. A wiser approach is for stakeholders to make a short list of qualified fabricators and then consult with those companies. Their response will be more forthcoming and meaningful if they feel that their input will provide them a reasonable chance of getting the job.

The short side of involvement at this stage is that fabricators might not be willing to share real cost data or hard numbers because they cannot commit yet to a contract. In addition, without a contract, the fabricator cannot begin certain activities before design is complete, such as partial mill orders and partial shop drawings.★

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For more information on how to maximize design-team communication and efficiency, don't miss Andy Johnson and John Cross' short course, "Moving up the Construction Food-Chain—From Bottom Feeder to Killer Whale" at the 2003 NASCC in Baltimore, MD.