A Tale of Two Fabricators

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Every fab shop has its own story to tell.

IN THE FALL OF 2008, AISC's eight regional engineers were tasked with visiting every AISC Member fabricator in their region to learn more about their specific businesses and how we, as regional engineers, can best assist them. Since November, I have personally toured more than 95 fabrication shops. In doing so, I was struck by how interesting the ins-and-outs are of a fab shop are, and also the differences between how each shop does business.

One of the biggest is connection type and style; every shop has its own preference. And efficient connection design is the topic of one of AISC's continuing education seminars this year. Certainly, the connection limit states (bolt shear, bolt bearing, weld shear, block shear, etc.) and connection types (welded, bolted, bearing, pretensioned, slip-critical, shear, moment, etc.) are all important considerations and options. But the final connection you use in your project may be influenced most by something much more applied: the type of setup your fabricator uses and the connections they prefer for that setup.

Some steel fabrication shops are set up to handle repetitive, beam-and-column-type work with low work hours required per piece. These shops run through a large amount of inventory annually and are experts at moving pieces through the "line" and out to the job site. Other shops specialize in more complicated work that can be labor-intensive and schedule less tonnage per year as a result.

Traditionally, shops that are set up for high-volume, low-labor work find their jobs in markets like commercial building construction, and shops that are set up for low-volume, high-labor work find them in markets like industrial construction. Of course, there always will be some overlap into other markets regardless of what segment a fabricator picks as its specialty. For example, a shop that does mainly industrial work will also do some amount of commercial work, probably in its geographic area. The reverse is true for a mainly commercial shop; it will probably do a small percentage of its work for local industrial jobs.

It's important to recognize that no one specialty will necessarily make one of these shops better or more efficient than the other. Rather, each has its place in today's construction market. Often, fabricators will collaborate with each other on projects to take maximum advantage of their respective strengths. Let's examine the layout of two fictional fabrication shops to see how one fabricator's capabilities differ from its neighbor.

Shop A

Shop "A" is a high-volume, low-labor shop. This shop is profitable based upon the sheer volume of tonnage that passes through, as the labor per piece is minimal. It often runs night shifts—especially when beams that require minimal to no fit-up work are run through the beam line—and have fabricated pieces ready to ship in the morning. An ideal project for this type of setup would be a framing scheme with rectangular bays and simple-span filler beams framing to girders.

The shop has a large lay-down area—outside in this case—that is full of inventory waiting to be run through two separate beam lines, which increase productivity inside. Both lines are set up to cut beams to length, but one is set up to punch holes and the other is set up to drill holes.

Punching holes is quicker and more economical, when it is permitted. When the thickness exceeds about 1 in., a member will generally need to be drilled rather than punched, because punching is a brute-force method that may damage the steel. Therefore, the punch line is used for smaller members with thinner webs and flanges, and the drill line is used for larger members.

After beams are cut to length and the holes are made, they will travel to a fit-up bay to have any connection materials, such as plates, angles, stiffeners, doublers, and base plates, applied. Because Shop A prefers low-man-hour jobs; it only has two or three workstations set up for welding. They will probably not bid a job that consists of mainly welded connections because it would tend to form a bottleneck in the fit-up bay—unless the bid could be based upon alternative connections proposed by the fabricator. Shop A also has:

- an angle line for cutting and punching angles for connections and members
- a plate cutting table where gusset plates and other connection plates are cut from larger plates
- a small bay off to one side for fabricating handrail and stairs for jobs that require miscellaneous steel only
- a painting bay
- a blasting machine to create surface preparation for painting, especially if architecturally exposed structural Steel (AESS) is part of the job

After the filler beams have been cut to length, had their holes drilled, and cambered if that is required, they are shipped out to the site with no further work required at the shop. Girders and columns, however, go to the fit-up bay

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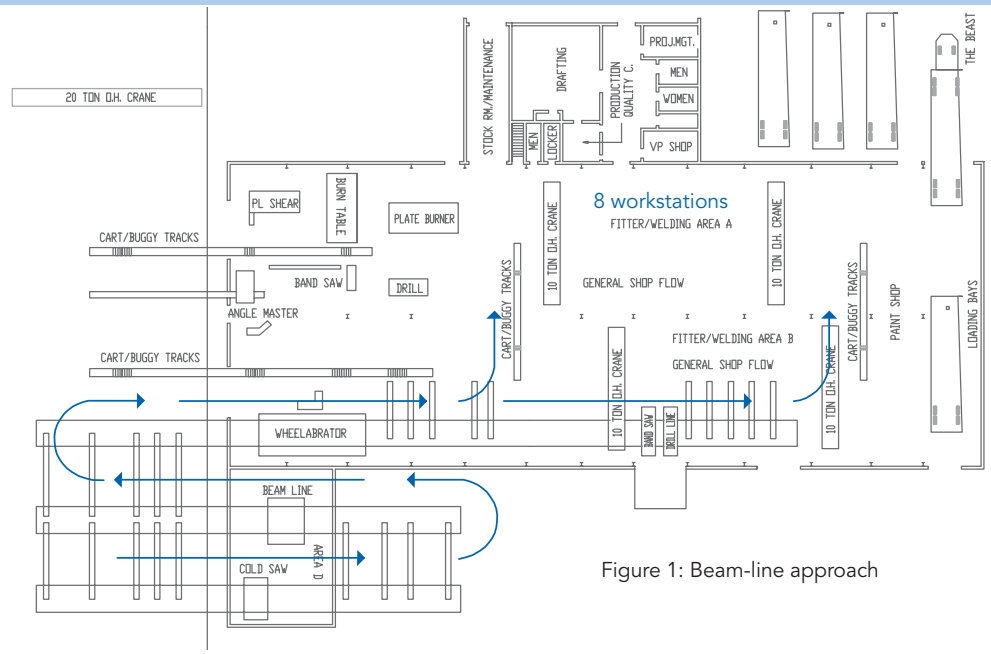

Figure 1: Beam-line approach

where connection materials are attached to them.

The infill beams represent a work level of two to three man-hours per ton, and the girders represent a work level of five to six man-hours per ton. Overall, this shop averages three to four man-hours per ton of output from the shop.

Shop B

Shop B is a high-labor, low-volume shop that is profitable based upon the value of the labor it provides. The shop's annual tonnage is approximately one third of tonnage fabricated by Shop A.

The majority of its structural work is for heavy industrial structures, like power plants or offshore drilling platforms. However, the shop does bid more traditional structural work in its vicinity. Typically, half or more of the shop's work is plate work— either for structural applications, such as plate girders and large gusset plates, or for industrial applications, such as hoppers, silos, or mechanical shafts.

The shop is set up with a basic beam line that drills—no punching. It focuses more on welded work and isn't burdened wit the need to make holes as quickly. In addition, the beam line is not the centerpiece of the shop. Rather, this shop has 20 workstations set up to accommodate welding and plate-type construction and a large plate bay with two plate-cutting tables.

The shop has a dedicated bay set up for large truss work. Because of the large sections fabricated in the shop, it employs workers who are skilled in heat cambering methods. Smaller sections are cambered with a more traditional cold cambering machine; cambered members are not easily fed through a beam line.

Shop B prefers welded connections. The welders it employs are masters of their craft and have many years of experience. The shop highlights its ability to have greater control over complex connection work while simultaneously operating with the "shop-welded, field-bolted" philosophy of constructability.

In terms of square footage, this shop is much larger than Shop A, because it has so many welding workstations, as well as a truss bay and extra plate bay. Shop B averages 10 to 12 man hours per ton of output.

Material Procurement

Regardless of shop size or the type of work preferred, all fabricators have a choice when they need to get steel for a project. They can either order steel directly, and in mill quantities, from the rolling mill, or they can purchase it from a steel service center. In fact, almost every fabricator will tell you they use a mix of these options, and there are advantages of working with each.

When ordering steel from a rolling mill, the unit cost is typically lower, but there is usually a minimum order that must be placed. This is called a "bundle" and might amount to, say, five to 20 W18x35s. For smaller fabricators who order steel on a job-to-job basis rather than an inventory basis, this quantity might be too large. Steel service centers, however, make it possible to order the exact number of members you need. They also offer delivery within a matter of days rather than based on a mill rolling schedule, which can take quite a bit longer.

A typical truck delivery from a service center might include several types of steel at once—wide-flange beams, HSS, angles, and plate material—and, again, all in smaller quantities than could be ordered directly from the mill. Also, service centers can can cut members to length so that fabricators end up with less "drop" or scrap length. And most will provide staged delivery so that the material doesn't have to wait out in the fabricator's yard for extended periods of time until it can be run through the line.

Cash flow is also a factor. Ordering from a service centers allows the fabricator to get a firm price quote at the time of order, while mill pricing can be more fluid. Service centers do charge a premium on top of mill prices for providing these services. This premium is based upon the individual client's relationship and past business with the service center. (For more on service centers, see "A Wide Range of Wide-Flange," 1%8 at **www.modernsteel.com**.)

Many large fabricators work with mills almost exclusively because they have a large backlog of work and don't need to worry whether a full bundle of material will be used. In addition, one domestic mill is now rolling larger "jumbo" shapes that were previously only available abroad.

Recommendations

The two shop examples given here are fairly extreme, and most fabricators will fall somewhere in the middle. A shop that tends to take on work that can be done with a beam line might suggest bolted connections with angles from time to time, and a shop that tends to pursue the workstation approach might suggest welded connections.

So what is the designer to do given that each fabricator is different than the next? Regardless of a fabricator's work methods, you can be an advocate for constructability by involving the fabricator early in the design process. As explained in AISC Design Guide No. 23, *Constructability of Structural Steel Buildings*, the fabricator can provide suggestions and advice that even the most experienced structural engineer might not have considered—and steer the project to maximum shop and field efficiency.

What about the cost? It seems that many general contractors and owners are convinced that design-bid-build generates the lowest-cost job. Yet there are many who have learned that a teamwork approach can mean higher quality at a lower cost. Steel

fabrication is a specialty, and the expertise gained from all participants in a team approach using early involvement can, in the end, save much more money than hard bidding.

The best way to appreciate and better understand how fab shops operate is to visit one in your area. Shops across the country will be opening their doors to the public on SteelDay on September 18 (see SteelDay coverage on page 22—and visit **www.steelday.org**). If you're not available for a tour that day, contact a fabricator and set up a personal tour for another day. See what they do and how they do it. Take the time to get to know them, and let them get to know you. Consider how you might work together as a team and make each other more successful and profitable. You'll be very glad you did! MSC

Real Shops

While we focused on two fictional fab shops, two very real ones—Garbe Iron Works in Aurora, Ill. and Hillsdale Fabrication (Alberici Construction) in St. Louis, both of them AISC members and Certified—generously shared their experiences and shop layouts for this article. Garbe is more of a conventional shop that is centered on a beam line, with a 45,000-sq.-ft facility (30,000 sq. ft of which is dedicated to steel fabrication). Hillsdale takes the workstation approach, with main production areas totaling around 220,000 sq. ft.

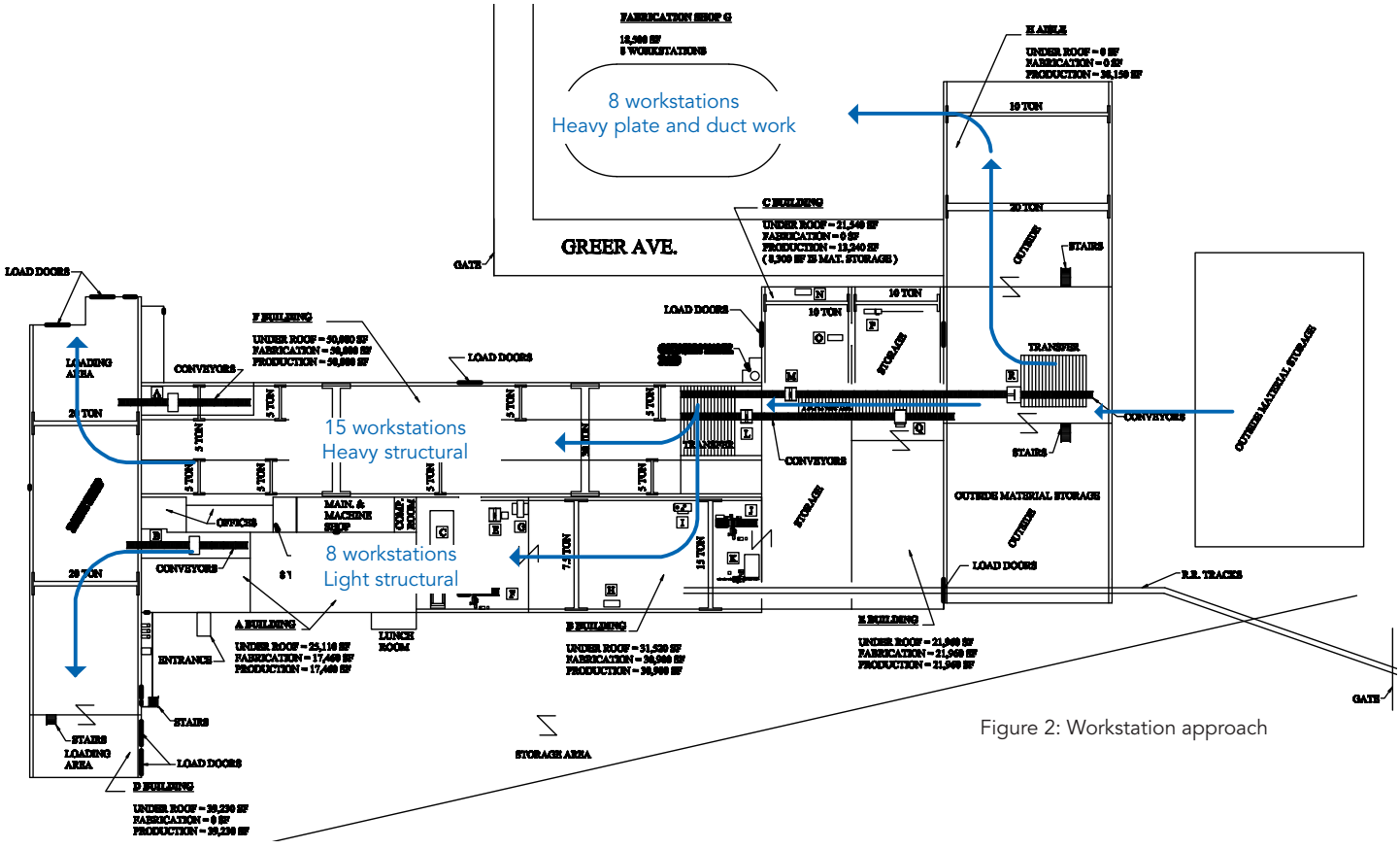

Figure 2: Workstation approach