Temporary Support

BY ALAN T. (TED) SHEPPARD, P.E.

By designing your own temporary steelwork you get what you need and can reuse it many times.

WORKING IN STEEL CONSTRUCTION, I always thought it was fun to design our own lifting devices and falsework, but then I am peculiar. One good thing about doing it on your own is it can save you money, especially on the second and third usage. Sometimes the material from one job only needs a slight alteration in order to work a second or a third time.

I applaud the efforts of steel erectors who design their own falsework and lifting devices. Unless you have a properly licensed and qualified engineer on staff, you will need engineering assistance in the design part, but that shouldn't stop anyone.

However, you also may have noticed that there really are no design standards for temporary structures or lifting equipment. Books, although not many, have been written about this type of design, but individual companies usually come up with their own criteria. If you hire an engineer to assist in the design or to do it for you, be prepared to tell him or her what criteria to use, or, at the very least, what you would like to have and how often you expect to use the equipment. An outside engineering staff may have their own guidelines, and this is fine, but you must tell the engineer that you expect to use this equipment five times, for example. Also, with that in mind, try to keep all of your devices to a size that will fit on a truck so that permits are not needed to travel on the highway.

I used to design lifting beams in my sleep, but it has been so long since I did that, I now have to go to my reference material. There are a lot of wrinkles in lifting beam and hitch design, too many for a short article, but a good treatise on this type of design is "Design and Construction of Lifting Devices," by David T. Ricker, which was published in the fourth quarter 1991 *Engineering Journal*. He makes it very simple and easy to understand.

When I worked for Bethlehem Steel, we had design standards that were developed in the late 1930s and early 1940s. They were modified a little over the years, but the key word to think of here is "conservative." Originally we used a compression formula from that era, but gradually we evolved to using the formula from the AISC *Specification*.

For booms and masts we reduced the allowable stress by 10%, no matter whose formula was used. But the most important parameter was the L/r ratio where L is the length in inches and r is the radius of gyration, also in inches. The radius of gyration is given in the AISC *Manual* for most shapes and sections. We really don't care about all that by itself, but the L/r ratio is important to keep members themselves from contributing to instability (by buckling, for example).

Also, you will want to reuse these pieces in order to reduce the cost of fabricating them. They will get banged around in service; so you want to be conservative. Keep those pieces big and sturdy.

Here are some rules of thumb for L/r values that I have used over the years and that you might find helpful:

- Booms: Prefer 80, but do not exceed 120
- Masts: Maximum of 120
- Bracing and other secondary members: Prefer 150, but do not exceed 180
- Falsework columns: 80 to 120

These values apply to pipe booms or built-up tapered booms. The falsework columns can be posts under cantilevered beams or large built-up bridge supports.

It is not always specified, but we tested our lifting beams in accordance with ANSI/ASME B30.20, *Below-the-Hook Lifting Devices*. This can be a problem if the lift is very heavy, but you can use crane counterweights, water balloons, or some homemade testing device. We would make the test lift, hold it for two minutes, lower the beam and disconnect it, then give the beam a visual inspection. We would then add all of the data, including the date of the test lift, to the design drawing.

When your firm takes on the challenge of coming up with its own lifting devices and falsework, you may see another positive side effect: Your employees will find that they can contribute to the design process. I have worked with an ironworker in New England, for example, who sends me things to check or make calculations for submittal. He has a great sense of proportion for design, so I rarely have to make any corrections. Given the opportunity, your people are likely to develop such a feel for this type of work, too. MSC

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