Not All Steel is Made the Same

Most people outside of the construction industry don't know that there is quite a variety of types of steel available for design. We tend to think of steel as a single item. Like different species of wood, the different steels have varying strengths, ductility (or bend-ability), and resistance to the environment. All of this is defined by the chemical makeup of the steel and how it is mixed, heated, cooled and formed into its final shape.

Even in a relatively simple structure, you will find a variety of steel. There's reinforcing in the concrete footings while hangers for wood joists are another type of steel. Steel wide flange beams make up the bulk of framing in steel buildings, as do bar joists and steel decking, but all have different properties. Each of these steels have been created and their properties carefully adjusted to meet the requirements of their production, use and long term performance. Wide flange beams often have a yield strength of 50 ksi (kilo pounds per square inch), while the bar joists and deck may be 33 ksi. Reinforcing steel is generally 60 ksi, though strengths up to 100 ksi can be found. There's stainless steel and even steel designed to weather or rust a little, but not a lot. Cor-Ten steel, unlike my son's car, develops a protective layer over the surface to protect the rest of the steel. It's often used in sculptures or facades of buildings or even some bridges.

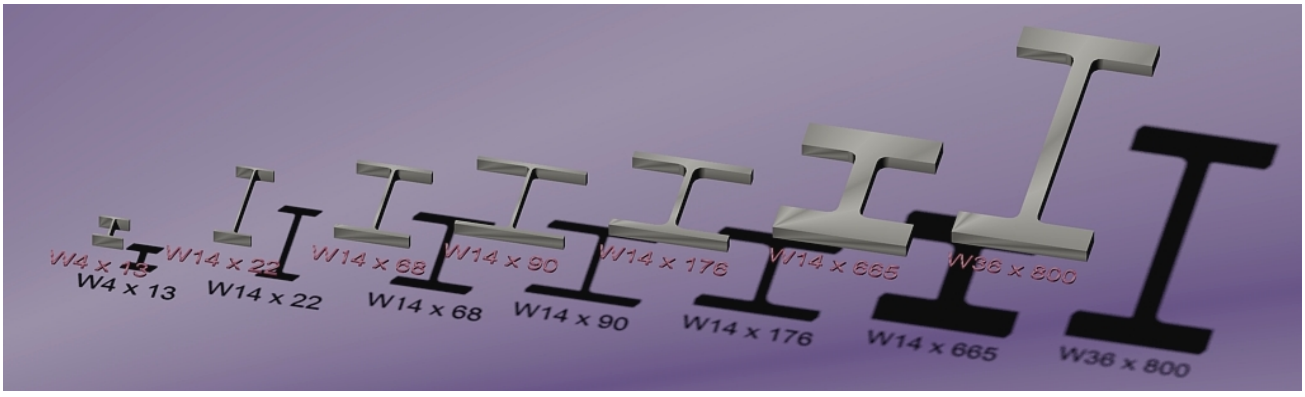
Not All W14's Are the Same Either

When is a 14 inch beam not a 14 inch beam? If you're talking about wide flange steel beams, a majority of them aren't 14 inches deep. Engineers talk about W shapes, meaning wide flange shapes, though a lot of people refer to them as I-beams, because of the similarity to the capital letter. But when you talk about the size of a beam, things can get confusing. Wide flange beams are called out by their nominal depth and their weight per foot. So a W16x26 is about 16 inches deep and weighs 26 pounds per foot of length, but it's actual depth is 15.7 inches.

Several of our employees attended a shop tour of LeJeune Steel in Minneapolis as part of the CASE/Mn annual spring seminar. Stephanie Young (pictured at right) managed to walk away with a 3/8" thick section of a W14x665 – that would be 665 pounds per foot. At 3/8" thick, this section only weighs about 20 pounds, but it's 21-$^{5}/_{8}$" deep, so it is not your typical W14. This size would most likely be used as a major column in a high rise building or a stadium where roof spans get very large. A single W14x665 might be able to support up to 5 million pounds!

The most common shapes used for beams are usually closer to the nominal depth. In the W14 family, for example, these range from 13-$^{5}/_{8}$" to 14-$^{1}/_{4}$" deep. The width of them varies from 5" to 10", with a whole range of thicknesses. This variety makes it possible to get a more economical section based on loads, spans and unbraced lengths (distance between framing to keep the beam from buckling to the side).

Below are some of the W14's to scale to see the range of them, as well as the smallest by depth (W4x13) and largest by weight (W36x800).



Of course, channels, angles and tubes follow their own set of rules for sizes. Maybe we'll cover that in another article.