Automation Has Arrived:

But Can It Really Make Trusses More Accurately?

by Jerry Koskovich, P.E.

A frank look back at 30 years of truss quality control, from one of the industry's automation pioneers

In the wood truss building industry we demand a lot from wood. We always have. But now that automation has entered the component manufacturing picture for good, the quality control game has changed. Or has it?

First, let me back up a little bit. In 1973 I began a new path in my career. After having been directly involved in building code enforcement for the previous ten years (which I continued doing for another dozen years), the State of Minnesota was just beginning to enforce the Uniform Building Code. At that time its focus was to better regulate truss manufacturers' products and factory built structures.

At the same time I had founded a business called Engineering Services Company. As impressive as the name was, I'm embarrassed to confess that I was the only employee. Truth is, as time went on, I didn't want it any other way. Initially the main intent of the company (me) was to provide third party inspections for truss manufacturers and modular home builders. It was through my association with many truss companies that I became familiar with the methods then employed to manufacture trusses and wall panels. Unless you're very new to the industry, you probably know most of the rest of that story.

The object of third party inspection was, of course, to assure that the finished product coming out of component manufacturers accurately represented what the nail plate suppliers intended. Needless to say, the designs of today are a far cry from those of that time. During that period the word "common" was applied to most designs since trusses were generally a fink truss, with the only variation being that of span and occasionally pitch. After a year or two of looking at such trusses, I could pretty well tell you all you needed to know about the truss without ever looking at the design drawings.

Today, common trusses are uncommon!

The quality of the trusses being produced at that time was generally good. Since things were simpler there perhaps wasn't as much to screw up. Mostly I paid attention to lumber quality, plate size and placement, and matching the design with the finished product.

Over the decades that truss manufacturing has been in existence, a number of things have evolved with the intent of improving the product and the means to manufacture it. One of those items related to the process of cutting scarfs where the top and bottom chords intersected.

Originally, since everything was cut with radial arm or circular type saws, the feather cut or scarf on the bottom chord wasn't a problem. The carpenter, using a tape measure and framing square or protractor, marked the raw lumber for length and angle as necessary, then made the cut. His skill with measuring and cutting controlled the accuracy of the component and ultimately the quality of the truss joints.

Since he was likely going to make many such cuts, he would set end stops or some other fixture to assure every component was cut the same. Crook or bow didn't generally matter since the piece was jammed into the stops or fixture where the cut was being made...the tail or opposite end could run wild so to speak.

at a glance

- With the advent of component saws, bow and crook suddenly became an issue
- There's only so much the saw manufacturers can do to compensate for crooked lumber.
- We've all likely witnessed the snail's pace of a complicated truss setup on a manually jigged pressing table.

With the advent of component saws, bow and crook suddenly became an issue. If the part bowed up near the end being cut, the finished length could become significantly shorter. The opposite was true if it bowed down. This condition was made more dramatic as angles became flatter.

The first action to minimize such variations was to crown the lumber up when it passed through the saw. It's still the first order of business for the sawyer. But this didn't solve all the problems, since lumber could vary from straight to severely bowed, thus causing great variations in the overall length and the accuracy of the angle being cut. The industry's answer to the length issue was to put a heel on the very end of the bottom chord scarf.

For the most part that solved the overall length problem. It didn't necessarily solve the angle accuracy problem. The greater the bow, the bigger the gap when fitting the top and bottom chords together. The truth is, even with automated component saws, the problem still exists. Most current component saws will have some means to try to control heel and centerline heights and problems caused by bow; however, if you insist on using every stick of lumber that comes from the mill, you'll still have the problem! There's only so much the saw manufacturers can do to compensate for crooked lumber.

Speaking of what comes from the mill, if you're not aware of it, let me enlighten you. When I was doing third party inspection, the lumber grading organizations had one rule referred to as the "five percent exclusion rule." What it means is that five percent of the material in a unit of lumber was allowed to be off-grade. While a lot of time has passed since I was doing inspections, I doubt that rule has changed. With that thought in mind, you can guess where that five percent will end up—in your yard.

In those first manual component saws, the accuracy of cut angles was dependent on both the sawyer and the saw. When new and clean, these saws generally had some form of protractor mounted to the quadrants of the saw that produced good results. The sawyer would hand crank the saw blades into position using the protractor as his guide. With the passing of time, the mechanical means of moving the blades would become worn, thus causing cut inaccuracies even though the angle readouts appeared correct. This is where the sawyer earned part of his keep. If he was good he knew how much he had to cheat the readout to produce the accurate cut. Thus he became irreplaceable! I can't tell you how many times I've had shop owners and managers tell me they were going to "fire that so and so" when they got an automated component saw. I know of some instances where they actually did!

The tolerance for angles has changed since the emergence of automated component saws. When I began producing saws, the accepted norm was an error up to about one-half a degree. That error leaves a pretty significant gap on a long scarf cut joint. Today's automated component saws should consistently hold accuracies from "spot on" to not more than one- or two-tenths of a degree off. When the saws are functioning properly and with reasonably good wood, the joints should look like they grew together!

With the invention of linear saws the methods of cutting have changed, but the required accuracies and the nature of lumber hasn't. In general I suspect that angle accuracies may have improved, since the end of the stick being processed is generally clamped in place within a foot or two of the end being cut. Of course, a hook on the end of the piece is still going to present a problem. In our case, while we don't attempt to straighten the piece by clamping, we've developed a sensor that adjusts the height of the saw blade to compensate for degree of bow. Whichever method is used, the results when confronted with crooked lumber, in general, should be superior to what might be expected on a component saw processing a similarly crooked piece.

While the means to process the cut components have improved, I can't honestly say the wood itself has gotten better. My point is, to a large extent, the quality of the finished component or truss is still a function of the material being processed. It's a little like the phrase we often hear about computers..."Garbage in, Garbage out!" Continued on page 52

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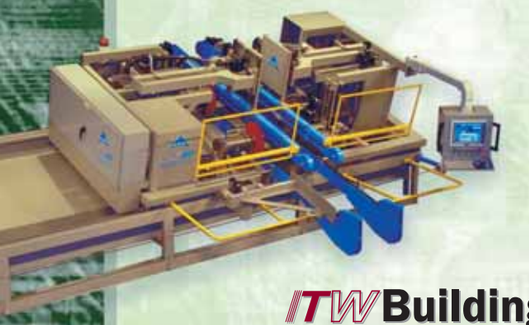

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Automation Has Arrived...

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The opportunity to improve quality has likewise presented itself with automated jigging systems. We've all likely witnessed the snail's pace of a complicated truss setup on a manually jigged pressing table. It can be a geometric exercise of incredible scale. Measuring, marking, stringing, rechecking, adjusting, and so on! Spending an hour or more trying to get it right is not uncommon.

With the automated jigging systems currently on the market, the prospects of dramatic improvements in accuracy are a given, assuming the jigging system is functioning as advertised. What once took an hour or more to configure a complicated truss is now done in seconds.

After the truss is positioned on the computer screen a press of a key sends the automated system to work in so little measurable time, it virtually has no effect on build time. Since the automated jigging systems are typically spaced at two feet or less along the length of the table, little or no extraneous fixturing is required. In addition, since the jigging system doesn't need to be manually positioned, the operator is then free to be staging raw components, plates, etc.

Best of all, the production of finished trusses will typically be two or more times what a crew can do on a manual set table. These improvements in production are further enhanced when the number of trusses per setup is few in number. Jigging up to build a truss is the same whether you're building one truss or a dozen. The problem for manual jigging comes when the trusses per setup is closer to one. More time is spent in setting up than in building trusses.

The frosting on the automated systems cake is the hours of time saved over that of manual jigging. That time can translate into more production per shift or at the very least, a dramatic improvement on the bottom line based on your current production demands. On the average table if you didn't save two hours or more per shift I would be surprised.

What could be better...improved accuracy and quality while racking up greater production and thus profits. It's a no-brainer!

Add a laser projection system to an automated jigging system, and you will gain even faster, more accurate lay ups of components in the jigging.

Another valuable feature from a curb appeal point of view is the availability of inkjet printed identification on trusses, walls and all of their components. The customers of component manufacturers see these markings and associate them with a truly professional manufacturing process.

It seems obvious that the means to create and fabricate the best truss and wall products ever produced are already in place and have been so, to some extent, for about the past two decades. While the industry has, in some instances, been slow to accept all of these production and quality enhancing machines in the past, it seems that today, automation has arrived. If you haven't taken advantage of what's available to enhance your production and quality, you may be setting yourself up for some tough sledding against your competition. On the other hand, if you're already into automation, you've gone a long way toward making it as good as it gets.

However, as I noted earlier, the one item that the machines and the machine makers have little or no control over is the material they're required to work with! To truly produce a quality product you have to commit to using raw materials that provide your machines and crew a chance to make the product you'll be proud of. SBC

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