STRUCTURAL BUILDING COMPONENTS MAGAZINE (FORMERLY WOODWORDS)

June/July 2000

"Can Technological Advances Help These Wood Truss Problems" by John E. Meeks, P.E.

Historically, simple wood truss designs recognized the relative stiffness and continuity of plated wood truss joints in the design standards established by the Truss Plate Institute. In the early years, while wood trusses were displacing joist and rafter wood framing, truss designs were limited to mostly simple Fink and Howe configurations. Early editions of TPI design specifications (TPI-66) defined moment coefficients that presumed continuity over panel points as well as heel and peak plate stiffness to reduce bending moments in truss chords. Axial forces were determined by rational analysis assuming pinned connections at all joints. Bending and axial stresses were combined using National Design Specification (NDS) interaction equations in their simplest form.

The rapid advancement of computer software within the industry, based upon costly full scale testing programs by individual companies, has resulted in high precision truss analysis using joint stiffness analogs and inventories of lumber and plate sizes and gauges which are customized by the software supplier to the truss manufacturer’s specifications. Most truss designs are based upon code established minimum loads, or loads established by the building designer, which are then used by the truss designer to design the truss that the truss manufacturer will produce. This results in a minimum truss design that will meet all requirements of the customer, and that can then be built from an established inventory of lumber and connector plates. These are enormous changes that have occurred in technology for an industry that has existed for a relatively short time, comparatively speaking.

At the present time, the truss design engineer presumes that under ideal conditions of manufacture, delivery and installation, the truss will perform as designed. It has been my experience that if there is a failure in performance, the lumber specification may come under an unfounded attack by any plaintiff’s attorney with an “expert” who thinks the truss lumber looks like it has “too many large knots.” Perhaps one solution might be the development and introduction of new technology that could be used to reject oversized knots, excessive wane and/or high slope of grain in dimension lumber that would result in a new “component grade”? *WTCA QC* does aid a truss manufacturer in assessing incoming lumber quality on an ongoing basis, based on the individual truss plant’s criteria and assessment of the quality of lumber necessary. The underlying expectation is that the grade stamp accurately states what the lumber design properties are since truss plants are not in the lumber grading business.

Some manufacturers, working with their truss designer, establish automatic reduced plate values and lumber stresses for long spans or for unusual truss designs. Larger than specified connector plates and better than specified lumber grades are usually acceptable for any truss design. However, the above mentioned “adjustments” are usually carefully considered by the manufacturer, as they will add to the cost of the project. Can existing technology be programmed to help the manufacturer optimize truss performance and at the same time assure product safety?

Lumber producers could aid with this particular dilemma of the truss manufacturer by offering a wider selection of "component grade" lumber sizes (2x2, 2x3, 2x4, 2x5, 2x6, 2x7, 2x8), thereby permitting greater variety in the computer selection of lumber. The truss manufacturer with a larger inventory of lumber could have a more competitive position, by producing a minimum truss that could be subject to "adjustments" for unique conditions with lower added cost.

It has been my experience that minimum plate sizes and "open" joints are always subject to criticism by any plaintiff's attorney with an "expert" who thinks the plates "just look too small." This is especially true if the plates are out of position or missing from one side of the joint (it doesn't matter if the joint in question was not the cause of the problem). The highly precise technology that designs trusses with such extreme care at times breaks down when plate placement is still accomplished by hand by a workman with little or no knowledge of the fundamentals of truss joint design. Can existing technology find a way to position plates precisely and to be sure both sides of every joint are tight and plated?

As long as wood truss design continues to be done in the shops of the truss component manufacturers and plate manufacturers, can their already three dimensional computer program technology be used to include "system" design of the entire roof or floor system? Building designers seem to be anxious to turn over the technical aspects of their design responsibility to others and perhaps it is time for the industry to add value to the structural system design and offer this service, for a fee, of course.

If the wood roof or floor truss system is designed and manufactured by the truss manufacturer, can existing technology include the design of temporary and permanent bracing for the proper installation of the components? Under this scenario, the bracing lumber, connections and manufactured bracing sub-components could be designed with the temporary and permanent bracing and delivered with the trusses.

In my experience, almost all of the significant problems in the wood truss industry occur on the job site after the components are delivered and out of the hands and responsibility of the manufacturer. Yet, almost all product accident or malfunction litigation is unfairly expanded to include the component manufacturer as a prime defendant. With the additional responsibilities described above, it is my belief that many truss manufacturers will face the inevitable and hire well-trained, responsible and dependable erection crews to install their products. Can existing technology be expanded to include sufficient guidelines for erectors to use in the installation of complete wood structural systems?

It would be my pleasure to work with a small team of bright young engineers within WTCA to continue its work of tackling some of these industry challenges.

John Meeks, P.E., is a consulting engineer in Fort Lauderdale, FL.

SBC HOME PAGE