**STRUCTURAL BUILDING COMPONENTS MAGAZINE**
November 2002

# The Role & Importance of Quality Control by Mike Baker, P.E.

Throughout the manufacturing world—quality is a given. It is a cost of doing business. Anyone who operates in this world will describe the quality or their products as among the best. However, unbiased observers typically recognize distinct differences in the level of quality between different producers and product lines.

So what determines the quality level from a particular producer or a particular industry? Unfortunately, there is no one "key" and no single right answer. Producing a quality product demands continual focus, commitment and improvement. Not only must a company be committed to quality, it must be constantly on guard to avoid the surprises that can creep into even the best programs.

Structural wood products are typically approved for use in two forms. The first is those products that have a large historical presence and have been written into a building code. In this case, the design values have been established from years of use and are standard for all products. Quality can still vary, but manufacturing targets and designs all use similar values.

CLICK ON IMAGE FOR LARGER VIEW

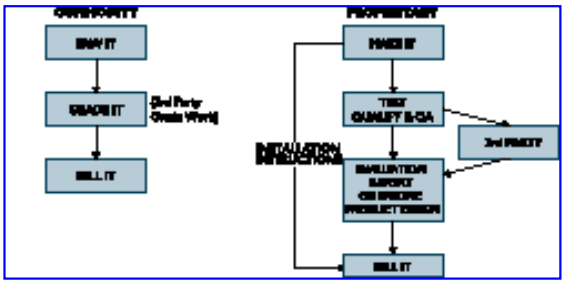


FIGURE 1

Proprietary products are written into the code using the alternative product section. This section is added to all major codes to allow newer innovative solutions to be utilized. It does require that products be evaluated and approved by the building official for the intended end use there.

Proprietary manufacturers follow ASTM or other recognized standards to qualify the product and set design values. They submit data to a code evaluation service, which reviews the data and issues an opinion as to the suitability of the product for the intended application. Figure 1 shows the general process.

Many organizations have a role in the proper use of products. Code evaluation agencies are instrumental in establishing the standard of use for common products and to provide an independent review on proprietary products. Through the use of evaluation reports, they allow a consistent message to be conveyed to building officials across the country. These agencies rely upon independent third party agencies to provide verification that any data presented is representative of the performance and quality of the product being evaluated.

As shown in Table I, the levels of review and approval for the use of structural products vary enormously. However, the one constant is that it is the manufacturer who is responsible for the product's quality. Other groups are important partners in the quality process, but they should not be relied upon as the means to producing a quality product.

**TABLE I**

| Product | Who makes it? | Qualification Testing | Additional Grading | Ongoing QA Testing | Gradestamp or Trademark | Who provides application support? | Who is legally responsible for final product quality? |
|---|---|---|---|---|---|---|---|
| Visually Graded Lumber | Manufacturer | Not required - established from historical data | Manufacturer & 3rd Party | Not required | Manufacturer & 3rd Party | EST Codes | Manufacturer |
| Plywood & OSB | Manufacturer | Manufacturer & 3rd Party | N/A | Manufacturer & 3rd Party | Manufacturer & 3rd Party | Manufacturer | Manufacturer |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Glulam | Manufacturer | Limited Process Testing Required | N/A | Manufacturer & 3rd Party | Manufacturer & 3rd Party | Manufacturer | Manufacturer |
| I-joists | Manufacturer | Manufacturer & 3rd Party & Model Code Staff Review | N/A | Manufacturer & 3rd Party | Manufacturer & 3rd Party | Manufacturer | Manufacturer |
| SCL | Manufacturer | Manufacturer & 3rd Party & Model Code Staff Review | N/A | Manufacturer & 3rd Party | Manufacturer & 3rd Party | Manufacturer | Manufacturer |
| Metal Plate Connected Trusses | Truss Manufacturer | Metal Plate Connector Manufacturer | N/A | Truss Manufacturer & 3rd Party | Varies by Local Jurisdiction | Truss Design Drawing per state engineering laws | Truss Manufacturer |
| General Steel | Manufacturer | Not required | N/A | Manufacturer | None Required | Design Engineer | Manufacturer |
| Cold Formed Steel Trusses | Truss Manufacturer | Proprietary Shape Provider or Steel C-section | N/A | Truss Manufacturer | Truss Design Drawing per state engineering laws | Truss Manufacturer & Proprietary Shape Provider | Truss Manufacturer |
| Most Other Materials | Manufacturer | Not required | N/A | Manufacturer | None | Design Engineer | Manufacturer |

**CRITERIA FOR AN EFFECTIVE QUALITY CONTROL PROGRAM**

**1. Commit to quality:** It starts at the top and permeates the entire organization. The senior management team not only talks quality, they support it. Tough issues involving quality are resolved based on their technical merits. No one likes to delay an order or to destroy production. Separating the decision of product adequacy from customer issues can be incredibly powerful and is critical to an effective quality system.

In our organization, plant managers are responsible for quality but the technical organization has responsibility to review and determine quality of any particular product. A decision to accept production is determined by meeting established standards. Any questionable production is evaluated based on testing, process control measurements and other data. If the QA technician on the floor says the product doesn't go, then we have to figure out another way to supply product to the customer.

**2. Establish manufacturing standards at the plants:** For a company with one facility, management may have a solid idea of what is going on. With multiple plants, it is only a matter of time before each plant operates a unique process and subtle differences in the product start to occur. Every plant within our company operates under a manufacturing standard, which stipulates the operating boundaries for the plant (allowable wood species, press temperatures, adhesive types, loads, etc.). Each variable is reviewed and qualified to ensure the product produced will meet all design properties. The standard allows flexibility at the plant level depending on local or seasonal needs and is frequently reviewed and updated to remain current. If the standard no longer applies to actual practice—either the process changes or the standard is changed.

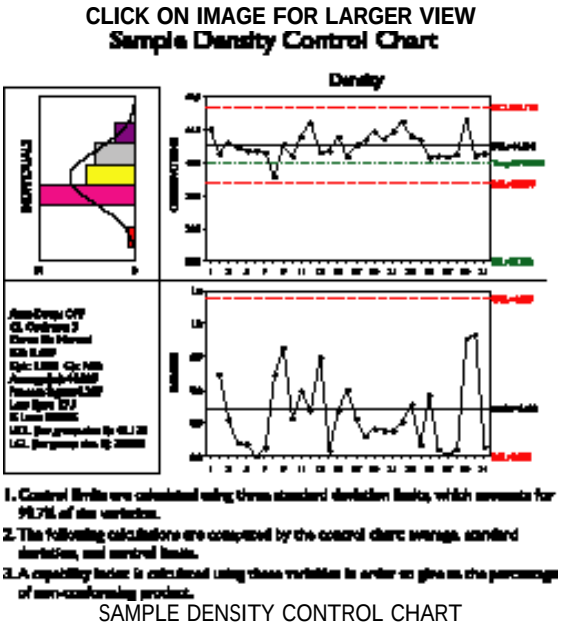
**3. Test data frequently:** The role of testing is hard to over-emphasize. It is the basis of all data and information and allows one to identify any developing trends. We test full-scale and small-scale specimens and review trends and design values monthly. We also verify incoming material, which allows us to ensure that purchased material conforms to our specifications prior to introducing it into the process.

**4. Implement a third party-grading agency:** These agencies and organizations have an important role in a manufacturing process but they cannot assure quality. What they can do is assure that a manufacturer is following their own established quality program and provide an independent look at the operation.

The use of an independent agency to review plants and processes can be a valuable addition to any quality program. There are several high quality firms that provide this service. Partnering with the inspection agency and participating in training programs will yield dividends, as the quality of the inspection lies in great part to the quality and knowledge of the individual inspector. If you employ such a service and you are only doing a "checklist," you may not be getting your money's worth.

**5. Process control-documenting and tracking trends:** Documentation is a fundamental foundation of process control. Production operators are trained to measure, record and/or trend process variables to ensure conformance to the manufacturing standard. Our quality assurance team is focused on the statistics of key process variables and their impacts to our manufacturing process and product performance. The purpose of statistical process control is to identify and manage the natural variation that is part of every process. It is important to understand the extremes of any process and not simply the average results. We continually measure standard deviation, co-efficient of variation, and process control limits on all key variables.

CLICK ON IMAGE FOR LARGER VIEW




SAMPLE DENSITY CONTROL CHART

Control charts are used to understand the variation of all raw materials brought into our process, of process variables such as adhesive application rates and for all finished products. The data is entered into our database and checked against our manufacturing standards to ensure compliance.

Tracking occurs at the machine and requires the operator to understand the natural variability of the equipment they are operating. Training for this individual is essential. With training, an operator will know when his operation is within the normal tolerances for the process or when the equipment requires attention. Without training and a strong level of understanding, operators will continue to turn dials, change settings, and modify the process to keep the equipment at the average. This results in unintentional additional variability at best.

As we improve our processes, we have found it possible to lower our costs. As process improvement occurs, we have less variability so we operate closer to target specifications without the risk of excessive downfall or producing non-conforming product. Our measurements on critical components (key process variables) occur early in the process, allowing us to catch problems prior to moving them downstream or to a customer.

**6. Inertia:** It is critical to have a complete unbiased look at every process. A big risk to quality production is the inertia and belief that everything is being done correctly. Using a pre-printed check sheet can introduce obvious concerns. Inspectors can walk past a real problem just to take a dimension or to check a box that has never varied in the last 20 years. Make sure the system in place is robust and challenging by minimizing repetition as much as possible. If you are using a check sheet make sure it has actual measurements on it and does not just require a series of checkmarks. It takes time to walk through your process and objectively view what is really going on and compare it to what you think is going on.

A good way to battle inertia is implementation of a continuous improvement process. Using data obtained in statistical process control and sharing information between plants, the status quo can constantly be challenged and the process improved.

**ISO—GOING TO THE NEXT LEVEL**

We started down the ISO path in 1996. While we have not implemented full ISO registration in all of our plants, we have implemented an ISO similar Quality Management System (QMS). Initially there was skepticism about the direction and most believed that ISO would require a lot of paper work and tracking, increased work loads, with little to no

measurable gain. We had a robust quality control system in place for years. And we were good! (We were guilty of item #6 above). Implementing ISO made us take a hard look at ourselves; we learned some things and every one of our plants saw improvement.

ISO does not ensure good quality and it does add paperwork. Just tracking results with no corrective action will not improve any process. Providing written Job Instructions (JI's) seems silly until you realize how many times a new employee is placed into a critical role during hectic times with little to no training. Having written instructions for each operation ensures consistency. Just like the manufacturing standards, they have to be current and changed to reflect reality to be of any use.

Using a continuous improvement form (CIF), we now have a process that forces us to address each and every problem. Going out and telling the operator not to repeat a poor practice works fine until they call in sick or they just forget. With written instructions, there are no questions as to what the problem was or what corrective action was taken.

**AUDITS**


The ISO process requires an annual audit by the registrar to ensure compliance. The plants also do internal audits with plant personnel to ensure compliance. But the biggest value we have received is the start of a quality audit program. This audit program involves people from QA, engineering and includes experienced operators from other facilities. We focus on every aspect of plant operation from maintenance practice, QA methods, calibration of equipment, training records of personnel, and any customer complaints. We even inspect existing inventory, including full bundle inspections. We talk to people on the floor to see how they operate and what they really understand, not just what management thinks they understand. The auditors focus on problem areas as well as identify areas where the plant has implemented a practice that represents an improvement over the status quo. The auditors typically take these new ideas and improvements back to their own plants.

**SPECIAL CONSIDERATIONS FOR PRODUCTS LIKE TRUSS CHORDS**

We started supplying truss chord product to the truss industry several years ago. Our product for this market segment has a niche in high stress applications. Therefore, it is paramount that the product performs as stated. We investigated how best to provide this product to the industry with a high degree of confidence. We invented and implemented a new grading technology. Every square inch of every piece is automatically inspected for defects or low-density area before it goes into Truss Chord grade. Since a huge part of the quality is dependent on the design and fabrication of the truss we worked very closely with the several leading producers of truss plates to incorporate proper design methods and values for our products. We also decided to align ourselves with the best truss manufacturer such as those that have a fully functional QA program, such as the In-Plant WTCA QC program. Such a program follows many of the items detailed in this paper:

1. It establishes a commitment to quality.
2. It requires compliance to a manufacturing standard.
3. It provides frequent manufacturing data.
4. It documents and tracks trends allowing for continuous process improvement.
5. It shows directly whether there is complacency creeping into the system.
6. It helps the QC education and training process.

Quality is expected, but it is not free. Each of the items we have implemented cost money. They do provide good value for the money spent and having a rigorous QA program reduces falldown, liability and other related expenses (not to mention customers seem to prefer a quality product). We believe this commitment to a disciplined quality program delivers great value to our customers.

---

Mike Baker is a Registered Professional Engineer who has been with TrusJoist for 15 years. He currently serves as TrusJoist's Vice President of Engineering and is responsible for the approval of product applications, new product development, industry and code activities, product testing, and establishing

manufacturing standards and product quality assurance programs.

---

SBC HOME PAGE



The mission of Structural Building Components Magazine (SBC) is to increase the knowledge of and to promote the common interests of those engaged in manufacturing and distributing of structural building components to ensure growth and continuity, and to be the information conduit by staying abreast of leading-edge issues. SBC will take a leadership role on behalf of the component industry in disseminating technical and marketplace information, and will maintain advisory committees consisting of the most knowledgeable professionals in the industry. The opinions expressed in SBC are those of the authors and those quoted solely, and are not necessarily the opinions of any of the affiliated associations (SBCC, WTCA, SCDA & STCA).