Statistically Speaking

BY ROBERT ZAYKOSKI

Firms of any size can make better use of their data through basic statistical analysis.

AS AN AUDITOR, I have been privileged to see many different practices in the structural steel fabrication and erection industry. Many of these practices have been challenged in recent years due to economic pressures. As a rule, we know we can't keep doing business the way we did in the past. Today's economic environment has forced all of us to rethink how we do business. Every decision is thought through carefully, every business process is being evaluated, and every organization is smaller than it was a few years ago. What remains constant, however, are the functions that still need to be performed. So, as we move forward, and make organizational or facility changes, how do we assess the effectiveness of these changes?

I have found that in general we have not placed solid metrics on the processes in place, not to mention those that have changed, and consequently we cannot easily determine how effective a particular change is.

Across the industry today, statistics is the tool most commonly used to determine effectiveness of change. In this article, I will introduce some simple principles and examples of how statistics can be used throughout the steel fabrication business.

Manufacturing companies have been using statistics to understand and control their operations for decades. Steel fabrication often is viewed as being a unique manufacturing business, because it does not require making the same part over and over. Yet the shop does perform the same repeating operations. Accuracy and precision are needed for material to be cut to size, holes to be drilled, parts to be fabricated and fit, and welds made. In fact, as an industry, we rely heavily on this fabrication accuracy and precision. Without it, design and engineering requirements would be difficult to meet, not to mention the difficulties that would be encountered in field operations.

Using some simple statistical tools, it is possible to determine and track how fabrication processes are performing. These techniques lend themselves to both automated and manual systems.

Most companies find that tracking equipment capability is often based on operator intuition. For instance, when talking to drill line operators, I often ask how they verify whether the equipment is working properly. Most commonly the answer goes something like this: "I check the first piece at the start of the day, and every 15 or so during the day. If any of the pieces are off by more than 1/16 in., I do an adjustment to bring it back in line."

What is interesting here is that most operators don't know what the common variance around the target value is. By making adjustments, they are causing the equipment to move around its natural or design variability, and may be worsening the problem.

When the equipment is new, it should meet the manufacturer's design variability. Unfortunately, these systems rely on secondary systems, such as the transfer system, so each integrated system needs to be assessed together. Ideally, you would gather data when the equipment is new, so that as time goes on you can assess how wear is affecting your process. This is not to say you can't start right now with the equipment you have. In fact, doing so allows you to determine what the control limits are. This way your operators and maintenance people will know whether or not the equipment is operating within its expected range.

Fabricators and welders often view the QC inspectors as their nemesis. Management often views this function as the gatekeeper that prevents bad product from "escaping" the confines of the shop. These individuals often gather and document considerable information. Too often this information is destined for file cabinets or project binders, never to see the light of day. Yet it is this data, when properly analyzed and understood, that allows management to make business-based decisions that improve the bottom line. For instance, it would be useful to understand what percentage of pieces going through the shop are error free on first inspection, thereby never needing to return for rework, repair or worse, replacement. This first-pass

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What is Statistics?

According to *Merriam-Webster's Collegiate Dictionary*, "statistics is a branch of mathematics dealing with the collection, analysis, interpretation, and presentation of masses of numerical data."

The most commonly recognized statistic is the mean, or average, of a set of numbers. This tells us where the number-weighted center of the data is. Although a useful calculation, the mean is really of little value without an understanding of the variability of the data.

Measures of variation such as the variance, mean deviation and standard deviation show how the data are spread around the mean, often best communicated through the use of charts and graphs. With an understanding of the variation as reflected in these measurements, one can determine how effective a process is and the probability of making a mistake. With further analysis, it becomes possible to better understand what drives variation in the process. By optimizing the process, it is possible to both reduce variation and reduce the probability of generating errors.

There are many sophisticated statistical tools that rely upon the use of the mean, variation and proper presentation. Through use and mastery of these tools, you can readily employ some of these sophisticated methods to improve your business.

yield gives us an understanding of how much additional time it takes to get steel through the shop. The higher the number, the more efficiently the operation runs.

Another area in the fabrication process that is easily adaptable to statistical evaluation is the paint operation. When dry film thickness (DFT) measurements are taken for each piece, statistics can be used to understand the variability of application. In fact, many of the electronic DFT tools readily perform these calculations for the data set. Turning the data into information will tell us whether the painter is reaching or exceeding the target film thickness. If painters are consistently exceeding the target DFT, the company can work to reduce its paint costs by communicating this information and optimizing the paint process.

So far I've spoken only about the fabrication process. Clearly much of the information gathered from operations will help us understand why projects may or may not perform well compared to the estimate. As the fabrication process is optimized, costs should go down, allowing more confident estimates and improving profitability. In addition, by looking at historical data, it is possible to refine the estimating process with solid numbers based on type of assembly, size of members, and the processes involved as well as field costs.

Detailing, whether performed in-house or subcontracted, is another area where we can use statistical tools to optimize the process. For instance, how often does the detailing manager follow rework of drawings? What is the normal variability around approval times? Although you have little control of the approval process, analysis of the process may spark methods of communication that will improve approval timing.

These are just a few examples of how statistics can be used in your business. Overall, I would encourage you to initiate the use of simple statistical tools as you improve your business. By making decisions based on established metrics you will be able to readily measure the effectiveness of your improvements. Many companies regularly use these tools to the point that these become part of the company culture. Furthermore, as you begin to better understand your business capabilities, you may start to use more sophisticated tools, such as LEAN and Six-Sigma, which rely on these basic statistical tools. MSC