

# Time & Motion

## The Keys to Efficiency

**Open your eyes,  
pull out your stopwatch,  
and improve your bottom line.**

By Jim Parrie, Ph.D., CPF

**M**any production framers have expressed an interest in how to establish the use of metrics (manufacturing statistics) in their facilities. While there is a massive amount of information available about metrics, an important starting point is the use of time motion studies (TMS). This important basic building block of metrics can provide some valuable information you need to get started in establishing metrics at your facility.

Metrics are key when you make fundamental business and personnel decisions in a manufacturing facility. For example, do you know the difference between how many frames your saw operators can cut in one day and how many they should cut in a day? Or how many pictures a fitter should assemble in an hour? Knowing the answers to these and similar questions are essential when determining manpower levels and accurate job costing. However, compiling metrics takes more than merely using a stopwatch and timing how long it takes to cut a frame,

### Origins of TMS

The practice of TMS is regularly credited to the American engineer Frederick Taylor because of his pioneering work in which he sought to improve industrial efficiency. Two other individuals deserve equal credit, the husband and wife team of Frank and Lillian Gilbreth,



who contributed seminal works in pure motion studies.

TMS were developed to minimize the number of motions needed to do a task. Taylor felt that workers in repetitive jobs intentionally or

unintentionally work in an inefficient manner. He believed that there is one best method for performing any particular task and that if that were taught to workers, their productivity would go up. (It was also his idea to give workers breaks throughout the day based on experiments that showed iron ore workers were more productive if they took periodic rests.)

So what does this have to do with making your framing facility more efficient? When you improve efficiency, some people will be inconvenienced and some systems may see a dramatic upsurge in volume while others may be totally eliminated. Those changes are acceptable if the overall system becomes more efficient. Some individuals may experience discomfort or may have their roles eliminated. (“Roles” is used as opposed to “jobs.” If a staff member is motivated and has value, a smart manager will provide new opportunities for that worker.) Temporary discomfort is just the price of achieving an efficient system. The best possible outcome is for a factory to run at optimal performance so that wages, profits, and the value received by the consumer all remain high.

A data page from ShortHorn, a software program from AureliuSoft used to track TMS data, shows the times for each section involved in a frame cutting operation along with other pertinent information for the process.

## Madison Project #1209

Do you wish to use pre-defined times?  Yes  No    Frame Size: 11" x 14"

Is this a single frame?  Yes  No  There is no frame    How many frames to stack? 0    Event Time

Mldg#     Moulding Width

Moulding type?  Wood  Metal  MDF  Polystyrene  Other

How many mats?

Mat #     Template #

Mat #     Template #

Fillet(s)  Yes  No

How many fillets?

Glazing type?  Reg. Glass  Non-glare glass  UV Glass  
 Non-glare UV  Plexi

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Step	Description	Time
Step 1.	Grab material	6
Step 2.	Cut long rails	13
Step 3.	Place cut rails on cart	3
Step 4.	Move measuring stop	4
Step 5.	Cut short rails	11
Step 6.	Place cut rails on cart	3
Step 7.	Reset measuring stop	4
Step 8.		
Step 9.		
Step 10.		

Add More Steps

Total estimated time:

## Real World TMS

How do you go about performing a TMS? What follows are real world examples (with names and specifics changed for confidentiality). The lessons for production framers lie in how each of these systems changed, the seemingly initial adverse effects, the unintended findings, and the overall positive result.

One client, "Bob," owned a factory that was inefficient and losing money even though sales were at a record high. There were many areas that were not performing optimally. One area was customer service, which was swamped with phone calls from customers, vendors, and stores—all complaining. The department had hired extremely qualified people and paid them exceptionally well to handle the workload, but things were still out of hand.

Bob wanted to make the customer service department more efficient and to evaluate the costs and benefits of adding an integrated telephony system that would interface with an Internet-based customer relationship management (e-CRM) system. A telephony provider had recommended a \$20,000 telephony system that would integrate with a \$15,000 e-CRM system. The proposed package would allow the customer service representatives (CSRs) to see a customer's entire information as soon as a call came into the call center. Basically, a portion of this package was a very sophisticated caller ID system. The system also provided CSRs with the ability to see across the network and check the status of the customer's order and more.

While Bob thought this might be the solution to his situation, we recommended a further investigation. The reason is that, in many cases, what seems to be the problem turns out to be only a symptom—and not the root of the problem. We have often found that when

conducting TMS in a facility for the first time, there are often issues and benefits that show up that no one had previously considered. Such "unintended findings" often result in added cost savings as a side benefit.

So, before starting to do TMS and seeking out inefficiencies, we wanted to know what the people were doing at Bob's facility and why they were doing it. We met with the CSRs, factory personnel, salespeople, and customers to gain an understanding of everyone's roles, goals, and frustrations. After reviewing hundreds of calls with the head of customer service, they were grouped into various categories, including freight damage, wrong components, orders past due, and poor workmanship. A total of 15 error groups were tabulated using Excel. The category with the highest dollar cost was manufacturing errors. Those were then broken into a series of subcategories and studied further.

One of the costliest areas involved the fitters, and it was one of the easiest to remedy. Customers were complaining that their pictures fell off of the walls, that they wouldn't hang straight, and that identical pictures would hang at dramatically different heights. This was costing the company thousands of dollars a year in re-dos, replacements, refunds, and added customer service expense. And it was all about wire hangers not being tied correctly by everyone, every time.

We recommended a wire crimp tool to help alleviate this problem, but the owner choked on the \$1,200 per gun price tag. Bob apparently thought that spending more than \$35,000 on a sophisticated eCRM telephony system was perfectly logical, yet a \$1,200 solution to a significant problem was over the top—even though he was losing many times that amount on re-dos, refunds, and CSR time. He insisted that his workers would be less efficient and wouldn't like the tool.

## Conducting TMS

Instead of doing a TMS on the CSRs, we conducted a study on the fitters using two scenarios: one group did it their way while another group used a wire crimp tool. The format required a stopwatch, a pen, and some paper and consisted of three basic categories: observation, documentation, and timing:

**Observation:** First, watch the particular framing (or support) process for 15 minutes but do not write anything down or time anything. You want to observe all of the small things a worker does. The small things are often what can be eliminated.

**Documentation:** Next, write down every step, every motion, and every time the worker waits, walks, or stands. After that, watch the worker using only your list and check off each step you have written down to verify that you've recorded each step in the correct order.

**Timing:** Now, time each step with a stopwatch. Your recording page should be divided into rows, with each step of the process having its own row. It should also have columns with headings labeled Event 1, Event 2, Event 3, etc. The more events you time, the more accurate your data will be, and you should time each event at least 10 times. It is also more accurate if you time more than one employee. After you've timed a worker at least ten times, transfer the data from your worksheet to an Excel spreadsheet.

## TMS and More Unintended Findings

While documenting the fitters as they installed hangers and wire at Bob's facility, we discovered that each employee was doing the process differently. Some were using different tools to drill the pilot holes, and others were tying the wire differently. There were also different methods being used to adjust the length of the wire. The workers all had their own ways of installing hangers and wire, and none were doing it efficiently.

We decided to conduct a TMS on each fitter separately to see which one was the most efficient, which steps were the most common, and what steps could be eliminated. We found that the fitters were wasting at least six minutes every hour by tying the wire instead of using a wire crimp gun. Those six minutes, times eight

hours a day, times \$10 an hour equaled about \$8 per day or \$2,000 a year per fitter. Changing to a crimp gun would save Bob about \$2,000 every year—not to mention virtually eliminating the issue of wire not being tied correctly, thereby reducing the number of customer service calls and re-dos.

We also found another saving. The fitters were throwing away six feet of wire per hour. They were pulling extra wire because it was easier to wrap and tie a longer length. A wire crimp gun would allow a shorter pull of wire, thereby saving 48 to 50 feet a day or about one roll a month per fitter. At \$16 a roll, this meant a savings of about \$192 a year per fitter. When added to the labor savings, a \$1,200 wire crimp gun would save Bob \$2,192 a year—again, not to mention the savings in customer service payroll and re-dos and increased sales from better customer retention. So what started with Bob wanting to make his call centers more efficient led him to save more than \$25,000 a year

overall by cutting inefficiency in the fitting department.

After seeing the potential savings, Bob instituted standardized procedures so that all fitters now assemble pictures in exactly same way, using exactly the same tables and tools. At first, there was a lot of resistance from the fitters because they all had their own ways of doing things. They felt that they had been doing it that way for years, so there was no reason to change. And when the fitters first made the change, productivity declined slightly because they were not accustomed to the new format. But after a few days productivity increased, re-dos fell off dramatically, and customer service calls were slashed. Training and quality control became easier, pressure was eased on the call center, and overall frustration at the factory declined. And the company is making more money. As for the telephony system, based on TMS, new procedures were instituted and payroll was reduced—all without the need of the additional \$35,000 system.

## Other uses for TMS

TMS can be used in a variety of other ways. Consider the seemingly innocuous subject of puttying. A client, "Joe," conducted a TMS to reduce the labor spent puttying frames. A detailed analysis was to be used to establish a benchmark time for puttying. However, when con-



*Keone Kaumoku at Pictures Plus in Hawaii creates a videotape as part of a time motion study.*

ducting the analysis, we found that 80 percent of the frames being puttied were the result of bad miters. Joe then asked his saw operators how often they changed blades. They were being changed “whenever they start getting dull,” as per his instructions. The problem with that common strategy is that the cut errors only appeared downstream, when the frames were joined or puttied. And, by wearing blades down to the point of dullness, blade life was being shortened by one to two sharpenings.

Joe implemented a blade management program in which the saw operator changed blades at specific times on specific days. The blades were sent to a professional blade sharpening company. Each blade now has a serial number and can be tracked for wear, sharpenings, and defects. When a blade is worn out, the blade management company replaces it because the fee takes into account blade wear, life, and damage. Joe was able to reduce his overall blade costs and saw nearly an 80 percent reduction in the number of frames being puttied.

Incidental findings like this naturally decline the more times you conduct TMS as your systems and procedures become more efficient.

## Using TMS for Costing

TMS are invaluable when bidding on large jobs, especially those that are slightly out of the norm for you. Many OEMs—especially in the hospitality industry, where some customization is required—don't know their true labor costs. What does it cost to deekle and paint the edge of a lithograph? How much labor is involved in using foamboard to build up a specific mat? Little exceptions like these can break a manufacturing facility.

AureliuSoft has developed a software tool specifically for the picture framing industry to use in conducting TMS and other types of efficiency analyses. The application, named ShortHorn, shows the benefits of TMS when conducting a time-costing analysis for a new commercial order.

Most production framers don't know their actual labor costs for large scale orders. An error of two to three minutes in calculating labor costs can mean hundreds or even thousands of dollars in lost profit. TMS can help provide a manufacturer with more accurate estimates of direct and indirect labor costs. Here's an example. Using ShortHorn, we conducted TMS on the following job:

- 11"x14" image
- Dry mounting
- Regular glass
- 3" double mat
- 17"x 21" single 1 1/2" wood moulding
- 25,000 units

The client, “Sam,” had made certain assumptions in his labor costing structure. He originally calculated his

cut time for a 17"x 21" frame at 25 seconds per frame because he knew his framers could cut “about” 850 frames a day. He had timed how long it took to cut one frame by using a stopwatch and observing a saw operator make five cuts in a stick of moulding. Unfortunately, when Sam used “about” or “approximately” in his costing, he was off the mark. (If you use those terms, you're probably losing money or are grossly overcharging on jobs.) Sam's assumptions were put in a separate column in ShortHorn to determine the cost differential after the study was done.

Each step of the process was then timed using a PDA, as opposed to a stopwatch, using the PDA portion of ShortHorn. We performed a TMS and identified the steps and times of cutting a frame as usual. Among the things we found was that Sam had not considered all the steps needed to cut frames. The following steps and times were identified:

Description	Time (seconds)
Grab stick from cart, inspect, place on in-feed table	8
Cut two long rails*	15
Place cut rails on cart	4
Move material stop	4
Cut two short rails*	13
Total Time	44

*\*For higher material use and speed, the saw operator actually cut all the long rails at one time, then cut the short rails.*

TMS also revealed that the saw operator periodically had to stop to place defective moulding on the side; this occurred 8.2 percent of the time. The saw operator also stopped every 30 to 40 frames to remove sawdust from the cutting area and empty the waste collector once an hour.

The cumulative time of 44 seconds per frame times the 25,000 units resulted in a total cutting time of 416.67 hours. Another 18 seconds was spent for every bad stick of moulding in which defects had to be cut around or had other things causing low yield. That added another 25.06 hours. At Sam's cost of \$12 an hour for a saw operator, the differences were:

	Bob's Estimate	TMS Total Time
Cut	173.61 hrs	305.56 hrs
Yield Issues	0*	25.05 hrs
Debris Removal	0*	2.90 hrs
Total	173.61	333.51 hrs
Labor Cost	\$2,083.32	\$4,002.12

*\*Sam had not included these in his original equation.*

This disparity had a number of ramifications. The \$1,918.80 difference should have been budgeted for this

job. In reality, it would have disappeared instead in either overhead or indirect labor once it was turned over to accounting. By placing such a discrepancy in a category other than the job itself, Sam would never have a true picture of what his actual profit or loss was on the job.

Once the TMS was done Sam began using quality MDF moulding, which virtually eliminated the 25.05 hours in yield-related issues. He had never used MDF moulding before because he could import cheap moulding so easily. But when the labor for handling defects in moulding was added in, the decision was easy. The switch also resulted in savings in touch-up, quality control time, and waste.

### **TMS for All Jobs**

As with Sam, TMS can point out a variety of areas where labor times are being either over- or underestimated. TMS will also show you areas where you can minimize steps. The incidental finding that led Sam to switch to MDF also resulted in the elimination of enough hours from his quality control department to save him another \$15,000 a year. Sam also found that he could eliminate wasted motion through his hands-on study of each process within a specific job.

Sometimes, it doesn't take a TMS to reveal things that need to be changed. Before you conduct a thorough TMS audit of each process, procedure, and production

cell in your factory; just stand at the front door of your factory. Is it clean and well maintained? Is this the type of place you would be proud of showing your customers? Is your quality what your customers want? How much scrap is laying around in your moulding and mat areas? How much is in the garbage? Are you happy with the amount of overtime you're paying?

If any of these questions make you feel uneasy, then take 15 minutes and observe one person doing a repetitive job. Are they doing it exactly how you want it done? Is everyone doing that task exactly the same way? If the answer is no, then pull out your stopwatch and start saving money. ■

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Jim Parrie, Ph.D., CPF, a 30-year veteran of the framing industry, has owned and operated small frame shops, galleries, and wholesale operations to high volume OEM facilities. Currently, he owns Millennial Technologies & Consulting International, a consulting firm to high volume framers, retail chains, and manufacturers throughout the world.

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AureliuSoft will also be showing its latest TMS software release on Monday, Jan. 29 in the Production Efficiency class #E810 and in the Production Pavilion on Tuesday, Jan. 30