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Work Measurement Demystified

In order to improve labor efficiency and manufacturing performance, work measurement should be a primary consideration to establish baseline data and to be used as a diagnostic and process improvement tool.

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Virtually every manufacturer, at some point, needs to know how much time it takes for them to manufacture, pack, pick, paint or otherwise produce their products. You have to know this information, at some level – even at a basic level – in order to plan or schedule your production to meet shipments and to determine how many people you need to accomplish the task.

Some companies just wing it by asking their supervisor how long it takes, or by looking at hours-worked reports and dividing by the number of products produced. Other companies hire industrial engineers or time study technicians to do time studies or use other work measurement tools — always striving to have the most accurate time data they can.

Work measurement means different things to different people. For purposes here, we will loosely define work measurement as the use of various proven techniques in order to establish a "standard time" or average time to perform a specific work task following a defined method. This can be expressed as: pieces per hour, minutes per piece, hours per piece, moves per hour, loads per hour, pounds per hour and the like.

The goal here is to assign a time to a task that follows a specific and defined method. If the method is followed and the worker works at a "normal pace," then you will achieve the rated pieces per hour. By knowing that information, you can plan how long it will take you to produce an order, and if that is not quick enough, it will lead you to setting up

Time studies can be very effective ways of measuring current employee performance and attempting to identify possible areas for improvement.

another line, buying another machine, or adding workers.

The time study process was invented more than 100 years ago and has been tweaked and perfected over the years. An engineering discipline called industrial engineers have historically been the purveyor of the time study trade; however, during the past 20-30 years it seems both industrial engineers and time study have fallen out of favor to other schools of thought such as self-directed work teams. Even Lean methodologies seem to gloss over, not highlight, the benefits of work measurement.

As a productivity consultant, I have never been engaged by any company that had an active work measurement program in place. Typically, those that do are already running efficiently because they have eliminated the wastes and inefficiencies and do not need the services of a consulting company like mine.

Benefits of Standard Work Times

The benefits of standard work times and method descriptions (the forerunner to Lean's Standard Work) are many. Some of the uses are as follows:

- Labor costing
- Quoting labor
- Costing new products
- Scheduling
- Forecasting
- Measuring employee performance and efficiency
- Calculating incentive wage pay
- Manpower analyses
- Develop standardized work
- Eliminate waste
- Methods improvement analyses
- Line balancing
- Equipment evaluation and justification
- Capacity studies
- Development of labor standard data
- Production manning requirements calculations

Usually, work measurement means some type of time and/or motion study is involved, whether manually with a stopwatch or with one of many predetermined time systems that are available, and there are some very good ones. However, for purposes of this article, we will focus mostly on the stopwatch methods, as most people have access to a stopwatch.

There are several different types of time studies that we use, which include but are not limited to:

- Elemental-breakdown stopwatch time study. This is the most common and is a useful starting place for most work measurement tasks or process analyses. It is usually used for short duration work that is repetitive in nature. This method is almost always used to time one individual worker. This type of study is used for line-balancing and is usually the study to start with to understand any work task.
- Non-repetitive time study. This method is used for those jobs that have a long cycle time and where the elements may only occur once during the study. An example would be a coil change on a stamping press, which is a one-time event that you will not see again for several hours, or would be used to study a maintenance worker performing a task like a motor change. Many indirect labor tasks are studied using this method.
- Work sampling study. Work sampling studies can be used when full-time observation is not practical and the information needed is an approximation. The samples can be taken at random or specified intervals and at whatever frequency is convenient for the observer until a sufficient number of samples have been collected.
- Group timing technique (GTT) is used by a single observer to simultaneously study a group of workers doing a group task. A good example would be studying a team doing a full-body paint job on a trailer or motorhome. This is very useful where workers roll off of one task and onto another during the course of the work.

Start with the End in Mind

One of the first things to determine before doing a study is defining the purpose for it and how the information will be used. For example, studies supporting an incentive wage program or times that will be used for establishing a selling price should be meticulous, include detailed elemental breakdowns, carefully rated and with many timed cycles, taking as much time as necessary to ensure accuracy.

On the other hand, if your boss needs a quick snapshot of how long it takes to pack up a carton of product at the end of the line before he calls the customer, then a few cycles capturing the overall event might be sufficient. You do not want to waste time doing detailed studies when they are not needed.

Work measurement and the time study process is the first step in understanding the work your people perform, in establishing control of your process, and in the elimination of wastes and wasteful practices that increase your costs with no value. If you ever have a task or process that you do not understand, or you do not understand why it takes

so long, or you would like to understand it enough to make cost-saving changes, then you need to do a time study on it.

There is something about watching an employee for an hour, writing down everything they do and timing each of those steps that shed a great deal of light on the subject. During virtually every time study I do, I make all kinds of notes regarding ideas for things like:

- Proposed method changes for questionable tasks
- Suspected over-processing
- Batching
- Excessive inspections
- Possible opportunities for a machine, automation, mechanization
- Safety issues or unsafe practices
- Identify non-value-added tasks to be eliminated
- Identify quality-checks or witness marking that were supposed to have ended long ago
- Find machine cycle times that have been degraded and slowed down over time
- Work area layout problems causing wasted time
- Tool sharing or tool shortages
- Operator long walks or reaches
- And a host of other similar issues.

The times collected during the study for these problem tasks help prove and support the proposed changes.

Correct Steps for a Proper Time Study

The process of doing a time study using a stopwatch is fairly simple, but takes practice to get good at it and consistent in its application. Time study observers must make sure that the operator being timed is fully trained on that job. You do not want to attempt to study someone still in training on it. It is also helpful to have the supervisor verify that the operator is trained on the job and there are no unusual conditions going on.

Most stopwatch time studies should include some basics if done right. They include:

- Elemental breakdown of the work. Rather than timing the overall cycle, break it into logical concurrent steps or "elements." A simple example might be: pick up and load part, machine cycle time, unload and set aside.
- Sketch of the workplace. This is a hand sketch of the actual workplace at the time of the study showing the equipment, the operator position, the location of the raw parts and the finished parts and relative location and orientation within the workplace. No measurements are needed and it does not have to be to scale. It should be enough to recreate the conditions, if required.
- Date, time started and time finished. This is basic but important for a number of reasons. For future reference, it could be needed to confirm product models studied, shifts studied, time of day reference and many other useful purposes.
- Enough timed cycles of each work element. Make sure you collect enough cycles to ensure a good average. If the times are very consistent you may only need 10-15 cycles. If the times vary significantly, then you may need 25-50 cycles to make sure you have enough for a fair study.
- Performance rating of the operator. Performance rating is the only black art to stopwatch time study and may be a bit difficult to explain here, but is extremely important if accurate time studies are required. Rating begins with the training of the time study technician/ industrial engineer in the concept of 100 percent performance. This is usually done through the use of rating films.

  The goal is to rate the operator as to his combined "skill" and "effort" doing the work. A normal operator who is thoroughly trained in the job itself and working at a normal pace would be rated 100 percent. If he was working harder than normal he might be rated 120 percent, or if he was working slow or fumbled a lot he might be rated 80 percent. The rating range typically runs from 75 percent to 135 percent.

  Outside of this range accuracy begins to suffer. This percentage is then applied to the average time taken from the timed cycles to either add to or take away from the time average in order to make it fairer. It would not be fair to time the fastest operator and use those times to set the standard without rating that person, thereby adding time to his average in an effort to normalize the data.
- The addition of a factor to compensate for personal, fatigue and unavoidable delays. P, F & D is also a factor that should be added to the normalized time in an effort to be fair and compensate the workers for restroom and water breaks, fatigue that happens throughout the day, including the weight handled, and unavoidable delays caused by equipment jams, or talking with the supervisor and the like. Typically, this will be about 15-20 percent added on to each normalized element.
- Record any machine cycle times, if any. If there is a machine cycle involved, always time the machine cycle itself separately and record that on the time study form. This way there is a record of the speed of the machine in case it is determined the speed is too slow and you can get it sped up.

Many times I find that the actual machine cycles are much slower than they were when they were designed and purchased. This causes wasted labor and lost capacity. Always check this and compare to historical records and correct it.

I realize that this is a difficult topic to adequately cover in a short article. However, it is my goal to shed light on this great and often overlooked tool in a manufacturer's tool box. I encourage you to take a second look at the benefits and advantages of work measurement in your business.

I use this tool, to some level, on virtually all engagements, as it is the core to understanding what is taking place. In Lean methodologies, part of the task is assigning times to the value stream. You really can't see the whole picture without it. PRO