Analysis of Data and Computation of Net Times

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TIME study is recognized today as necessary to equitable wage payments, the proper scheduling of material, an accurate measure of present plant capacity and the determination of future plant requirements. We now propose to use the studies as a means of establishing unit time laws. With the gradual increase in knowledge of the subject on the part of time study men, as well as of executives and workmen, there is an apparent desire to overcome those irregularities which appear with altogether too much regularity. The only answer is established laws. The problem is to discover and define these laws.

The majority of our time study men approach a job with the principal thought of setting a rate on that particular job. The operation is broken down into elements so as to eliminate all unnecessary work, but the elements are not chosen because of their similarity or relation to the particular class of work. For this reason it is difficult at a later time to compare this study with another on the same class of work. It is not possible to check the rate of speed of the elements of this study with others, and therefore the value of an element must be fixed by the judgment of the time study man.

When you place a series of studies on the same class of work together you find a wide variation in the values of similar elements—provided you are able to find similar elements. These studies may be all right for determining time values as a basis of wage payment because the law of averages may bring the total out about right. High time values are usually offset by an equal number of low ones. This is a questionable method, however, and it is necessary to find a way to set time values that will be recognized by all concerned as true values. These laws of true unit time values exist and are unconsciously used every day by the first class time study man with a good memory (not good judgment, as is popularly supposed) and the habit of breaking up jobs into the same common elements. It is our purpose to formulate the good memory of the best time study men into laws, similar to the laws of feeds and speeds, for the use of all concerned in the plant.

The majority of present studies are taken for what may be truly called temporary rates and are entirely unsuited for the establishment of standard time units. The elements are not specifically described or classified in such a way that a uniform rate of speed can be applied to the element when it appears later. Even the terms used in describing the element are changed from one study to the next. The whole study actually fails of the real purpose of a time study, which should be an accurate scientific description and measurement of the work being performed.

To illustrate the method we used in finding the laws which govern the output of machine work, insofar as the man is concerned, we shall describe the steps taken on the grinding operations on an automobile crankshaft. At the time, this crank (a six cylinder) was just nicely started in production in a shop which had never built anything but four cylinder cranks. All operations were on individual temporary piece work prices. The men were average workers in this line of work, and we had the fullest co-operation of the superintendent of the department. A general survey showed the work could be divided into five major classifications: (1) handling the crank, (2) manipulating the machine, (3) machine time, (4) gauging, and (5) necessary allowances.

We then broke the five major classifications up into common elements, separating the constant from the variable elements and arriving at our standard nomenclature.

A. Remove from conveyor and stand on end by machine. (C)

A. Remove from conveyor and land in machine. (C)

A. Pick up from floor and land in machine. (C)

B. Tighten tail stock (screw type) (V) per turns of handle.

B. Tighten tail stock (spring type) and clamp. (C)

B. Close hinge clamps 180 degrees (V) per clamp.

C. Tighten hinge clamp nuts with fingers (V) per thread times the number of nuts.

C. Tighten hinge clamp nuts with wrench (V) per sixty degree turn.

D. Start work spindle (shift lever). (C)

E. Move tools or work to contact (V) per inches per minute.

F. Engage feed. (C)

H. Machine time (power feed) (V) length of cut, divided by R.P.M. multiplied by feed, equals time of cut.

H. Machine time (hand feed) (V) per inch of travel or cubic inches of metal removed per minute.

I. Disengage feed. (Reverse of F)

J. Stop machine. (Reverse of D)

K. Release nuts with wrench. (Reverse of C)

L. Loosen nuts with fingers. (Reverse of C)

M. Open hinge clamps. (Reverse of C)

N. Release tail stock (screw type). (Reverse of B)

O. Release tail stock (screw type). (Reverse of B)

P. Remove piece to conveyor. (Reverse of A)

Q. Remove piece to floor. (Reverse of A)

After taking all of the studies we found many elements not in our original survey, but they came under the major classifications and had their own value.

In order to keep the machine running day in and day out allowances appeared necessary for (1) extra stock handling, (2) oiling machines, (3) cleaning out chips or mud from grinding wheels, (4) carrying water, (5) grinding and replacing tools, and (6) personal time.

We wish to stress the importance of a general survey before a first group of studies is made. This general survey is only a guide to what we want the studies to tell us. The studies will tell many more things than could be conceived in advance, but it is very necessary to have a predetermined and clearly defined course charted before attempting to sail.

In this case the constants were described in such a way that there was no danger of their overlapping the next elements. The variables had their range set and also the unit of measurement. We were then ready to go to the shop to take our studies, knowing just how to classify what we observed as we observed it. Our time study form was laid out to make twenty observations by continuous time, with the foreign elements at the top. The operators selected were considered the best. The elements were recorded in accordance with our standard nomenclature and the twenty observations made. At the conclusion the operator was rated according to the way in which he worked during the study. We took sixteen studies, sent them to the clerks to make the subtractions, and then analyzed the individual times of each element. The quality of the operator performing the work was first noted and constantly kept in mind as we studied each element. We first cut all times which were marked as not being true readings when the study was in process. With the obviously incorrect readings eliminated it was possible more closely to examine the balance of the readings.

The writer always puts a small x in the space above the time noted if the operator hesitates or if a foreign element actually enters without there being time enough to read and record it as a foreign element. The same is done if the reading is too small to be recognized as a true minimum time. Mr. Dwight V. Merrick tells us his general rule in considering what reading to keep and what to cut. He says a reading should be discarded if it is thirty per cent below or fifty per cent above the adjacent time. However, we found this true only on first class men working at their best.

The quality of the operators, because of the fact that men working on piece work have a tendency to hold back and not put forth their best efforts, has to be taken into consideration. The next thing to consider is the element itself. Is the nature of the element such as to lend itself to mechanical rhythm or not? Is there a chance for obstruction, beyond the operator's control, that would tend to produce a high deviation, or has there been a misreading? If the same time appears several times along the line it could hardly be a misreading. If it appears only once the times above and below should be observed to make sure the reading under question was not run into either the preceding or following elements. As a further check, some of the other studies should be looked over to see if the time appeared in them. In deciding whether or not to keep a reading the main thing to be determined is whether or not it is a true reading. Having decided this, every other element should be subjected to the same critical examination and comparison with other similar elements appearing in previous studies.

When the whole study had been checked, and all abnormally high readings and all low misreadings cut, the studies were returned to the clerks who summed each line, found the average time of each line, recorded the minimum time and computed the deviation factor by dividing the minimum time into the average time of each line. They