

operation has the greatest effect on the standard that is set and on the productivity of the worker. For these reasons, the study and development of methods is the most important factor in this work. The standard should be based not only on time but on the amount of effort expended in the performance of the work, the characteristics of the work and those of the worker. To establish proper standards, methods must be analyzed from the point of view of fatigue. Unnecessary motions must be eliminated and the execution of the necessary ones facilitated, so that the energy of the worker may be expended with the maximum of effectiveness. These desirable results may be obtained by making a motion study of the job. A motion study can be made in various degrees of detail. There are cases where it is not necessary to go into a high degree of detail. In highly repetitive operations, however, it is important that the method be studied very minutely.

One of the speakers stated that we must take time studies, set the rate, and after that we will get the one best way. If I have understood that correctly, I wish to say that I cannot agree. We must find the best way first and then determine the time to perform in accordance with the established method. Having established the best method which the equipment and conditions permit, and standardized it, we not only have made possible a greater output for a given amount of effort, but also a standard which will invariably result in increased earnings to the worker and reduced cost to the management.

Another point brought out is that we must time the average man, or time work on the basis of average performance. That is true if we want to know how long it takes to do a job or to get an average. But we should be most interested in bringing the performance of the mediocre workman up to that of the skilled.

The transference of skill is one of the most valuable results of standardization after the method has been studied and a careful analysis made. Skill cannot be transferred if we consider elementary operations, because we are only giving the operator a sequence of these elemental operations, as they are sometimes called, and not making a serious attempt to tell him how these suboperations are performed. For instance, let us consider the elements that are sometimes used as divisions of oper-

ations, such as "pick up piece and place in fixture." Now, it makes a great deal of difference just how that piece is grasped, with which hand it is grasped, or the manner in which it is held in order to assemble it to the fixture in the easiest way possible. All of these have a decided effect on the overall time of those elementary units which the time study observer has chosen as divisions of the method for the purpose of establishing and standardizing time values.

Skill cannot be transferred with any reasonable degree of effectiveness unless the operator can identify the method in terms of elements of motion and perform these elements of motion in their proper order. This is extremely important, especially in short repetitive operations—and has worked successfully in various kinds of activities.

Since this meeting marks an attempt to bring together and formulate the fundamentals of time study practice in order that they may be usable in industry with somewhat common results, it seems to me that any effort exerted in that direction would be worth while. My suggestion is to consider carefully the various techniques employed in analyzing and standardizing work and build up one reasonably good code which can be used in industry at large with benefit.

John C. Shover.¹⁴ There are just three points which I wish to mention. The first is to stress the essential principles that were set forth by the speaker this morning; among others (1) that the conditions must be right; (2) that the watch must be in view; (3) that the methods must be studied.

In introducing time study in one department in which there were one hundred girls and where there had been no time study before, it was found advisable to take a great deal of time to get conditions right. The girls were not familiar with the stop watch, and so we asked the foreman to allow us to talk with the operators first. The foreman said, "No! You go in there and time those operators. It is their business to do what they are told to do. Never mind talking it over with them." Our study was delayed several days before the foreman changed his idea and gave the desired co-operation. With the foreman's assistance, the operators were told what we had in

¹⁴Production Research Department, Aberfoyle Manufacturing Company, Chester, Pa.

mind to do; they examined with interest the stop watch which we handed to them, and they asked questions until they understood the purpose of the study. As we went along in the study we made sure that the operators were friendly and ready for observation. If an operator appeared to be too nervous to have a time study taken, she generally replied in answer to our inquiry as to how the work was running, that it was running very badly. In such a case, we left her and returned at another time. Our study then was for the purpose of determining the best methods and of establishing a standard procedure. The study was, of course, followed by a substantial increase in production—nine to fifteen per cent per machine hour.

Another matter which I wish to bring to your attention is the importance in rate setting of making allowance for skill¹⁵ as reflected in the time required to learn an operation, as well as the time required to perform it. For example, let us consider one element of a certain operation, namely, locating the loose end of a ball of yarn before tying up the yarn or starting a process. Eventually the fingers detect this loose end of yarn without any loss of time, but they cannot do it in the first trial nor in the hundredth. It is well to consider the period of time required to learn to make a motion effective, for the acquired skill is worth something, and the acquiring of it costs both the operator and company. The length of the learning period of an average operator under standard training conditions may represent approximately the degree of skill involved in the operation.

Several references were made by the speaker to the relation of foremen to time study and other management studies. One particular experience will be illustrative of my third point. Individual records were carefully compiled of the production in a six months' period of over four hundred operators under various foremen, and individual production ratings were listed on the basis of average production in the six months period per man hour. At that time each operator was rated as to quantity of production by her foreman according to his observation and opinion. A comparison of the foremen's opinion ratings with the actual production ratings showed that the foremen had placed only about fifty per cent of the operators in the classes corresponding to the statistical groups. In management studies it is quite necessary to have the

foreman's co-operation and it is very useful to have the benefit of his knowledge, but it may be worth while to verify the information gained from him.

May we be permitted to offer one criticism of Mr. Thompson's paper. His time studies are so very well done that he seems to tell us that all management studies should be done with time study methods; whereas we should prefer to say that all management should be done as properly as his time studies, which are quite scientific.

George D. Babcock.¹⁶ There is a matter of technique which I wish to touch upon. In a coincident production industry like that in Western automobile plants, we have the problem of rapidly setting temporary piece rates. When a new model car is to be produced, the mechanical or methods departments spend a great deal of time and study in determining the best types of machinery and most suitable tools for a particular operation, and in the setting of machine speeds, etc. There is little use of standard equipment. It is almost entirely specialized. Tool designing, the selection of machinery, and the plant layouts for installing that machinery always precede any direct time study. This study begins as production starts simultaneously in all departments.

Thus we must set at once a great many rates so that workers may begin to receive commensurate pay for their effort as soon as work starts. Conditions are not suitable for permanent rates and at this time studies are all temporary. Then there are the permanent rates to be set and standards to be established. We take great care in establishing these latter.

Advocates of two principal methods of time study have discussed Mr. Thompson's paper—one that carefully selects a man for a particular job and then makes an exhaustive study of all the elements involved; and another that forms an opinion of any operator's effort while he is being studied. Both methods are desirable in an industry such as ours. All our temporary studies are of the latter estimating or qualifying plan. There is no opportunity to select particular men. Quick evaluations must be made and rates set. However, when the plant is in operation and rates approximating fair earnings to the men and fair speed of performance to the superintendent have been set, we then start

¹⁶Dodge Brothers, Inc., Detroit, Mich.