TIME STUDY
DETERMINING THE RATING FACTOR

IENG 301

FUNDAMENTALS OF WORK STUDY AND ERGONOMICS

DETERMINING THE RATING FACTOR

- After the time study has been taken the next step is to subtract successive watch readings in order to get the time for each element.

- **Selecting time values**:
  - It now becomes necessary to **select from these data a time value**, for each of the elements **that will be representative**.

  - Occasionally there may be an abnormally high or low time value, which may require special attention.

DETERMINING THE RATING FACTOR

- The fact that there is considerable variations in successive times for certain elements, however, does not mean that all high and low elements should be thrown out. In many cases there are good reasons for such data (e.g. An occasional hard casting may require longer drilling time). If such time values are typical or representative of what may be expected on the job, they should not be eliminated from the study. It is a good policy not to eliminate any reading unless there is a definite reason for doing so.

DETERMINING THE RATING FACTOR

- Many organizations use the **arithmetical average** of the stopwatch readings in determining the representative time for the element.

- The **modal method** consists of taking the time that occurs most frequently for the element. High and low time values will have less effect upon the selected time by this method than by the average method.

DETERMINING THE RATING FACTOR

- Perhaps the most important and the most difficult part of time study is to evaluate the speed or the tempo at which the person is working while the study is being made. The time study analyst must judge the operators speed while making the time study. This is called rating.

Definition of Rating

- Rating is that process during which the time study analyst compares the performance (speed or tempo) of the operator under observation with the observer own concept of normal performance. Later this rating factor will be applied to the selected time value to obtain the normal time for the job.

Systems of Rating

1. Skill and effort rating:

- Around 1916, Charles E. Bedeaux introduced the Bedeaux system of wage payment and labor control. His plan was based on time study, and his time standards were expressed in points or "Bs." A point or B was simply another name for what we now call a standard minute. His time study procedure included the rating of the operator's skill and effort and the use of a standard table of fatigue allowances. Bedeaux used 60 points equal to standard performance. In other words, an operator working at a normal pace was expected to produce 60 Bs per hour and it was expected that the average incentive pace would be around 70 to 85 points per hour.

- Before Bedeaux, the performance rating was mainly selecting the stopwatch readings, from the data of the time study. Thus, if an operator were judged to be working at a fast tempo, a watch reading considerably above average would be selected as the representative time for the element.

Systems of Rating

2. Westinghouse system of rating:

A four-factor system, for rating the operator performance, was developed at Westinghouse and it was originally published in 1927. These four factors are (1) skill, (2) effort, (3) conditions, and (4) consistency. A scale of numerical values for each factor was supplied in tabular form, and the selected time obtained from time study was normalized or leveled by applying the sum of the ratings of the four factors.

Westinghouse System of Rating

Skill			Effort		
+0.15	A1	Super skill	+0.13	A1	Excessive
+0.13	A2		+0.12	A2	
+0.11	B1	Excellent	+0.10	B1	Excellent
+0.08	B2		+0.08	B2	
+0.06	C1	Good	+0.05	C1	Good
+0.03	C2		+0.02	C2	
0.00	D	Average	0.00	D	Average
-0.05	E1	Fair	-0.04	E1	Fair
-0.10	E2		-0.08	E2	
-0.16	F1	Poor	-0.12	F1	Poor
-0.22	F2		-0.17	F2	
Conditions			Consistency		
+0.06	A	Ideal	+0.04	A	Perfect
+0.04	B	Excellent	+0.03	B	Excellent
+0.02	C	Good	+0.01	C	Good
0.00	D	Average	0.00	D	Average
-0.03	E	Fair	-0.02	E	Fair
-0.07	F	Poor	-0.04	F	Poor

Westinghouse System of Rating

Example:
    Let;

       Selected time = 0.50 minutes,

Excellent skill, B2	+0.08
Good effort, C2	+0.02
Good condition, C	+0.02
Good consistency, C	+0.01
Total =	**+0.13**

Therefore,
    Normal time=0.50 x 1.13 = **0.565 minutes**.

Systems of Rating

3. <u>Synthetic rating</u>:

- Evaluate operator's speed from predetermined time values.

- The procedure is to make a time study in the usual manner, and then compare the actual time for as many elements as possible with predetermined time values for the same elements. A ratio can be established between the predetermined time value for the element and the actual time value for that element. This ratio is the performance index or rating factor for the operator insofar as that one element is concerned.

$R = P/A$ where,   R: Performance rating,
P: Predetermined time …
A: Average actual time…

Systems of Rating

4. <u>Objective rating:</u>

- First the operator's speed is rated against a single standard pace which is independent of job difficulty. The observer merely rates speed of movement or rate of activity, paying no attention to the job itself.

- After the pace rating is made, an allowance or a secondary adjustment is added to the pace rating to take care of the job difficulty.

- Job difficulty is divided into six classes, and a table of percentages is provide for each of these factors. The six factors or categories are (1) amount of body used, (2) foot pedal, (3) bimanualness, (4) eye-hand coordination, (5) handling requirements, and (6) weight of the job.

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Systems of Rating

5. Physiological evaluation of performance level:

- Heart rate in beats per minute and oxygen consumption in calories per minute can be used to measure physiological work. Moreover, electronic equipment is available for monitoring and recording such information with a minimum of interference with the activity of the person.

- The increase in the heart rate and the increase in oxygen consumption above the resting level is an indicator of the physiological cost of the work performed.

- Assume that an operator works on a job for which there is a time standard and that the number of pieces produced shows that his or her performance level is 100 percent. During this same time the operator's heart rate in beats/minute and oxygen consumption in calories/minute are measured. If the same operator work on another job, we can judge from either heart rates or oxygen consumption on his/her performance rate.

Systems of Rating

6. Performance rating:

- The most widely used system of rating is that of rating a single factor-operator speed, pace, or tempo. This system is called "performance rating."

- The rating factor may be expressed in percentage, in points/hour, or in other units. Here we shall use the percentage system (with normal performance equal to 100 percent).

The Range of Human Capacities

- In a factory, if a large group of people did exactly the same manual task using the same method, the fastest operator would produce approximately twice as much in a given time as the slowest operator.

- This range 1 to 2 would be expected only if we consider a large sample of people just as they would be found in a factory.

Frequency Distribution

- With the range of working speeds or operators tempo, we are interested in knowing what the distribution would be for a group of factory workers all doing the same job.

- Graphical representation, such as the frequency distribution, can help us to find out the distribution of observations.

Establishing a Standard as the Basis for Rating

- The data obtained by a time study show the actual time taken by operator to perform a series of consecutive elements of work. They tell nothing of the pace at which the operator worked while the study was being made. It is necessary to consider the operator's speed in order to determine a standard that will permit an operator working at a normal pace to do the task in the time set for the job.

Establishing a Standard as the Basis for Rating

- The need for rating has been pointed out, and the way the rating is used has been indicated. It is obvious however, that some bench mark or some standard of comparison is required if rating is to be used as a measuring device. We must define our normal or standard. To say that normal speed is that speed expected of a qualified person working without incentive or at a day-work pace, using a standardized method, does define the term adequately. However, normal speed or normal rate of movement can be demonstrated; motion pictures can be made of typical factory jobs with the operator working at a normal tempo or at a known level above or below normal. Almost any person can be taught to rate operator tempo in terms of the established standard.

e.g.

  ○ Walking on the level at 3 miles/hour is a normal tempo.
 ○ Dealing a deck of cards into 4 equal piles (0.50minutes) is a normal tempo.

Rating Film

- Perhaps the most common form of rating film is made, by having experienced operators performing the same operation, work at a number of different speeds. Then the several section of film are placed together, separated from each other by a few feet of blank film, and each selection is identified by a code.

The Relation of "Normal Pace" to "Average Incentive Pace"

- Because time standards are often used as the basis for some form of wage incentive plan, we are interested in the relationship between normal pace and the average pace expected of those on incentive.

- The performance of the great majority of workers on incentive should be fairly close to the average for the group.

- **Note**: There is considerable evidence to show that if the working speed of each member of a large group of people, such as would be found in a factory, were arranged along the base line according to magnitude in percent of normal, and if the vertical scale indicated frequency, the shape of the curve would fit fairly closely the normal bell curve.

- **Note**: It is not expected, of course, that any group of workers would exactly fit the normal curve.

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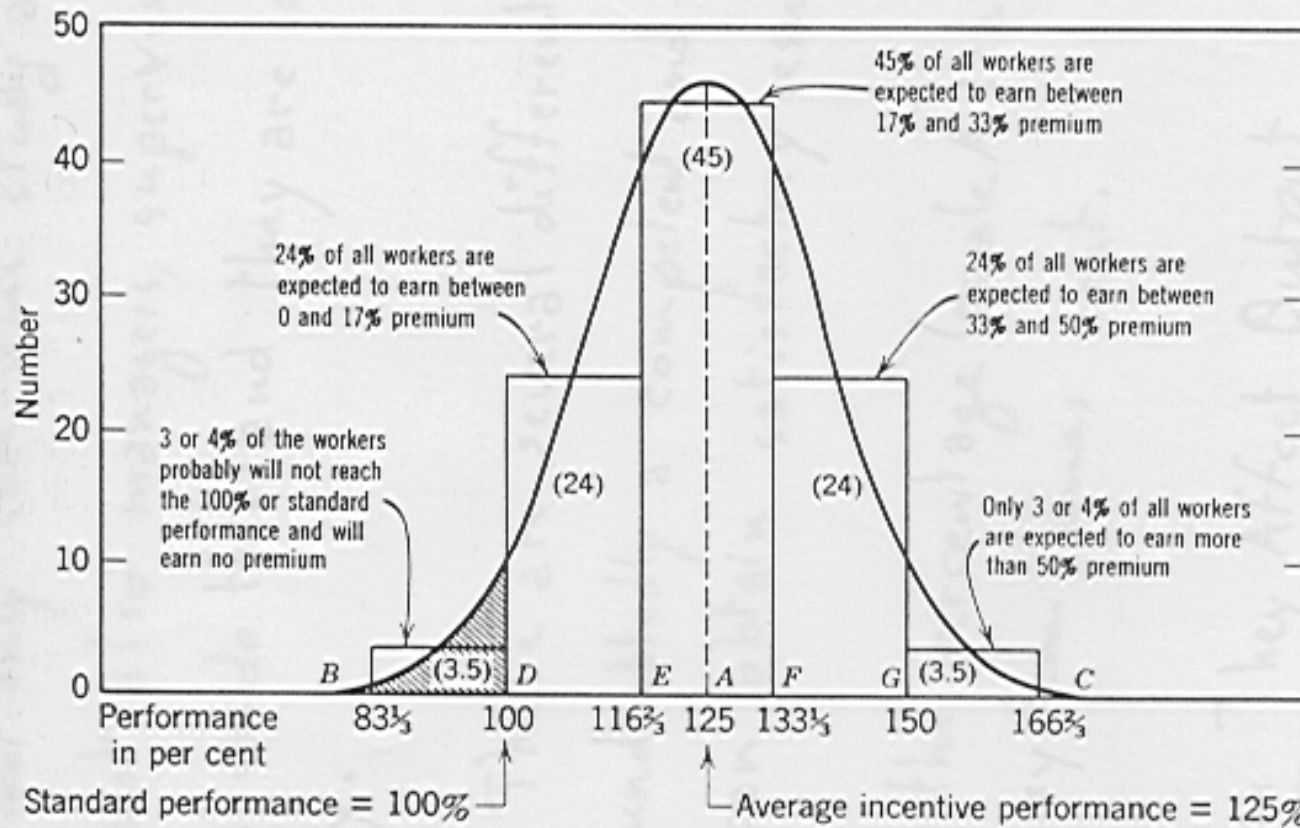
Figure 199 Chart showing the number of workers in each class interval through entire performance range, as determined from the normal distribution curve. Ratio of slowest worker (83⅓%) to fastest worker (166⅔%) is 1 to 2. A 100% premium plan of wage payment is used. It is assumed that a premium is paid for all production above standard. That is, for each 1% increase in production above standard, the worker is paid 1% additional wage above his hourly base rate. The base rate is the guaranteed wage paid to all workers whether they reach 100% performance or not. This hourly base rate is established by job evaluation.

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Establishing a Company Standard

- After the basic reasoning back of rating is fully understood, each company should establish a standard for its own use. Agreement should be reached as to what the normal or standard tempo, or performance level, should be in the plant.

- Then, some simple operations from the plant, which can be performed by anyone, should be selected for demonstration.

- The method should be standardized, and the time for each job, with the operator working at normal pace, should be established.

- Thus, a library of standard films can be built up over a period of time for use as a bench mark for rating in plant. Not only can time study analysts be taught to rate, but also managers, supervisors, and the operators themselves can do this; and they are doing it in many plants today.

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Rating Scales

- There are several different rating scales in general use, and undoubtedly a competent and well-trained time study analyst can obtain satisfactory results with any one of them.

- A survey shows that the percentage (scale A) has greatest use and the point system comes next.

Rating Scales
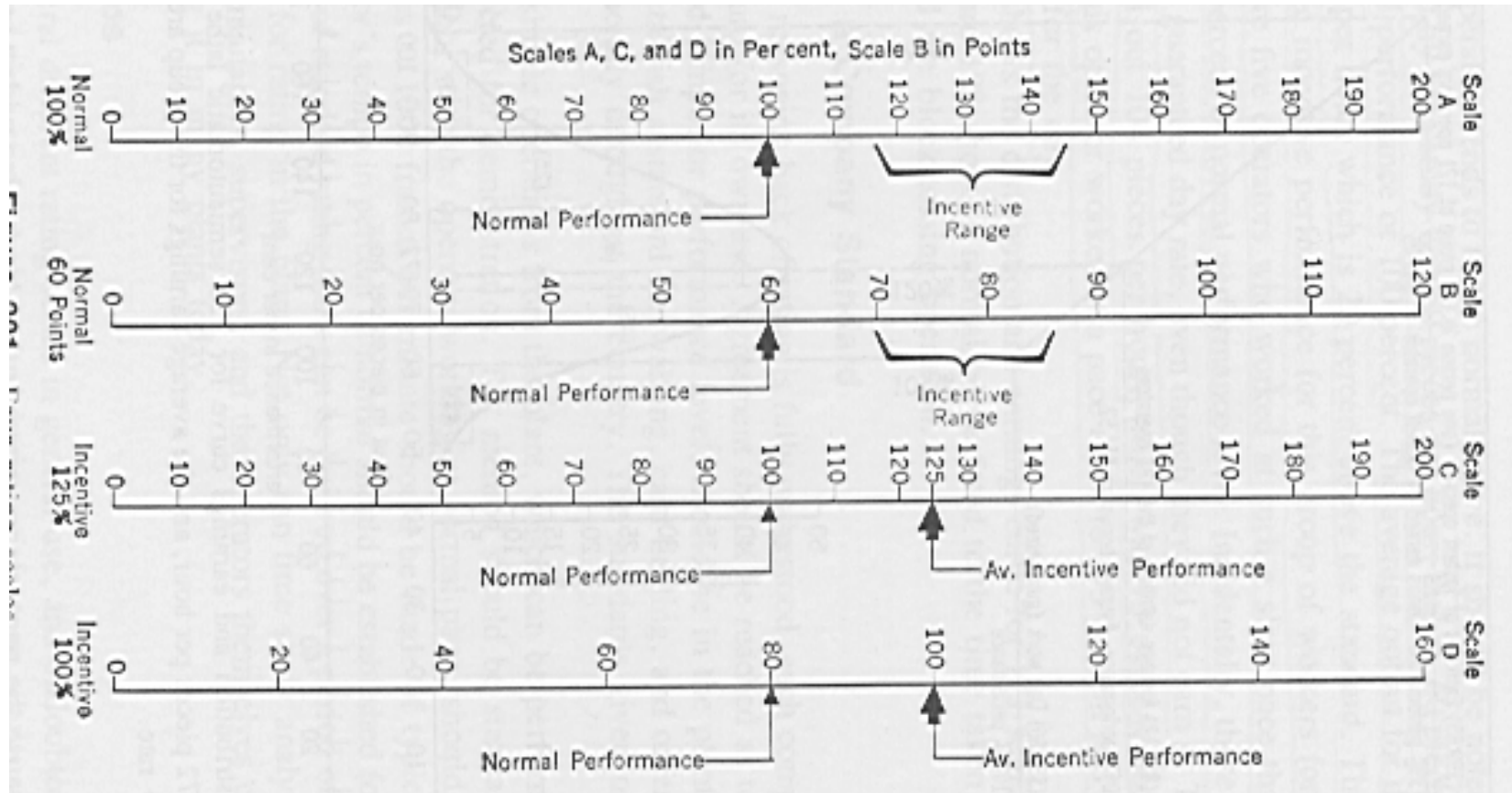
Speed and Method as They Affect Output

- There are two main factors that affect the number of units of work that a person on manual operations can produce in a given time. They are:

    1) Speed of muscular movements,

    2) Method of doing the task.