TIME STUDY
TIME STUDY EQUIPMENT: MAKING THE TIME STUDY

IENG 301

FUNDAMENTALS OF WORK STUDY AND ERGONOMICS

TIME STUDY EQUIPMENT: MAKING THE TIME STUDY

- Time study, predetermined time systems, standard systems, standard data, and work sampling are used for measuring work in industry.
- Time study is the most versatile and the most widely used.
- Time standards obtained from these data are used as the basis for company-wide wage incentives.

Definition

- Time study is used to measure work.
- The result of time is the time that a person suited to the job and fully trained in the specified method will need to perform the job if he or she works at a normal or standard tempo.
- This time is called the standard time for the operation.

Uses for Time Study

Although time study originally had its greatest application in connection with wage incentives, it and the other methods of measuring can be used for many other purposes including:

1. Determining schedules and planning work.
2. Determining standard costs and as an aid in preparing budgets.
3. Estimate the cost of a product before manufacturing it. Such information is of value in preparing bids and in determining selling price.

Uses for Time Study

4. Determining machine effectiveness, the number of machines which one person can operate, and as an aid in balancing assembly lines and work done on a conveyor.
5. Determining time standards to be used as a basis for the payment of a wage incentive to direct labor and indirect labor.
6. Determining time standards to be used as a basis for labor cost control.

Time Study Equipment

- The equipment needed for time study work consists of a timing device and an observation board.

- The devices most commonly used for measuring work are:
  1. Stop watch or electronic timer (i.e. decimal stop watch).
  2. Motion picture camera (with constant-speed motor drive or with a micro-chronometer in the picture to indicate time).
  3. Electronic data collector and computer.

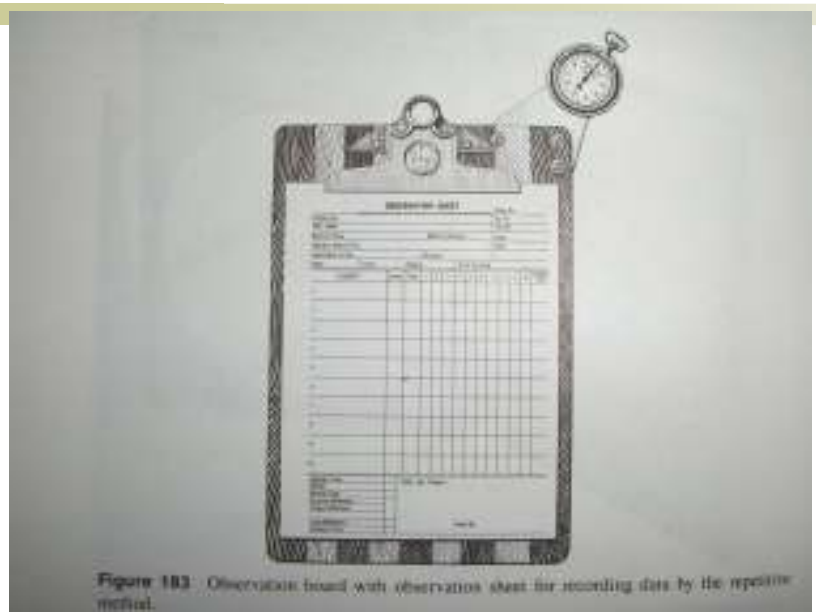
Stop Watch or Electronic Timer

Motion Picture Camera

Electronic Data Collector

Figure 181 Datamyte data collector showing keyboard and display. (Courtesy Electro General Corporation.)

Obervation Board



Other Equipment

- A speed indicator, or tachometer, is needed where machine-tool operations are studied.

- The analyst should check speeds and feeds in making a time study, even though the machine has a table attached which gives this information for each setting of the speed and feed-control levers.

Making the Time Study

- The exact procedure used in making time studies may vary somewhat, depending upon the type of operation being studied and the application that is to be made of the data obtained.

Making the Time Study

These eight steps, however, are usually required:

1. Secure and record information about the operation and operator being studied.
2. Divide the operation into elements and record a complete description of the method.
3. Observe and record the time taken by the operator.
4. Determine the number of cycles to be timed.
5. Rate the operator's performance.
6. Check to make certain that a sufficient number of cycles have been timed.
7. Determine the allowances.
8. Determine the time standard for the operation.

Request for a Time Study

- A Time study is not made unless an authorized person requests it. Usually, it is the supervisor who requests that a study be made, but the plant manager, chief engineer, production control supervisor, cost accountant, or other member of the organization may make such a request.
  - It is the supervisor's responsibility to make certain that the operation is running satisfactorily before requesting the study.
  - The supervisor should also see that the operators have thoroughly learned the job and they are following the prescribed method.
  - The supervisor should inform the operators in advance that a Time study is to be made, stating the purpose of the study.

Is the job ready for Time Study?

- The analyst should go over the job with the supervisor of the department. As they discuss each element of the operation, the analyst asks the questions:

1. Can the speed or feed of the machine be increased without affecting optimum tool life or without adversely affecting the quality of the product?
2. Can changes in tooling be made to reduce the cycle time?
3. Can materials be moved closer to the work area to reduce handling time?
4. Is the equipment operating correctly, and is a quality product being produced?
5. Is the operation being performed safely?

Is the job ready for Time Study?

- **Note:** The time standard for a job will not be correct if:
  - The method of doing the job has changed.
  - The material does not meet specifications.
  - The machine speed has changed.
  - Other conditions of work are different from those that were present when the Time study was originally made.

- **The Time study analyst therefore, examines the operation with the purpose of suggesting any changes that he or she thinks should be affected before the Time study is made.**

Is the job ready for Time Study?

- It is expected that the Time study analyst will be trained in Motion study and will bring all possible knowledge in this field to bear on the operation about to be studied.
- Any suggested changes that the supervisor wishes to adopt should be made before the study is started.
- The supervisor of course makes the decision as to the way the job is to be done, but the analyst and the supervisor should discuss each element of the operation and should agree that the operation is ready for a time study.

Making the Time Study

1. Recording information.
2. Dividing the operation into subdivisions or elements.
3. Listing the elements in proper sequence.
4. Timing the elements with the stopwatch and recording the readings.
5. Determine the number of cycles to be timed.
6. Noting and recording the operator's tempo.
7. Making a sketch of the part and the work place.

Reasons for Element Breakdown

1. One of the best ways to describe an operation is to break it down into definite and measurable elements and describe each of these separately. These elements of the operation that occur regularly are usually listed first, and then all other elements that are a necessary part of the job are described. The beginning and end points for each element may be specifically indicated.

2. Standard time values may be determined for the elements of the job. This makes possible, to determine the total standard time for an operation.

Reasons for Element Breakdown

3. A Time study may show that excessive time is being taken to perform certain element of the job or that too little time is being spent on the element. Also the analysis of an operation by elements may show slight variations in method that could not be detected so easily from an overall study.

4. An operator may not work at the same tempo throughout the cycle. A Time study permits separate performance ratings to be applied to each element of the job.

Rules for Dividing an Operation into Elements

- All manual work may be divided into fundamental hand motions or therbligs. These subdivisions are short in duration to be timed with a stopwatch. A number of them, therefore, must be grouped together into elements of sufficient length.

- The following **rules** should be followed:
  - The elements should be as short in duration as can be accurately timed.
  - Handling time should be separated from machine time.
  - Constant elements should be separated from variable elements.

Taking and Recording Data

- The three most common methods of reading and stopwatch are:
  - Continuous timing
    - The observer starrs the watch at the beginning of the first element and permits it to run continuously during the period of the study. The observer notes the reading of the watch at the end of each element and records this reading on the observation sheet.
  - Repetitive timing
    - The watch are snapped back to zero at the end of each element.
  - Accumulative timing
    - Direct rading of the time for each element by the use of two stop watches which are connected by a lever mechanism in such a way that when the first watch is started, the second watch is automatically stopped, and when the second watch is started the first is stopped.

Breakdown into Elements and Cycle Time Calculation

STUDY NO. 8765

ELEMENTS	SPEED	FEED	1
1. Fill core box with 3 handfuls of sand. Press sand down each time.			.09
			0.9
2. Press sand down with one trowel stroke. Strike off with one trowel stroke.			.06
			.15
3. Get and place plate on core box, turn over, rap, and remove box.			.13
			.28
4. Carry plate with core 4 feet. Dispose on oven truck.			.04
			.32

Figure 185 Part of observation sheet for operation "Make Core for Crank Frame." The watch readings and the subtracted times for the first cycle are shown. See Fig. 203 for complete study.

The time for each element was later determined by subtraction (Fig. 185). Thus, for the first element, .09 (.09 − 0 = .09) minute was placed in the upper line opposite element 1. In a similar way for the second element, .06 (.15 − .09 = .06) minute was placed in the first vertical column opposite the second element.

TIME STUDY SHEET

OPERATION			
DEPT.	START	DATE	OPERATOR
PART DESCRIPTION	STOP	SHEET	
MP SHEET	DIFF. (ELAPSED TIME)	STUDY	ENGINEER
JOB NO.	PRODUCTION PIECES	SHEET	
LEAD-TIME	PART TRAVEL DISTANCE	EMPLOYEE TRAVEL DISTANCE	

ELEMENTS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	

OBSERVATION SHEET

SHEET 1 OF 1 SHEETS — DATE

OPERATION Drill ¼" Hole — OP. NO. D-20

PART NAME Motor Shaft — PART NO. MS-267

MACHINE NAME Avey — MACH. NO. 2174

OPERATOR'S NAME & NO. S.K. Adams 1347 — MALE [√] FEMALE [ ]

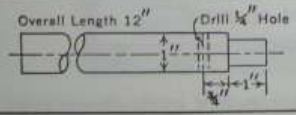
EXPERIENCE ON JOB 18 Mo. on Sens. Drill — MATERIAL S.A.E. 2315

FOREMAN H. Miller — DEPT. NO. DL 21

BEGIN 10:15 FINISH 10:38 — ELAPSED 23 — UNITS FINISHED 20 — ACTUAL TIME PER 100 115 — NO. MACHINES OPERATED 1

ELEMENTS	SPEED	FEED		1	2	3	4	5	6	7	8	9	10	SELECTED TIME
1. Pick Up Piece and Place in Jig			T	.12	.11	.12	.13	.12	.10	.12	.12	.14	.12	
			R	.12	.29	.39	.54	.66	.77	.92	8.01	14	.32	
2. Tighten Set Screw			T	.13	.12	.12	.14	.11	.12	.12	.13	.12	.11	
			R	.25	.41	.51	.68	.77	.89	7.04	.14	.26	.43	
3. Advance Drill to Work			T	.05	.04	.04	.04	.05	.04	.04	.04	.03	.04	
			R	.30	.45	.55	.72	.82	.93	.08	.18	.29	.47	
4. DRILL ¼" HOLE	980	H	T	.57	.54	.56	.51	.54	.58	.52	.53	.59	.56	
			R	.87	.99	3.11	4.23	5.36	6.51	.60	.71	.88	11.03	
5. Raise Drill from Hole			T	.04	.03	.03	.03	.03	.03	.03	.03	.04	.03	
			R	.91	2.02	.14	.26	.39	.54	.63	.74	.92	.06	
6. Loosen Set Screw			T	.06	.06	.07	.06	.06	.06	.06	.06	.07	.08	
			R	.97	.08	.21	.32	.45	.60	.69	.80	.99	.14	
7. Remove Piece from Jig			T	.08	.09	.08	.08	.09	.08	.07	.08	.09	.07	
			R	1.05	.17	.29	.40	.54	.68	.76	.88	10 08	.21	
8. Blow Out Chips			T	.13	.10	.12	.14	.13	.12	.13	.12	.12	.11	
			R	.18	.27	.41	.54	.67	.80	.89	9.00	.20	.32	
9.			T											
			R											
10. (1)			T	.12	.11	.13	.14	.12	.12	.11	.13	.12	.12	.12
			R	11.44	.56	.69	.82	.87	17 01	18.09	.21	.31	.42	
11. (2)			T	.12	.14	.12	.11	.12	.10	.13	.15	.12	.11	.12
			R	.56	.70	.81	.93	.99	.11	.22	.36	.43	.53	
12. (3)			T	.04	.04	.04	.03	.04	.04	.04	.04	.04	.04	.04
			R	.60	.74	.85	.96	16.03	.15	.26	.40	.47	.57	
13. (4)			T	.54	.53	.55	.52	.57	.54	.50	.53	.55	.54	.54
			R	12.14	13.27	14.40	15.48	.60	.69	.76	.93	21 02	22.11	
14. (5)			T	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
			R	.17	.30	.43	.51	.63	.72	.79	.96	.05	.14	
15. (6)			T	.06	.06	.06	.07	.06	.05	.06	.06	.05	.06	.06
			R	.23	.36	.49	.58	.69	.77	.85	20.02	.10	.20	
16. (7)			T	.08	.08	.09	.08	.08	.07	.08	.06	.08	.08	.08
			R	.31	.44	.58	.66	.77	.84	.93	.08	.18	.28	
17. (8)			T	.14	.12	.10	.09	.12	.14	.15	.11	.12	12	.12
			R	.45	.56	.68	.75	.89	.98	19.08	.19	.30	22.40	
18.			T											1.11
			R											

SELECTED TIME 1.11	RATING 100%	NORMAL TIME 1.11	TOTAL ALLOWANCES 5%	STANDARD TIME 1.17



TOOLS, JIGS, GAUGES: Jig No. D-12-33
Use H.S. Drill ¼" Diam.
Hand Feed
Use Oil - S4

TIMED BY J.B.M.

Figure 184 Stop-watch time study of a drilling operation made by the continuous method.

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Number of Cycles to be Timed

- If precision is 5%:

N' = required number of observations of the element

$$N' = \left(\frac{40\sqrt{N\sum X^2 - \left(\sum X\right)^2}}{\sum X} \right)^2$$

N = actual number of observations of the element

X = each stop watch reading or individual observation

- If precision is 10%:

$$N' = \left(\frac{20\sqrt{N\sum X^2 - \left(\sum X\right)^2}}{\sum X} \right)^2$$

Rating

- As the time study analyst records the data, the analyst is also evaluating the operator's speed in relation to his opinion of normal speed for such an operation.
- Later, the rating factor will be applied to this "representative time" to obtain the normal time for the element.
- A common method is for the analyst to determine a rating factor for the operation as a whole.

Selecting the Operator to be Timed

- If more than one person is performing the same operation, the Time study analyst, as a custom, times the operator working at nearest to normal pace.

- Because a rating factor is used to evaluate the operator's speed, theoretically it makes no difference whether the slowest or fastest operator is timed. However, it is admittedly more difficult to rate correctly the performance of a very slow operator.

- It is not desirable to time a beginner, because the method is seldom the same as it will be when he/she has attained greater proficiency through experience on the job.