Table 5.1 Recording Techniques

Recording Technique	**Information Recorded**
(a) Charts	
1. Outline process chart	Principle operations and inspection of the processes.
2. Flow process chart	Activities of men, material or equipment are analyzed into five events viz., operation, transport, inspection, delay and storage.
3. Two-handed process chart	Movements of two hands or limbs of the operator.
4. Multiple activity chart	Simultaneous/interrelated activities of operators and/or machines on a common time scale.
5. Simultaneous Motion Cycle Chart (SIMO)	Movement of body members of the operator, expressed in terms of therbligs on a common time scale.
(b) Diagrams and Models	
1. Flow diagram	Path of men, materials and equipments on a scale model.
2. String diagram	Same as above except for the variation that it uses string to trace the path.
(c) Photographic aids	
1. Cyclegraph	Movement of hand obtained by exposing a photographic plate to the light emitted from small bulbs attached to the operator's fingers.
2. Chrono-cyclegraphs	Modification of cyclegraph in which recording is made using flash light.

Table 5.2 Symbols used in Process Chart

Symbol	Activity	Purpose for which it is used
	Operation	Indicates the main steps in a process, method of procedure, usually the part, material or product concerned which is modified or changed during the operation.
	Transport	Indicates movement of workers, material or equipment from place to place.
	Inspection	Indicates any type of inspection, check, measurement, visual scrutiny for quality and/or quantity.
	Temporary storage or delay	Indicates a delay in the sequence of events.
	Storage	Indicates a controlled storage in which material is received into or issued from stores under some form of authorization or an item is retained for reference purposes.

5.3Time study

- It was proposed by Frederick Taylor and later modified to include a performance rating (PR) adjustment.
- Once the method is established, the next objective is to set the standard time for the work. This aspect of work study is called Time study (or Work measurement).
- The main objectives of time study are:

1) To determine the standard time for various operations which helps in fixing wage rates and incentives.
2) To estimate the cost of product accurately.
3) To predict accurately the duration for a particular work and customer is promised accordingly.
4) To determine the number of machines an operator can run.
5) To determine the optimum number of men and machine.
6) To provide information for planning and scheduling.
7) To balance the work of all workers working in a group.
8) To compare the work efficiency of different workers/operators.

Work measurement techniques

1. Time study using stop watch.
2. Predetermined motion time system (PMTS).
3. Work sampling.
4. Analytical estimating.

The following table shows the application of each technique and unit of measurement.

Technique	Application	Unit of measurement
Time study using stop watch	Short cycle repetitive jobs	Centiminute (0.01 min)
PMTS	Manual operations confined to one work centre	TMU (I TMU = 0.006 min)
Work sampling	Long cycle jobs/ Heterogeneous operation	Minute
Analytical estimating	Short cycle non-repetitive job	Minute

Time study using stop watch is the most popular technique for determining standard time. The first task of the analyst is to divide the work/job into smaller work elements in such a way that the time for each element should not be less than 3 seconds because for such elements, recording time is difficult. The steps of time study are as follows:

Step 1: First select the job to be studied. Breakdown the work content of the job into smallest possible elements. Then, inform the worker and define the best method.

Step 2: Observe the time for appropriate number of cycles (such as 25 to 50).
Step 3: Determine the average cycle time (CT)

$$CT = \frac{\sum \text{Times}}{\text{No. of cycles}}$$

Step 4: Determine the normal time (NT)

NT = CT (PR)

Where, PR is the performance rating.

Step 5: Determine the standard time using the following formula.

$$ST = NT (AF) \text{ where } AF = \frac{1}{1 - \% \text{ Allowance}}$$

AF being the allowance factor.

5.4 Selection of job for Time Study

Time Study is conducted on a job

- which has not been previously time-studied.
- for which method change has taken place recently.
- for which worker(s) might have complained as having tight time standards.

5.5 Selection of Worker for Time Study

The worker on which time study should be conducted must

- have necessary skill for the job.
- have sufficient experience with the given method on the job (that is, he should have crossed the learning stage).
- be an ‘average' worker as regards the speed of working.
- be temperamentally suited to the study (those who can't work in normal fashion when watched, are not suitable for the study).
- have knowledge about the purpose of study.

5.6Time Study Equipment

The following equipment is needed for time study work.

- Timing device
- Time study observation sheet
- Time study observation board
- Other equipment

Timing Device. The stop watch is the most widely used timing device used for time study, although electronic timer is also sometimes used. The two perform the same function with the difference that electronic timer can measure time to the second or third decimal of a second and can keep a large volume of time data in memory.

Time Study Observation Sheet. It is a printed form with spaces provided for noting down the necessary information about the operation being studied, like name of operation, drawing number, and name of the worker, name of time study person, and the date and place of study. Spaces are provided in the form for writing detailed description of the process (element-wise), recorded time or stop-watch readings for each element of the process, performance rating(s) of operator, and computation. Fig. 5.1 shows a typical time study observation sheet.

OBSERVATION SHEET

SHEET 1 OF 1 SHEETS	DATE
OPERATION	OP.NO.
PART NAME	PART NO.
MACHINE NAME	MACH.NO.
OPERATOR'S NAME & NO.	MALE ☐ FEMALE ☐
EXPERIENCE ON JOB	MATERIAL
FOREMAN	DEPT.NO.

BEGIN	FINISH	ELAPSED	UNITS FINISHED	ACTUAL TIME PER 100	NO. MACHINES OPERATED

ELEMENTS		SPEED	FEED		1	2	3	4	5	6	7	8	9	10	SELECTED TIME
1.				T											
				R											
2.				T											
				R											
3.				T											
				R											
4.				T											
				R											
5.				T											
				R											
6.				T											
				R											
7.				T											
				R											
8.				T											
				R											
9.				T											
				R											
10.	(1)			T											
				R											
11.	(2)			T											
				R											
12.	(3)			T											
				R											
13.	(4)			T											
				R											
14.	(5)			T											
				R											
15.	(6)			T											
				R											
16.	(7)			T											
				R											
17.	(8)			T											
				R											
18.				T											
				R											

SELECTED TIME	RATING	NORMAL TIME	TOTAL ALLOWANCE	STANDARD TIME

SKETCH OF COMPONETS:	TOOLS.JIGS.GAUGES:
	TIMED BY:

Time Study Board. It is a light -weight board used for holding the observation sheet and stopwatch in position. It is of size slightly larger than that of observation sheet used. Generally, the watch is mounted at the center of the top edge or as shown in Figure near the upper right-hand corner of the board. The board has a clamp to hold the observation sheet. During the time study, the board is held against the body and the upper left arm by the time study person in such a way that the watch could be operated by the thumb/index finger of the left hand. Watch readings are recorded on the observation sheet by the right hand.