



RGPVNOTES.IN

Program : **B.Tech**

Subject Name: **Industrial Engineering & Ergonomics**

Subject Code: **ME-504**

Semester: **5th**



LIKE & FOLLOW US ON FACEBOOK

facebook.com/rgpvnotes.in

Method Study

Q1. What is work study? Explain with components. Write the importance & advantages of work study.

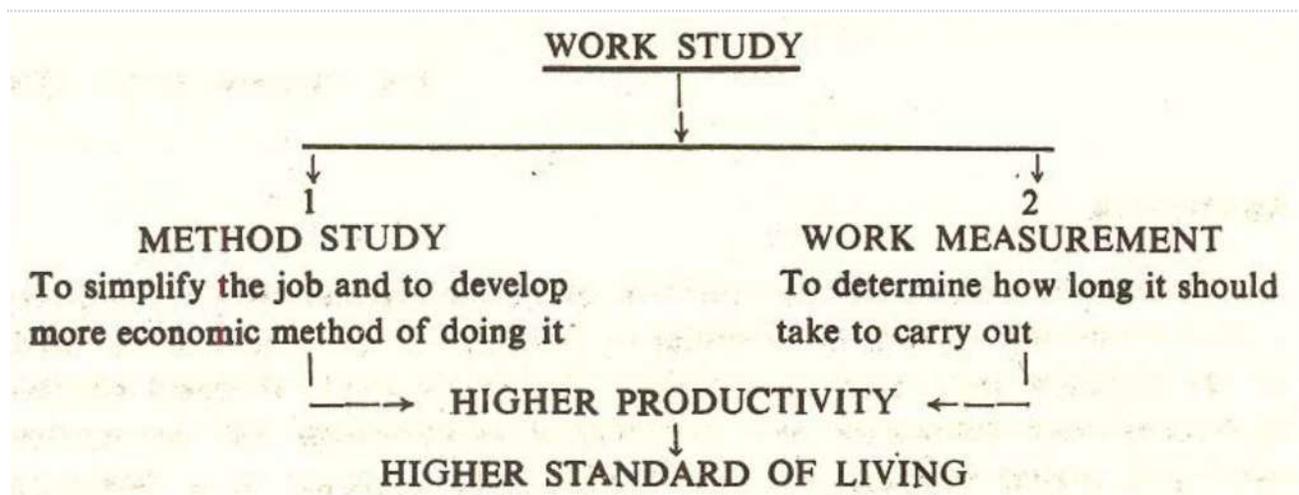
Ans: Work study is a generic term for those techniques, particularly METHOD STUDY and WORK MEASUREMENT, which are used in the examination of human work in all its contexts, and which lead systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed, in order to effect improvement.

The work study aims at improving the productivity through the systematic analysis of existing operations, processes, work methods and resources with a view to increasing their efficiency.

Work Study usually leads to higher productivity **with no or little extra capital investment**. It is evident that if a job or process is to be examined in order to improve the efficiency, both the method employed to perform the work and the time taken to complete it are significant.

Therefore, work study consists of two distinct yet complementary techniques: Method Study, which is concerned with the education of the work content of a job or operation while work measurement is mostly concerned with the investigation and reduction of any ineffective time associated with it, and for fixing up the standard time to be taken by the job after methods improvement has been carried out.

The relationship between work study, method study, work measurement can be shown as-



Work Study involves the continuous study and improvement of the activities on which performance depends and the issue of the time standards used in production planning and control.

Work study can be applied to almost all types of work, whether it be a factory, clerical or any other type of activity.

Methods' improvements have been very successfully adopted in banks, hospitals, offices, and retailing, in addition to defiance agriculture and all types of industries.

Q2. Define method study with its objectives & explain how the job is selected for method study?

Method Study is the first of the two main divisions of work study and is concerned with the way in which work is done. Method study is essentially used for finding better ways of doing work. It is a technique for cost reduction. The philosophy of method study is that 'there is always a better way of doing a job' and the tools of method study are designed to systematically arrive at this better way of doing a job.

Method Study is a technique for improving the efficiency of every type of work, ranging from that of complete factories to the simplest manual movements used in mass production.

Objectives of Method Study

The objectives of method study are:

- The improvement of processes and procedures.
- The improvement of factory, shop and workplace layout.
- The improvement of the design of plant and equipment.
- Economy in human effort and the reduction of unnecessary fatigue.
- Improvements in the use of materials, machines and manpower.
- The development of a better physical working environment.
- Improvement of quality of the products.

The first step, select, is obviously of great importance, for on it depends the success of the method improvement project. Great care in selecting projects for study is therefore necessary. Method study means a change for the better.

There are a number of factors involved in selecting a problem, and the considerations demanding attention may vary between different situations and organizations. In the choice of a job to be studied, the following factors should be kept in mind.

1. Economic considerations
2. Technical considerations.
3. Human reactions.

The economic importance of the job must be of such magnitude that it is worthwhile to begin a method, study of the job or to continue it. Bottlenecks in production, too much movement of materials in the operation, idle machines, idle operators and high costs of operations are the usual choices. The preferences should be given to the job with the greatest potential savings.

The availability of adequate technical knowledge is essential to carry out the study. For example the productivity may be raised by a change in method of processing of jute but the change should not be made due to technical reasons. This calls for an advice of Jute specialist.

In selecting a job human reactions should be given due-consideration. The relation between management and the workers must not be strained. Unpopular and tiresome jobs should be studied with improved functions. The workers will eventually accept method study, if the unpleasant features of these unpopular jobs are removed from them by the application of method study.

Q3. What are the various types of recording techniques, give the detailed classification. Explain the two handed process chart.

Ans:

When the job has been selected for Method Study, the next step is to collect and record all the relevant data. The facts collected about the existing method are subsequently subjected to a thorough examination with a view to evolving improved methods. Hence, a clear and precise record is necessary, if method study is to be effective.

Types of Recording Techniques

The recording techniques generally used are as follows:

-
- (a) The Operation Process Chart
 - (b) The Outline Process Chart
 - (c) The Flow Process Chart (material)
 - (d) The Flow Process Chart (man)
 - (e) The Multiple Activity Chart
 - (f) The Two Handed Process Chart
 - (g) The Simultaneous Motion Cycle Chart (8IMO Chart)
 - (h) The Flow Diagram
 - (i) The String Diagram
 - (j) The Travel Chart

The choice of which charting method to use depends on the task's activity level—that is, whether the focus is on-

- (1) a production process,
 - (2) the worker at a fixed workplace,
 - (3) a worker interacting with equipment, or
 - (4) a worker interacting with other workers
-

ACTIVITY	OBJECTIVE OF STUDY	STUDY TECHNIQUES
Production process	Eliminate or combine steps; shorten transport distance; identify delays	Flow diagram, service blueprint, process chart
Worker at fixed workplace	Simplify method; minimize motions	Operations charts, simo charts; apply principles of motion economy
Worker's interaction with equipment	Minimize idle time; find number or combination of machines to balance cost of worker and machine idle time	Activity chart, worker-machine charts
Worker's interaction with other workers	Maximize productivity; minimize interference	Activity charts, gang process charts



The two-handed process chart

The two-handed process chart is a process chart recording the work of the operator's hands (limbs) in relation to another.

A two-handed process chart is made up of two columns in which the activities of the left hand and right hand and the appropriate symbols are respectively recorded in sequence. The activities of the two hands are inter-related by aligning the symbols on the chart so that simultaneous movements by both hands appear opposite to each other.

Additional columns can be designed to record the activities of the other parts of the body whenever necessary.

Work of a fairly short duration is suitable for recording on this type of chart.

Example: Two-handed Process Chart

Job : Assembling washer and nut to bolt

Chart Begins : Hands empty, materials in bins

Chart Ends : Completed assembly aside to bin

Q 4. What is the Basic Procedure of Work Study.

Ans: I.L.O. recommends eight steps in application of work study:

Select the job or process to be studied.

Record from direct observation everything that happens using the most suitable of the recording techniques.

Examine the recorded facts critically.

Develop the most economic method, taking into account all -the circumstances.

Measure the quantity of work' involved in the method selected and calculate, a standard time for doing it.

Define the new method and the related time so that it can always be identified.

Install the new method as agreed standard practice with the time allowed.

Maintain the new standard practice by proper control procedures.

First four steps are common to Method Study as well as Work Measurement.

The fifth step is operative for Work Measurement studies.

The last three steps are again common to Method Study and Work Measurement.

Q 5. What is the need of the Method Study?

Ans. The need for improvement is not always apparent. However, following are some of the pointers which may indicate the area for study.

- (i) Operating costs-running higher than normal or gradually increasing
- (ii) High wastage-poor use of materials, machinery, labor, space and services
- (iii) Excessive movement and backtracking ions, handling of materials and men
- (iv) Existence of production bottlenecks
- (v) Excessive overtime
- (vi) Excessive rejections and reworks
- (vii) Complaints about quality
- (viii) Complaints from workers-poor working condition of heavy job etc.
- (ix) Increasing number of accidents-poor safety conditions.

Q 6 .Explain the various recording Techniques.

Ans. When the job has been selected for Method Study, the next step is to collect and record all the relevant data. The facts collected about the existing method are subsequently subjected to a thorough examination with a view to evolving improved methods. Hence, a clear and precise record is necessary, if method study is to be effective.

The common way of recording any information is to write it down. But writing down all the details of a complicated process in an industrial situation is not an easy task. Besides, reading through this information and visualizing the same, is an equally tough job. In order to avoid these difficulties, certain graphical forms of representations are adopted.

The advantages of such a form of recording are-

- (i) it helps in presenting the necessary information in a precise and clear manner and facilitates further analysis,
- (ii) it is easily understandable and can be clearly visualized, and
- (iii) Often presentation of the existing method or procedure, in a graphic form itself pinpoints obvious improvements.

Recording the Background Information

In order to become familiar with the job and the various inter-relationships, it would be worthwhile to collect a certain amount of background information about the situation under question. Such information may be in respect of organization structure, history of the jobs, the future trends, details with regard to the use of resources such as materials, labor, capital and equipment, etc. The type and details of background information required would depend upon the problem on hand. However, such information would be useful at the analysis stage.

Process Charts

Charting is a method by which the nature and sequence of the activities involved in process are recorded. A process chart is a pictorial representation of the activities that occur in the work method or procedure, in which suitable symbols are used to represent the various activities. The construction and interpretation of process charts are simplified by the use of these symbols, which are so designated as to be easily distinguishable and to represent standard activities in a shorthand form.

Charting Symbols

All activities can be broken down into five basic types of events and each is represented by a symbol. Following are the five standard symbols used in process charting-

	Operation. Something is actually being done. This may be work on a product, some support activity, or anything that is directly productive in nature.
	Transportation. The subject of the study (product, service, or person) moves from one location to another.
	Inspection. The subject is observed for quality and correctness.
	Delay. The subject of the study must wait before starting the next step in the process.
	Storage. The subject is stored, such as finished products in inventory or completed papers in a file. Frequently, a distinction is made between temporary storage and permanent storage by inserting a T or P in the triangle.

- (a) An operation occurs, when there is a change in the physical or .chemical characteristics of an object or material. Assembling and dis-assembling, making ready for the activity or putting away after another activity are also classified as operation. Mental activities such as giving or receiving information or calculating, etc., are included in operation;
Example: Turning a rod on a lathe, joining two components by welding, posting in a ledger, a chemical reaction, dismantling of a steam pipe.
- (b) An inspection occurs when an object is checked for either quantity or quality.
Example: Checking by counting, dimensional check, visual inspection of welding, checks a letter.
- (c) A transport occurs whenever there is any movement either by the .material or the man.
Example: Movement of material on a trolley, man walking.
- (d) A delay occurs when conditions do not permit the performance of the next activity immediately. Various delays and interruptions are denoted by this symbol.
Example: Material waiting near a machine for an operation and operator waiting for a tool near the tool crib.
- (e) A storage occurs when an object. is kept and protected against unauthorized removal.
Example: Materials in store, a letter in a file.

Present Method <input checked="" type="checkbox"/>		Proposed Method <input type="checkbox"/>		PROCESS CHART	
SUBJECT CHARTED		Requisition for small tools		DATE _____	
Chart begins at supervisor's desk and ends at		typist's desk in purchasing department		CHART BY J.C.H.	
DEPARTMENT		Research laboratory		CHART NO. R136	
				SHEET NO. 1 OF 1	
DIST. IN FEET	TIME IN MINS.	CHART SYMBOLS	PROCESS DESCRIPTION		
	30		Requisitions written by supervisor (one copy)		
	180		On supervisor's desk (awaiting messenger)		
65	1		By messenger to superintendent's secretary		
	120		On secretary's desk (awaiting typing)		
	30		Requisition typed (original requisition copied)		
15	.5		By secretary to superintendent		
	480		On superintendent's desk (awaiting messenger)		
	15		Examined and approved		
	480		On superintendent's desk (awaiting approval)		
20	.5		To purchasing department		
	240		On purchasing agent's desk (awaiting approval)		
	30		Examined and approved		
	240		On purchasing agent's desk (awaiting messenger)		
5	.25		To stenographer's desk		
	120		On stenographer's desk (awaiting typing of purchase order)		
	30		Purchase order typed		
	240		On stenographer's desk (awaiting transfer to main office)		
105	2237.25		Total		

Some Principles and Conventions

The Process Chart is drawn by denoting the activities by relevant symbols and placing them one below the other according to sequence.' These are joined by the vertical line. A brief description of the activity is given on the right of the symbol. Any other details such as distance, time, etc., can be given on the left of the symbol.

Types of Recording Techniques

The recording techniques generally used are as follows:

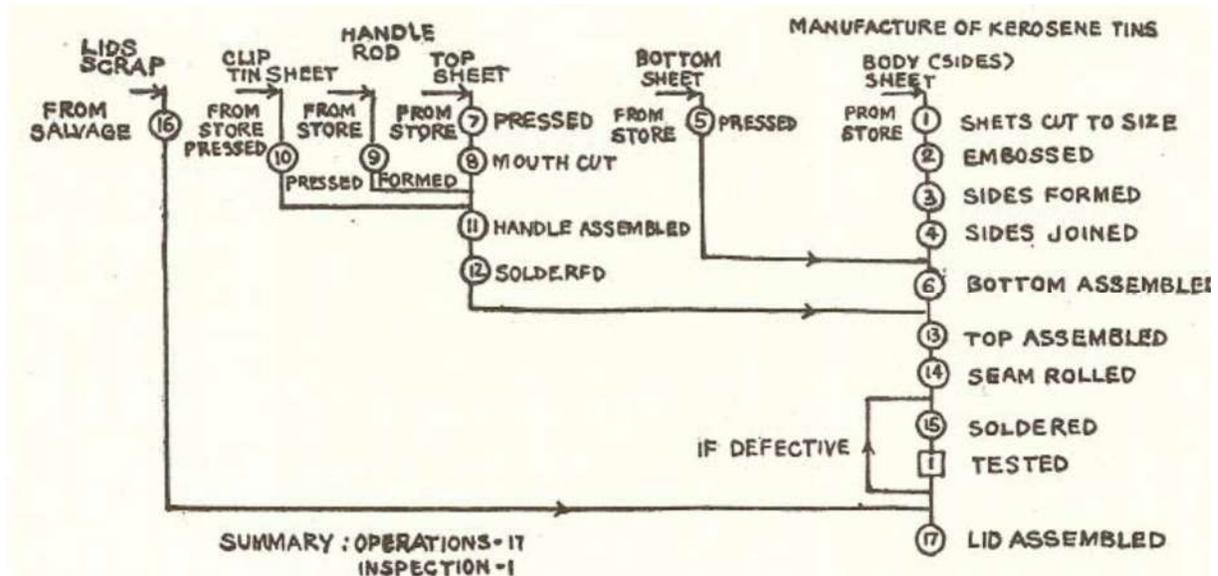
- (a) The Operation Process Chart
- (b) The Outline Process Chart
- (c) The Flow Process Chart (material)
- (d) The Flow Process Chart (man)
- (e) The Multiple Activity Chart
- (f) The -Two Handed Process Chart
- (g) The Simultaneous Motion Cycle Chart (SIMO Chart)
- (h) The Flow Diagram
- (i) The String Diagram
- (j) The Travel Chart

(a) The Operation Process Chart

At the initial stages it is valuable to get an overall view of the process. This will indicate how detailed further recording need to be. An operator process chart provides a bird's eye view of the whole process or activity. In an operations process chart all the operations and inspections involved are recorded. The chart does not indicate where the work takes place or who performs it. The delays, transport and storages are not indicated. But the entry points of materials are indicated.

"An operations Process Chart is a graphic representation of the sequence of all the operations and inspections involved in a process or procedure"

Such a chart will serve as a starting point for the critical examination. This is a very useful chart for initial analysis. Where the process is long and complicated, this chart provides an overall picture and gives adequate information for critical examination. This chart is particularly useful for recording maintenance and other indirect work. An example of the operation process chart is given-

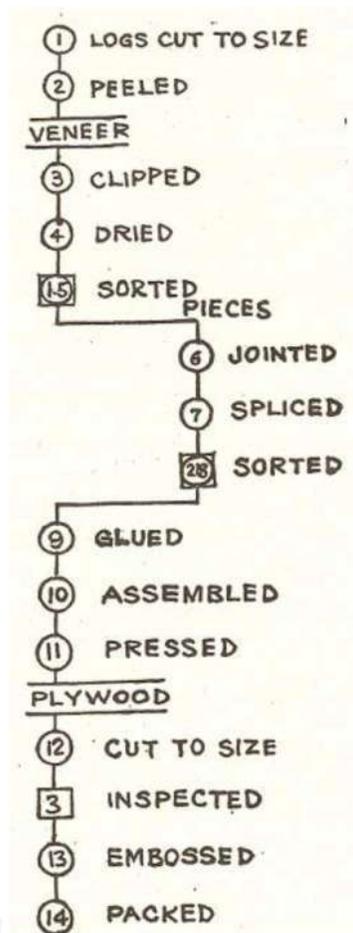


(b) The Outline Process Chart

"Sometimes as the initial stages of the study an overall view of the job under study can be obtained by recording only the key operations and inspections without **going into all the operations and inspections and other activities like delays, movements and storages.**"

Such a chart is known as an Outline Process Chart. This chart is particularly useful for large projects for getting a broad outline. Further amplification and analysis can be gone into if necessary, through an operation process chart or a flow process chart.

An example of the outline process chart of plywood manufacture is-



(c) The Flow Process Chart (Material)

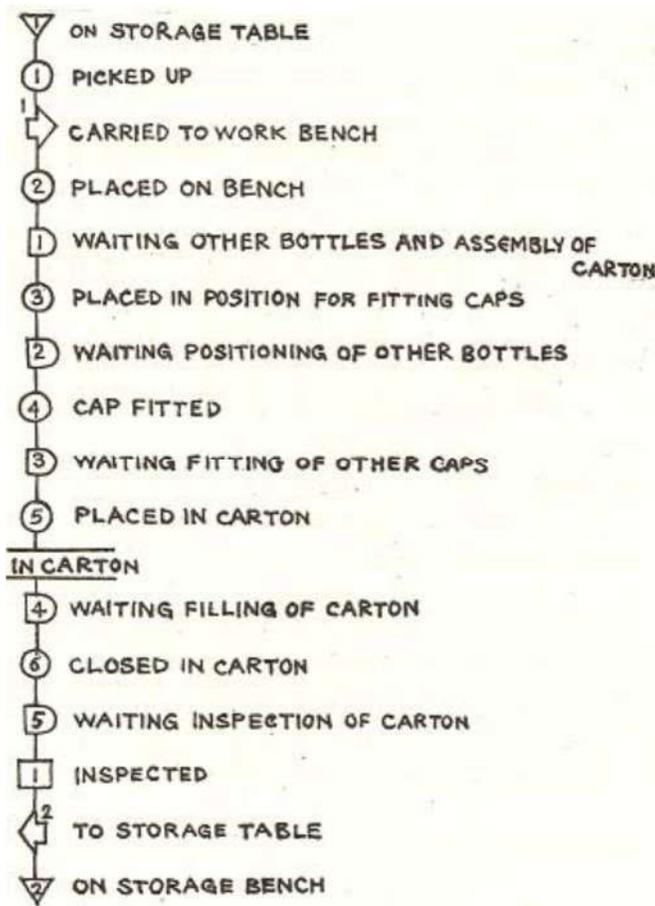
A flow process chart (material) is a detailed chart, indicating all the activities involved in a process.

"A flow process chart (material)), is a process chart setting out the sequence of the flow of a product or a procedure by recording all events under review in terms the material being processed, using the appropriate symbols".

In a flow process chart (material), the subject of the chart is material.

Since all the activities, operations, inspections, movements, delays and storages are recorded all the five symbols are used. The subject selected for recording should be one that provides continuity throughout the process.

A flow process chart (material) is more detailed than the operation 'process chart. All the factors contributing to the process must' be recorded.



(d) The Flow Process Chart (Man)

There are various types of charts that are used to record the method depending on the degree of details required. The flow process chart (man), is One of the basic charts to record the method. It is used to record the work of Individual operators. It gives a graphic representation of all the activities performed by the operators in the sequence in which they occur.

"A flow process chart (man) is a chart setting out the sequence of the flow of a product or a procedure by recording all event under review in terms of the worker using the appropriate process chart symbols."

The term storage is not usually applicable to an operator and hence this symbol is not used.

An example of the flow process chart (man) is shown in Fig.

Flow Process Chart (Man) - Present Method

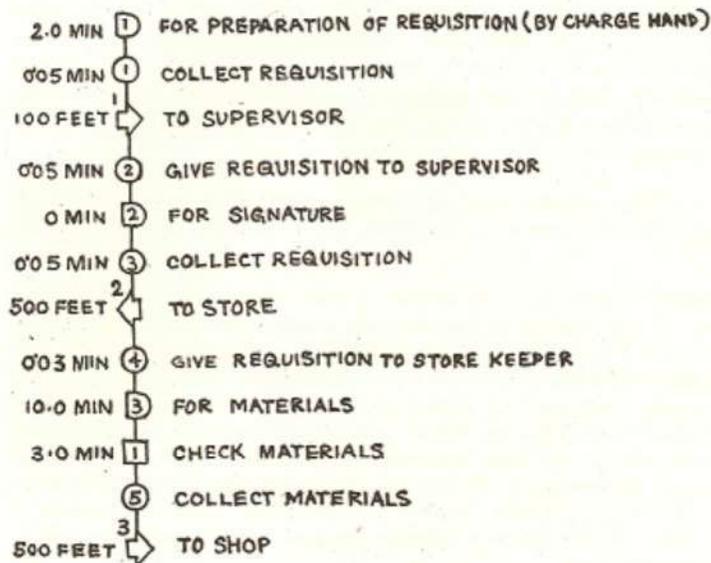
Job: Collection of materials from store

Subject charted: Machine Helper

Chart Begins: Helper awaiting for preparation of requisition Chart

Ends: Helper at the machine

The above points are shown in Fig.



SUMMARY

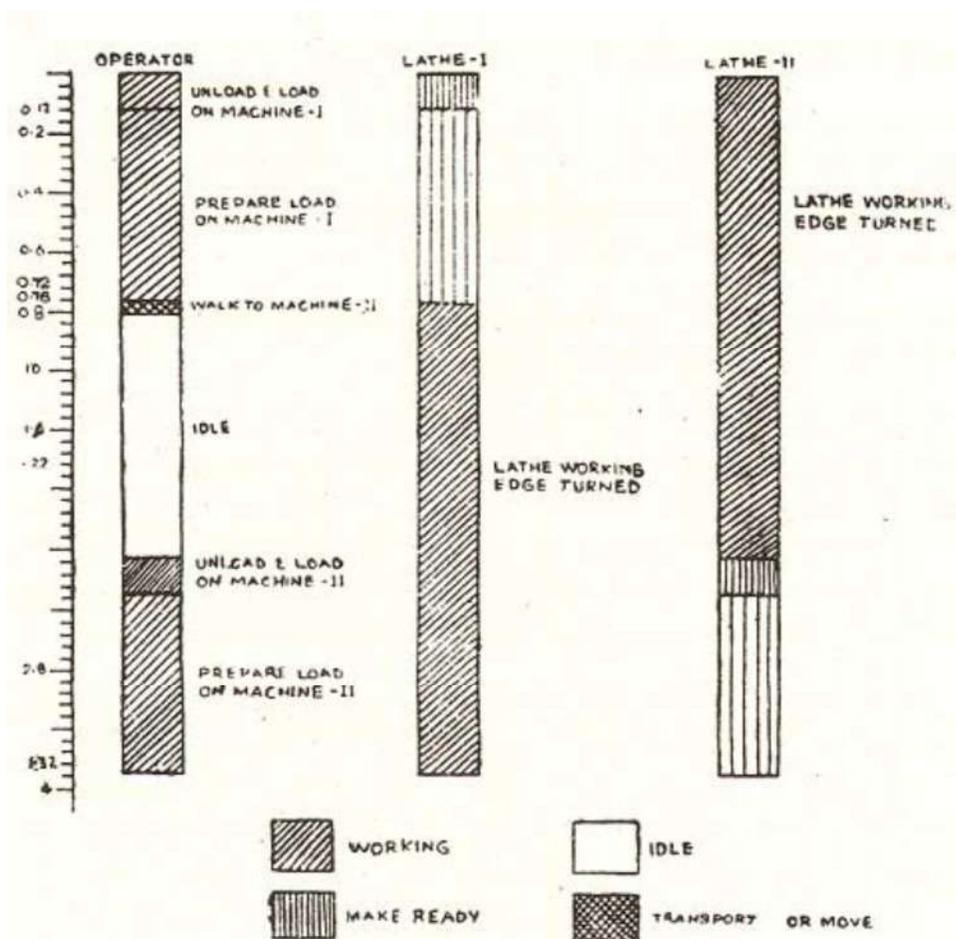
	NO	TIME (M.T.S)	DISTANCE (FEET)
○	5	4.0	
□	1	3.0	
➤	3	-	1100
D	3	13.0	

(e) The Multiple Activity Chart

There will be various situations wherein the combined and inter-related efforts of a group of workers and machines would be necessary for the performance of the job. The charts described so far can be used to record only one subject in anyone particular chart. Whenever a process involves the co-ordination of various activities it may be required to study the relationship between these activities. Such an inter-relationship is provided by the multiple activity chart. A multiple activity chart is used to record the activities of one subject in relation to others.

"A Multiple activity chart is a form of process chart recording the related sequence of work of a number of operators and/or machines on common time scale."

Separate vertical bars are attached to each worker and/or machine to be charted. A time scale is entered along side in a convenient place, usually on the left hand side. The activities are then plotted in sequence against the time scale within their own particular bar in the chart. Brief descriptions of the activities are also given along side.



SUMMARY

	TIME (MINUTES)		
	OPERATOR	MACHINE I	MACHINE II
WORKING	1 + 0	2 32	2 32
UNOCCUPIED	0 + 8		

(f). The Two-Handed Process Chart

Jobs that are completed at a single work place often consist of a series of activities of the worker's two hands and occasionally the other parts of the body. The two-handed process chart records the sequence of manual activities in such jobs in a graphical manner.

"The two-handed process chart is a process chart recording the work of the operator's hands (limbs) in relation to another."

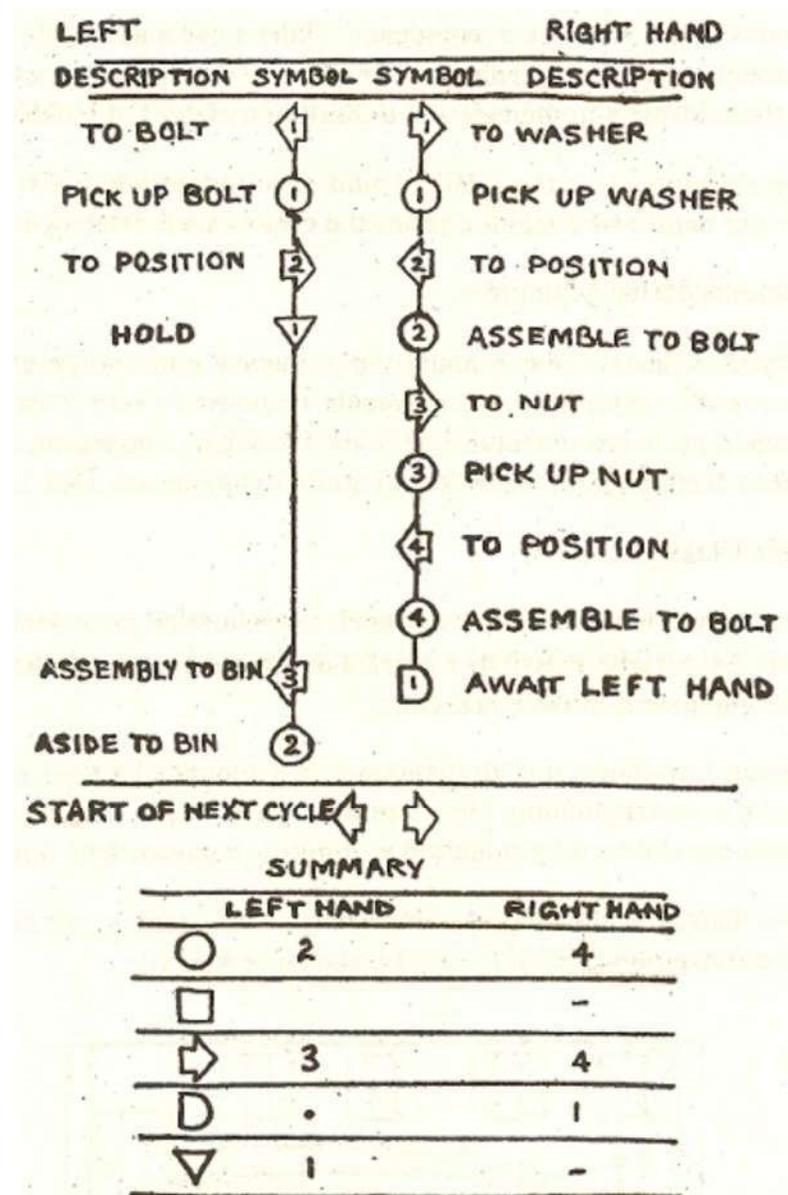
A two-handed process chart is made up of two columns in which the activities of the left hand and right hand and the appropriate symbols are respectively recorded in sequence. The activities of the

two hands are inter-related by aligning the symbols on the chart so that simultaneous movements by both hands appear opposite to each other.

Additional columns can be designed to record the activities of the other parts of the body whenever necessary.

The two-handed process chart generally employs the same symbols as the other process charts. In practice only four of the five symbols are used to any extent.

"Inspection" is rarely used since "inspection" are a combination of hand movements and operations.



(g) The Simultaneous Motion Cycle Chart (Simon-Chart)

The Simon Chart is a refinement over the two-handed process chart. It charts the activities of the two hands (or other parts of the worker's body) in relation to each other, during an operation.

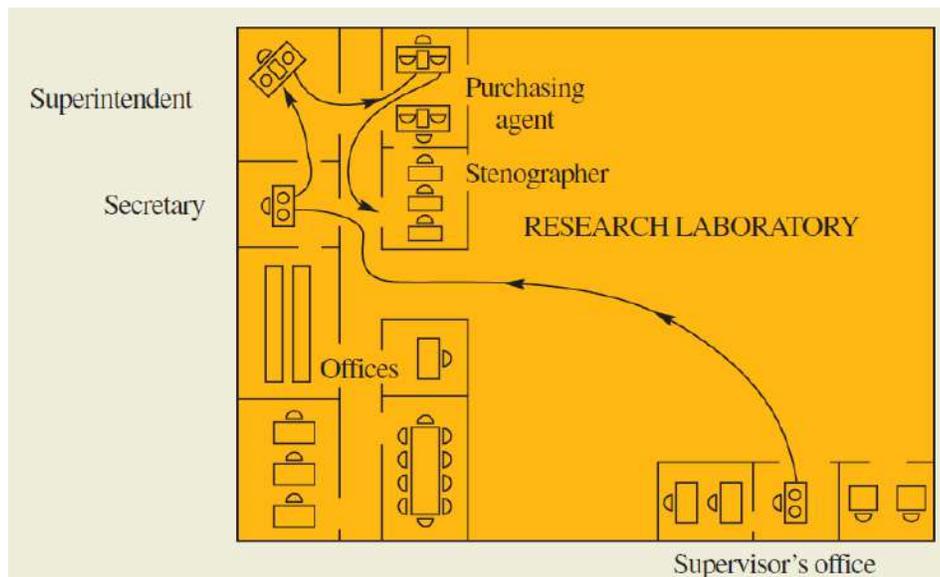
are recorded against a time scale. The activities recorded are in terms of "Therbligs"; which are very fine basic human motions. Such a chart can be prepared only with the help of photographic aids, involving expensive equipment. Short cycle and highly repetitive jobs are suited for this type of recording. By an analysis it will be possible.

Flow Diagram and String Diagram

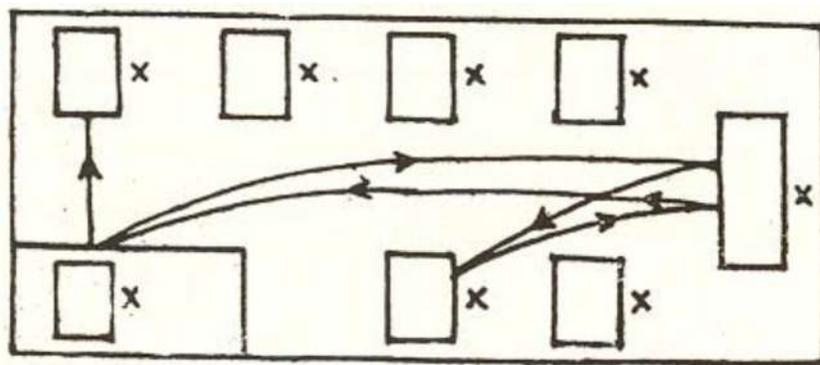
The Process Charts show mainly the sequence and nature of activities, the information given regarding the movements involved is, very little. The pattern of movements may have features like back-tracking, congestion, long distances, etc. To record these features the flow and string diagrams are used.

(h) The Flow Diagram

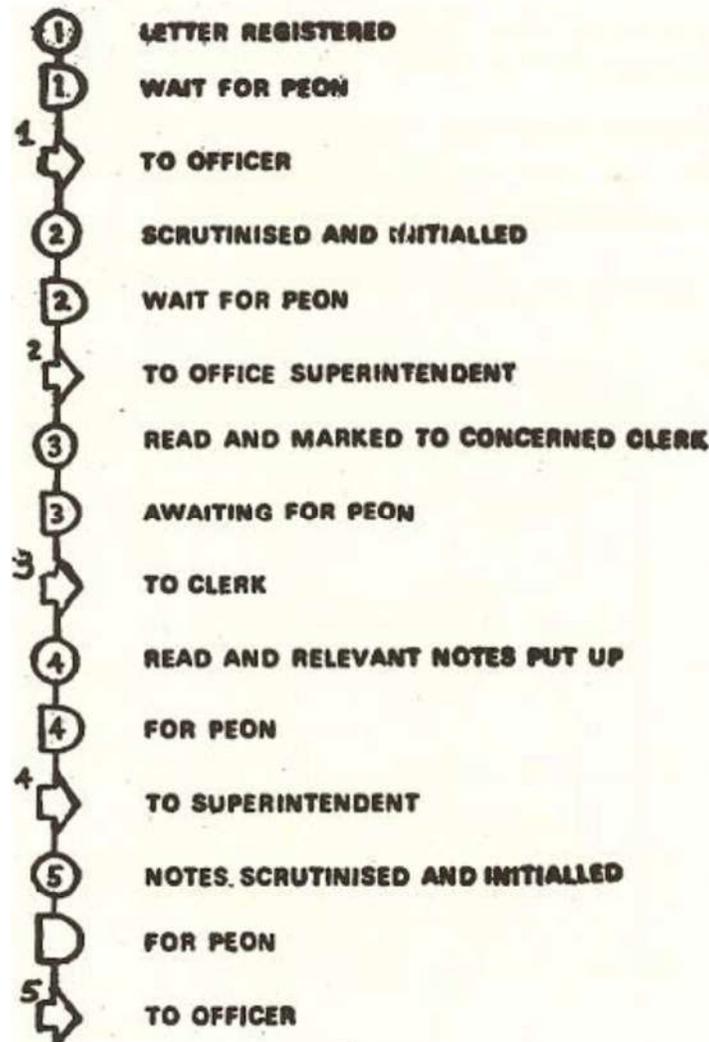
"A flow diagram is a drawing or a model substantially to scale, which shows the location of the various activities carried out and the routes followed' by workers, materials or equipment in their execution."



A flow diagram showing the movement of a paper in an office is given in Fig.



The corresponding FPC is partly shown in following Fig.



(i) The String Diagram

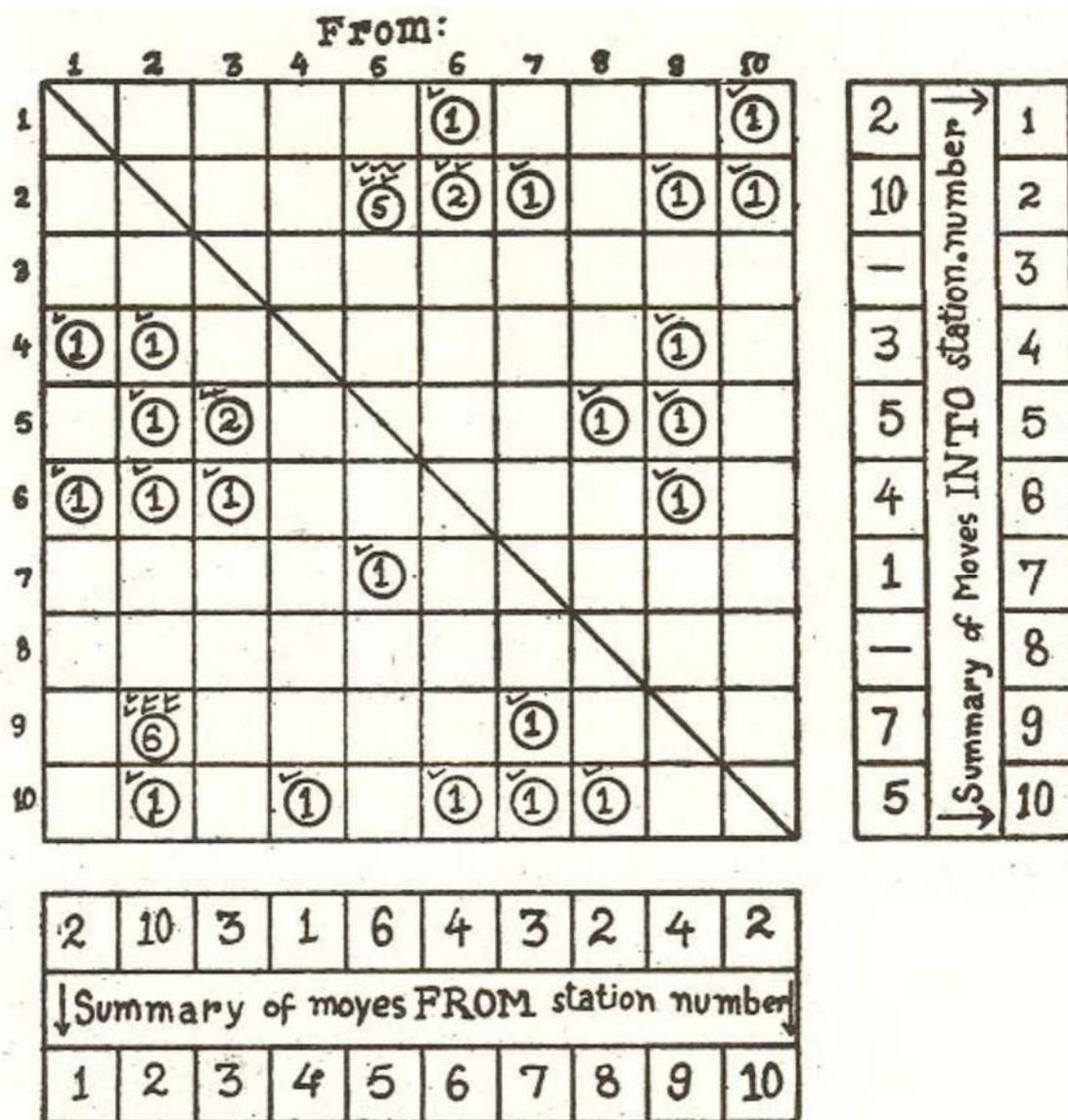
When there is too much of movement involved then, a flow diagram may become in comprehensible, in such cases, string diagram is used.

The scale layout is fixed to a board and plans, are driven into the board to mark the location of various activities and also at points where the direction of move changes. A thread is then wound round the pins following the various activities in sequence. The distance covered can be calculated by measuring the length of the thread used.

These diagrams are particularly useful when, considering problems of plant layout and design. Proposed improvements can be effectively demonstrated bold, to management and workers.

(j) The Travel Chart Travel Chart is a quicker and more manageable recording technique.

"A Travel chart is a tabular record for presenting quantitative data about the movement of worker, materials or equipments between any number of places over any given period of time."
The figure shows a typical travel chart. The 'travel chart is always a Square.



Principles of motion economy

The **principles of motion economy** form a set of rules and suggestions to improve the manual work in manufacturing and reduce fatigue and unnecessary movements by the worker, which can lead to the reduction in the work related trauma.

The principles of motion economy can be classified into three groups:

1. Principles related to the use of *human body*,
2. Principles related to the arrangement of the *work place*,
3. Principles related to the *design of tools and equipment*.

Use of Human Body

- The two hands should begin motions at the same time.
- The two hands should not be idle at the same time except during rest periods.
- Motions of the arms should be made in opposite and symmetrical directions and should be made simultaneously
- Hand motions should be confined to the lowest classification with which it is possible to perform the work satisfactorily:
 1. Finger motions
 2. Wrist motions
 3. Forearm motions
 4. Upper arm motions
 5. Shoulder motions
- Momentum should be employed to assist the worker whenever possible, and it should be reduced to a minimum if it must be overcome by muscular effort.
- Smooth continuous motions of the hands are preferable to zigzag motions or straight-line motions involving sudden and sharp changes in direction.

Arrangement of the Work Place

- There should be a definite and fixed place for all tools and materials.
- Tools, materials, and controls should be located close in and directly in front of the operator.
- Drop delivers should be used whenever possible.
- Materials and tools should be located to permit the best sequence of motions.
- Arrange the height of the workplace and chair for alternate sitting and standing, when possible.
- Provide a chair of the type and height to permit good posture.

Design of Tools and Equipment

- Combine tools whenever possible.
- Preposition tools and materials.
- Where each finger performs some specific movement, the load should be distributed in accordance with the inherent capacities of the fingers.
- For light assembly, a screwdriver handle should be smaller at the bottom.
- Momentum should be used to help the worker in doing their task not to increase their task.

Micro Motion Study Technique: Introduction, Definition, Purpose and Advantages

Introduction:

Micro motion study technique is best suited for those operations or activities which are of short duration and which are repeated hundreds of time. These are the operations or motions which require very small time and it is quite difficult to measure time for these motions accurately and the time required by these motions cannot be neglected due to repetitive operations.

In such activities it is interesting to go into greater details in order to find out which movement and effort can be avoided. All this is done to develop the best possible pattern of movement so that the operator can perform the operations repeatedly with a minimum effort and fatigue.

Definition:

“Micro motion study is the technique of recording and analyzing the timing of basic elements of an operation with the objective of achieving the best method of performing the operation.”

Such respective short duration activities involve quick movement of limbs which cannot be accurately studied and timed using two handed process charts. This is due to the fact that such record microscopic details such as different operation, Inspection and transport etc. Study of such microscopic movements in short cycle repetitive jobs is not sufficient.

Short cycle operations require to be studied for microscopic motions e.g., operation of picking up a nut from bin and its fixing consists of three hand motions namely reach for the nut, grasp nut and move hand back to assembly position. Such detailed analysis help to develop the best possible pattern of movements and hence enabling the operator to perform various operations repeatedly with minimum effort and fatigue.

Micro motion study is one of the most accurate techniques of work analysis used for work improvement. It makes use of motion pictures of the different activities or movement, so with the help of camera. Very small time upto 0.0005 minute can be measured and recorded by this system.

When picture camera is utilized, the procedure is known as “MICR-MOTION STUDY”. The motion time data from the film is transferred to simo chart. The simo chart data can be further analyzed for the purpose of work place layout or method improvement.

This technique was developed by Fran Gilbreth who considered that an operation consists of minute elements which may be repetitive or non repetitive. He termed these elements THERBLIG (after his name Gilbreth if spelt bank word is Therblig).

Purpose of Micro Motion Study:

It can be used for following purposes:

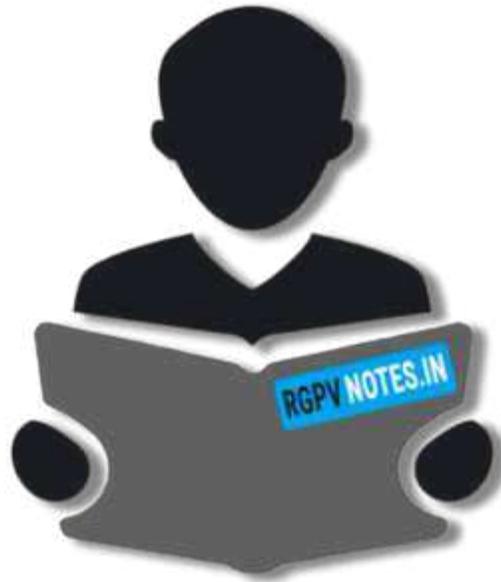
1. To study the nature and path of movements for obtaining the elements of an operation.

2. To study the activities of the machine and the operator.
3. To impart training to the workers or operators regarding motion; economy so that unnecessary movement by the workers may be avoided.
4. To study the relationship between the activities of operator and the machine.
5. To keep permanent record of the most efficient way of performing a task for future reference.
6. To obtain motion time data for developing synthetic time standards for various elements.
7. For carrying out research in the field of method and time study.

Advantages of Micro Motion Study:

It has the following important advantages:

1. It provides a permanent record of motion study on films.
2. A large number of operators can see the procedure at any time even after the completion of motion study work.
3. Films can easily reveal the difference between the present and the proposed technique.
4. Films can be demonstrated to large work force at any desired speed.
5. It provides very accurate time for each operation or motion in comparison to stop watch time study.
6. It helps in making detailed and accurate analysis of the prevailing technique.



RGPVNOTES.IN

We hope you find these notes useful.

You can get previous year question papers at
<https://qp.rgpvnotes.in> .

If you have any queries or you want to submit your
study notes please write us at
rgpvnotes.in@gmail.com



LIKE & FOLLOW US ON FACEBOOK
facebook.com/rgpvnotes.in