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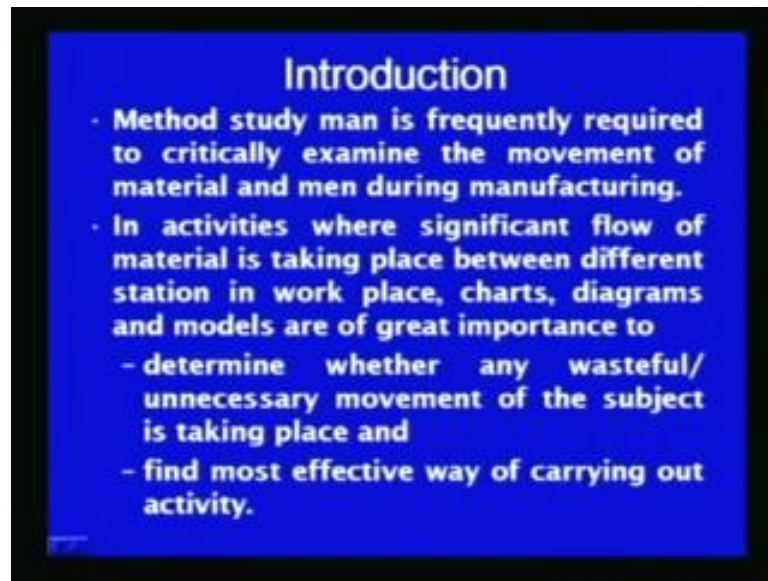
**Module - 03**  
**Lecture - 06**  
**Recording Techniques for Method Study Part – 2**

Dear students, as you know that method studies one technique, which is used for improving the existing method and developing most efficient and easier method for carrying out a particular job. For using method study for improvement of existing method or developing new method, there are seven steps which are followed one by one, the first of the those seven step is the selection of the job, which is to be studied. And the second one is the recording of the different activities, which are carried out for doing a particular job.

So, for the recording purpose different techniques are used in method study, so that the details about the different steps and activities can be gathered, which are being used for manufacturing a particular product or for doing a particular job. So, in earlier we have seen the two types of recording techniques, these where the outline process chart which is mainly used for a study of the sequence of the different important operations and inspection.

And the flow process chart, which indicates the flow of the man material and equipment in course of production, in sequence and that uses the five different elements and these elements are operation, transport, inspection and inspection delay storage. And in today's lecture, I will talking about the other recording techniques, which will include some of the diagrams and the film based techniques.

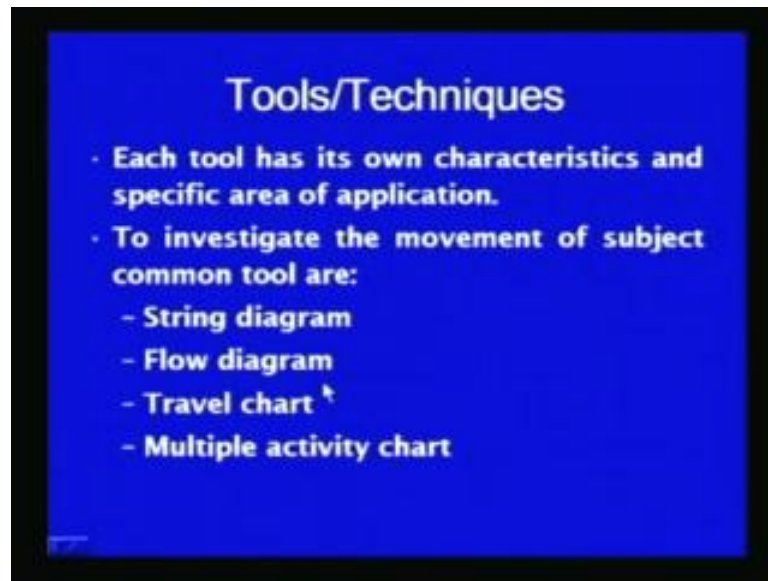
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So, here if you see the importance of a recording techniques in method study, as I have described just now it is important that the method study man critically investigates the different activates, which are being used for doing a particular job. So, that critical examination regarding the movement of the material and men and during the manufacturing is important to see, if any irrelevant and unnecessary movement is taking place or not.

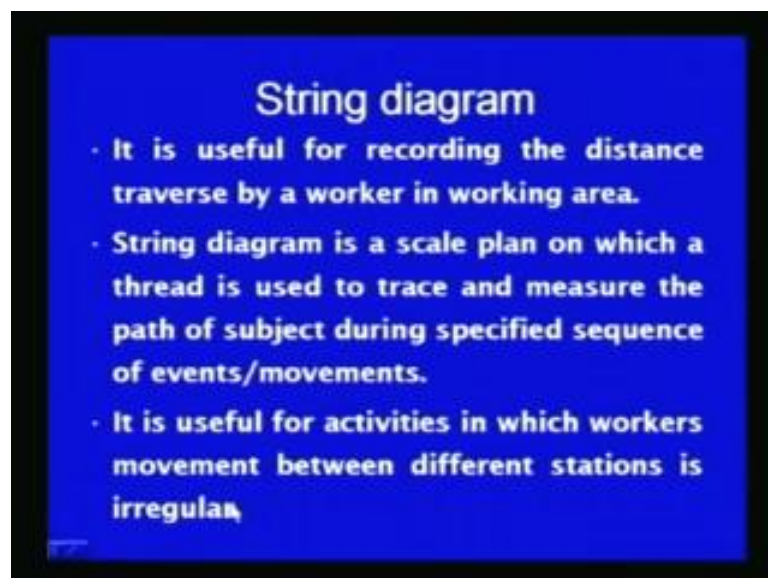
So, if in the activities particularly were significant flow of some material is taking place between the different stations in work place, the charts, diagrams and models are of great importance for recording purpose of the movement of the material, men and equipments between the different stations and there critical analysis. So, as to determine whether any wasteful or unnecessary movement of the subject is taking place in course of production or not and also to find out the most effective way of carrying out the activity.

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So, far the recording purpose of the movement of the men material in course of production various tools are used each tool has a it is own characteristic and area of it is application. So, to investigate the movement of subject the tools, which are commonly used are string diagram, flow diagram, travel chart and the multiple activity chart. Each the technique whether it is a string diagram, flow diagram, travel chart or multiple activity chart, each tool has it is own specific features and suitability for a particular application, we will be talking one by one about each of these techniques.

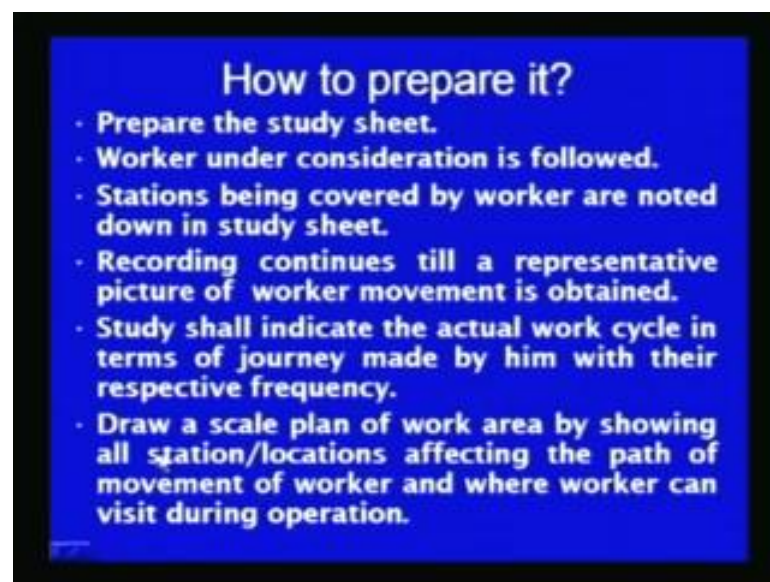
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A string diagram it is useful for recording the distances being traversed by the worker in the work area during the operation. And these movements are shown on a scale plan with the help of a thread, which is used to trace and measure the path of subject being covered during a specified sequence of events or movements. So, here a scale plan of the work area is developed and on that a scale plan threads are used to indicate the different paths which are being covered and the distances being moved by the subjects in course of production.

And also to measure the distances being covered by the subjects in course of production, in a particular sequence the way by which or in the order in which these movements are taking place. It is useful for the cases where the number of workers are working on a particular system or one worker is will looking after the number of stations. And it is useful activities, in which workers, movement between the different stations is irregular for not very standardized and repetitive kind of movement, this diagram is useful. Where the movements are random and irregular for a short period of time, under those conditions the string diagrams are found useful for recording the movement of the men material and equipment in course of production.

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For the preparation of the string diagram first of all a study sheet is prepared, which will help to note down all the things and the activities and events which are being carried out. The worker or the subject whether it is worker or material under consideration is

followed to note down, where he is going what are the different stations being covered by him, the stations being covered by the worker are noted down in study sheet.

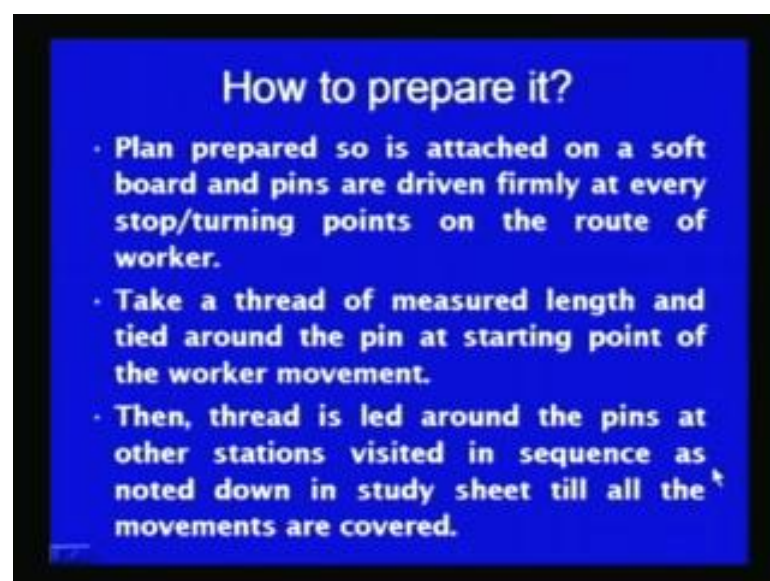
And then this noting down of the movements of the targeted subject will continue till a representative picture of the workers, movement is obtained. And a study this kind of a study shall indicate the actual work cycle, in terms of the journey being made by him with their respective frequencies. So, this kind of a study will continue until a representative picture of the movement of the targeted subject is obtained for a given department or during the course of production.

And not only the way by which and the sequence in which movements are taking place is recorded, but also their frequencies are also noted down. Then, using these inputs which will indicate the different stations being traveled by the subject and the frequency of the travel between the two stations is also noted down.

And this information is recorded in a scale plan of the work area the, so scale plan of the work area is developed first which will be indicating the all stations and locations that affect the path of movement of worker or the subject, where worker can visit during the operation or material can be transported during the operation.

So, a scale plan is developed in a white paper sheet which will be indicating the locations of the different stations and the points which can affect the path of movement of the worker. And on this a scale plan at the different stations and the points which can affect the movement of worker pins are driven on the plan.

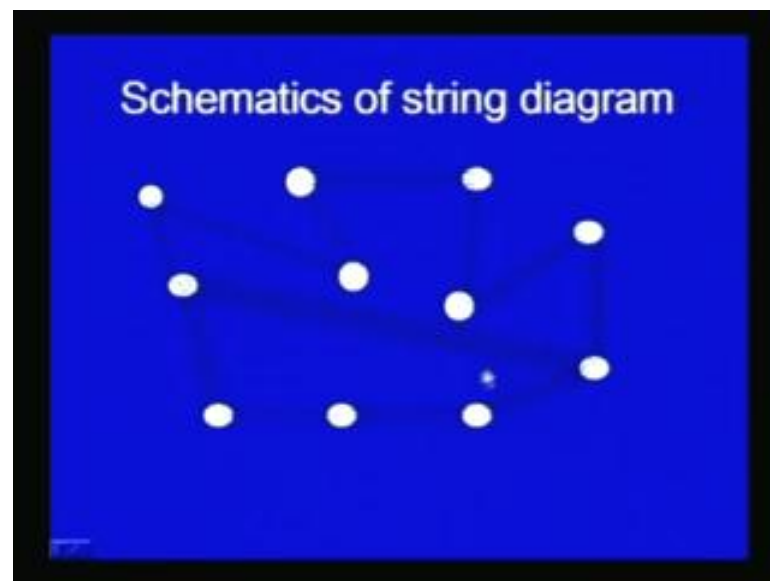
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Plan prepared show is attached on a soft board and pins are driven firmly at every stop and at turning point on the route of the worker or the subject. So, after preparing the plan of the work area, the plan is pasted on the soft board and then pins are driven firmly at each station or turning point, which will be coming on the route of the worker. And then thread is taken of the measured length and it is tied around the one pin from where journey is started by the worker.

And after that thread is led around the pins at other stations being visited by the worker in sequence as noted down in study sheet till all the movements are covered, which has been noted down in the study sheet. So, here the thread is tied around the pin at a station from, where visits are started and then the thread is led around the pins at which are located at a stations being visited by the worker in course of production. And this will continue until all the stations visited by the worker are recorded in the diagram by time and thread around the pins.

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So, here after this it can be seen in this diagram see these are the different stations in form of white spot showing and the different stations, which are to be visited by the worker. And then after from one pin the starting station the thread is tied around the pin and then the pin then thread is led around all the pins in the sequence, in which the worker will be making the movements between the different stations.

So, each thread presence of each thread represents one movement, if five movements are there, five visits are there between the two stations. Then, there will be five number of

threads between those two pins indicating the two stations, if there is a just two visits between the two stations, then there will be two threads only. So, likewise we will be able to see that how many threads are there and the number of threads between the two pins will be indicating the frequency of visits between the two stations.

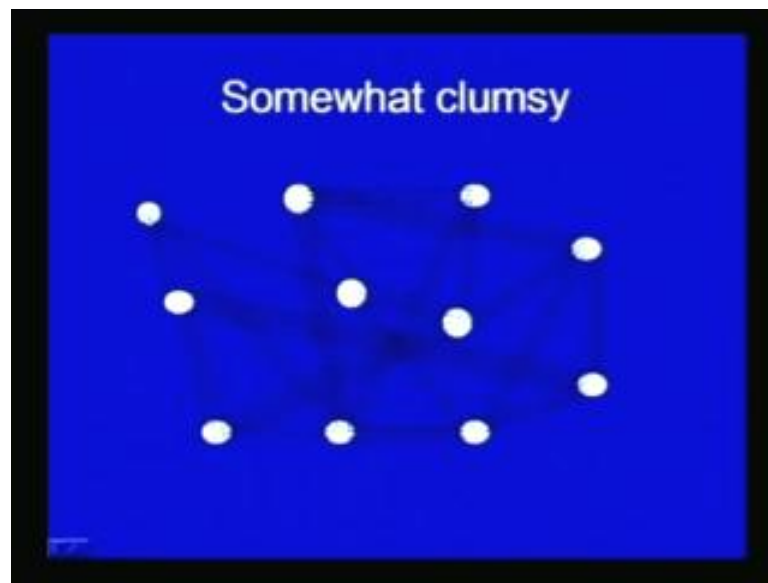
So, more number of threads between the two stations will indicate, the more frequency of visits between those two stations. So, here after tying or the thread around all the pins in such way that all the stations have been covered by tying the thread around the pins, it will be possible to see, what is the length of the thread which has been used in lying down the thread all around the pins.

And showing all the movements, which have been taken place by the worker between the different stations, in course of production over a certain period of time representing the representative movement of worker between the different stations. So, here this string diagram helps to show the plan of the different stations and the kind of movement which is taking place between the different stations of the worker or of the material and what is their frequency.

Too much frequency between the two stations, which are located far apart will be unnecessarily increasing the excessive movement of the material or a worker between the two stations. It maybe thought out that the bringing the two stations closer will help to reduce the unnecessary extra movement of the subject between those two stations. So, the visual impact of the string diagram helps to easily understand, the kind of movement which is taking place, which kind of movement which is there between the different stations of the worker or of the material.

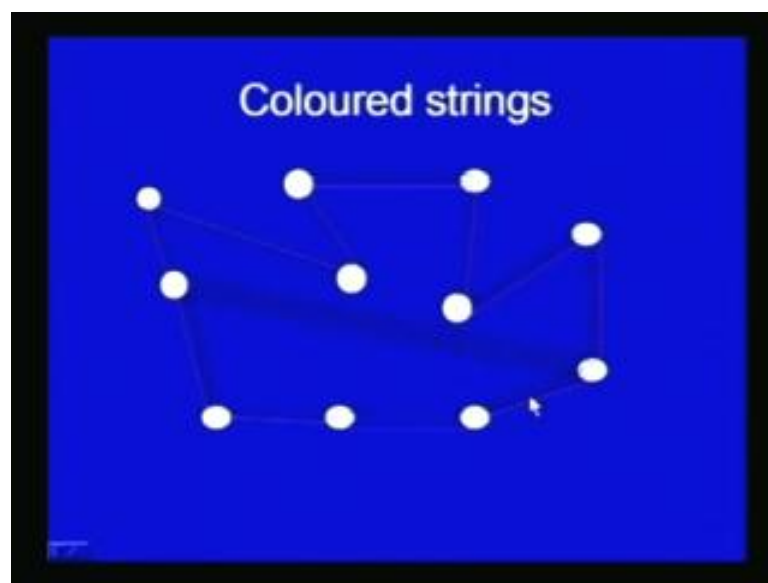


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So, here if the number of movements are too many and the movements are very zigzag in nature, then representation of all those movements using a string diagram can lead to have a very crisscross of the lines or of the threads, which may be difficult to understand. So, a very large number for the movements between the different stations in crisscross manner will simply lead to a clumsy situation, where a string diagram may not be able to help the kind of movements, which is taking place between the difference stations. And under those conditions sometimes the threads of the different colors are used to show the movement of the different subjects for increasing the clarity.

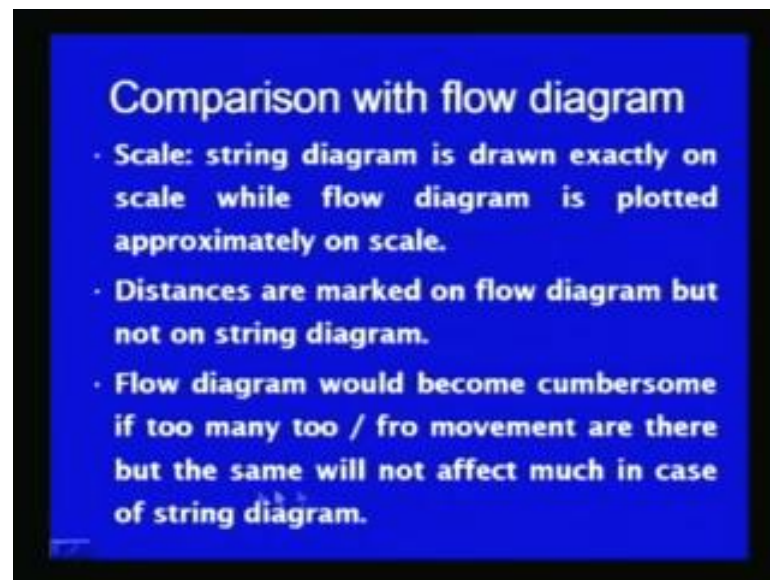
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Here some of the threads can be made of one color, other threads can be made of different colors for indicating the movement of the different subjects. So, that some sort of clarity can be increased and also this colored strings are mainly used to show the movements between the different stations, clearly if the number of subjects are more and that movement between the different stations is very zigzag in nature.

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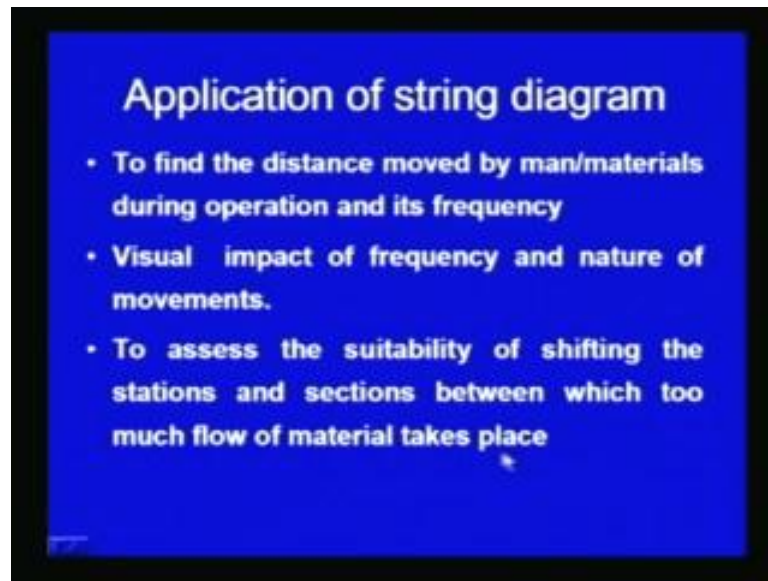


If we compare the flow diagram, which is one technique of indicating the movement of the material between the different stations. And this technique which is a string diagram, which is also used for indicating the movement of men or material in course of production. The comparison between the flow diagram and the string diagram lies in terms of the you can be seen, in terms of the scale the string diagrams are drawn exactly on the scale, while the flow diagram is plotted approximately on a scale.

The distance is marked on the flow diagram, but the distances are not marked on the string diagram only the length of the thread is used to show, the distance which is there between the two stations or the distance which is to be covered by the subject in course of production. The flow diagram would become cumbersome if the too many too and fro movements are there, but the same will not affect much in case of the string diagram.

In case of a string diagram, if very zigzag movements are taking place that to in very large numbers, then the string diagrams also becomes difficult, then to understand and to show clearly the kind of movements which is taking place between the different stations.

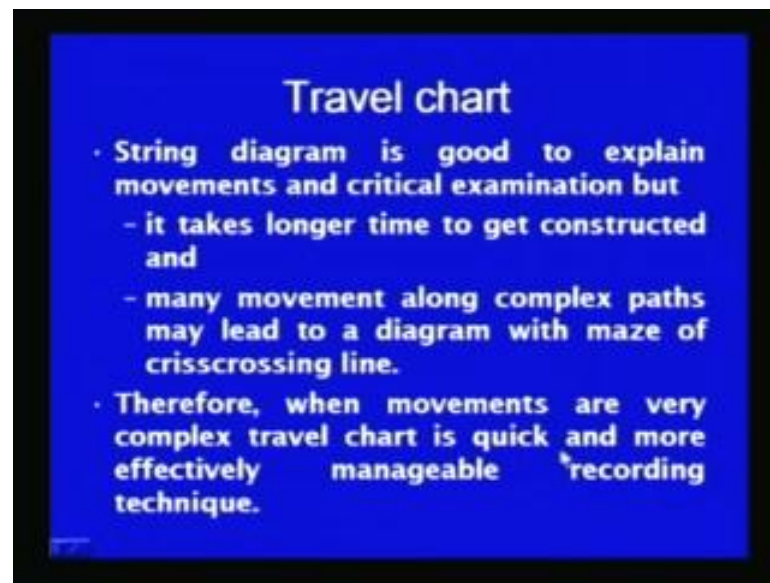
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So, you have seen the principle of the string diagram and the way by which it is developed. In light of the above, you can see that the string diagram can be used for a variety of applications, like to find out the distance moved by the man and material during the operation and also to see its frequency. It is a visual impact regarding their frequency and the nature of movements that can give the clues for improving the plant layout and reducing the unnecessary movement of the man and material in course of production, so as to improve the productivity.

This string diagram can also be used to assess the suitability of shifting the stations and the different sections between which too much flow of the material is taking place. So, if the two stations between which the movement of the man or material is too much and if they are located at a large distance, then the decision regarding the shifting of the stations and sections can be thought of, that shifting can help to reduce the unnecessary excessive movement of the man and material. The travel chart is another technique, which is used to show the movement of the man and material during the production.

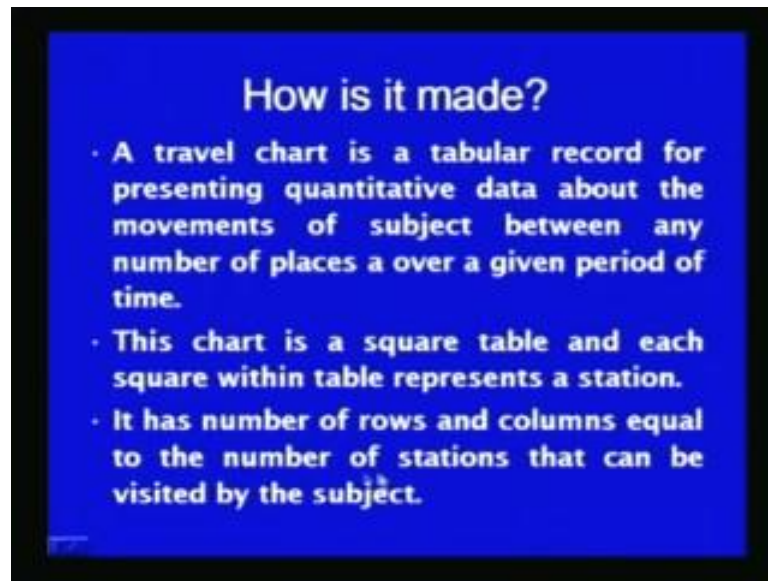
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A string diagram is a good tool to explain, the movements and the critical examinations, but it is very time consuming to prepare and get it constructed. And another aspect is that if the many movements are taking place along the complex paths, then a string diagram may lead to have the maze of crisscross lines only. So, the string diagrams are found not very useful, if the too many movements are taking place along the complex pass and another negative aspect related with the string diagram is that it takes longer time to construct it.

While therefore, the movements which are very complex in nature and large in numbers, the travel chart can be effectively used to study the kind of movements, which is taking place between the worker, movements taking place of the worker or the material between the different stations. This travel chart is found to be very quick and effective in recording and the different movements of the worker and the material between the different stations in course of production.

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How it is made, that you will see the process of preparing the travel chart is very simple it is a tabular record, a travel chart is basically in tabular form which records the quantitative data about the movement of the subject between any number of places over a given period of time. And this chart is a square table and in the square table each station within the table represents a particular station, it has a number of rows and the columns equal to the number of stations that can be visited by the subject.

So, a travel chart basically is a square table has the number of columns and the rows, which are equal in number and that number is found equal to the number of stations, which can be visited by the subject. So, here number of columns and the number of rows in travel chart will be equal and these numbers will be equal to the number of stations, which can be visited by the subject.

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		TO WORK CENTRE NO.							Total
		1	2	3	4	5	6	7	
FROM WORK CENTRE NO.	1		8	2	10	2	6		28
	2	16		6	3	15	10	2	52
	3	6	4		6	20	4	6	46
	4	2	8	12		10	6	1	39
	5	4	12	18	4		10	2	50
	6		16	2	6	3		9	36
	7		4	6	10				20
Total		28	52	46	39	50	36	20	

1. Manager Table  
 2. Secretary Table  
 3. Clerk usha Table  
 4. Clerk Sushma Table  
 5. Photo Copy Machine  
 6. Outboard  
 7. Water Cooler

**Busy route:**  
 3-5 (20 visits)  
 5-3 (18 visits),  
 6-2 (16 visits)

Here we can see, the travel chart this first column indicates the centre's from where visits can be made, there are 7 stations from where the visits can be made and the similar number of the stations 7 number of stations to which visits can be made. So, to the work centre where visits can be made and from the work centre from where visits can be made. So, here the rows indicates the centre's to which visit can be made and the column indicates the centre's from where visits can be made.

So, 1, 2, 3 to 7 indicates the number of centre's from where visits can be made and these numbers 1 to 7 indicates the number of centre's to which visit can be made. This last column here it indicates the summary of the total number of visits from the different stations, say for the visits from a station 1 or in total 28, likewise visits from a station 3 are visits in total visits are 46 in numbers.

So, here the last column indicates the total number of visits, which has been made from these stations and this the last row indicates, the lowest row indicates the total number of visits which have made to these stations. Here, in station number 1, 28 number of visits have been made in total in station number 2, 52 number of visits have been made in total. So, here this column indicates the station from where visits will be made and these row indicates the number of visits, which will be made in it indicates the station number to which visits can be made.

Here, because this is a square table which shows the different stations, which can be visited and from where visits can be made. In addition to these there are number of

square boxes in each box indicates the station, one station like say this box indicates this one station, this is another station, this is another station, like these are indicating the station number and these are indicating the station number.

And these number in each station indicating the number of visits, which are being made from one particular station to the another station, here if you see if visits are being made from station 1 to 1 it cannot be done. So, visits can be made from 1 to 2 that can be shown say by number 8, 8 indicates the number of visits from station 1 to a station number 8 or 8, visits from a station number 1 to a station number 3 or 2 in number, visits from a station number 1 to a station number 4 or 10 in number.

And to avoid any confusion a diagonal line is plotted, so that the visits are not shown in advertently from the station from 1 station to the same station. Like, here this box has been crossed, because it is corresponding to the visits from station number 7 to the station number 7. Here, likewise if you see the all these digits, these digits will be indicating the number of movements which are taking place from these stations to these stations.

How can we understand, say if we see the number of visits being made from a station number 7, here to the station number 2 there are 4 visits to the station number 3, there are 6 visits from a station number 7 to station number 4, there are 10 visits and there are no visits to the station number 5 and 6. So, here the total summary of the visits which are being made from the station number 7 are 20 in number, so likewise if we see these numbers it will indicate the total number of visits, which are being made from the station number 1 to the 7.

It will indicate that the maximum number of the visits are being made from station number 2 that is 52, then the second highest number of visits are being made from the station number 5 that is 50, and the third highest number of visits being made from the station number 3 that is 46. Then, similarly we can see the highest number of being visits made to the station number 2 that is 52, and the second highest number of visits being made to the station number 5 that is 50, and the third highest number of the visits being made to the station number 3.

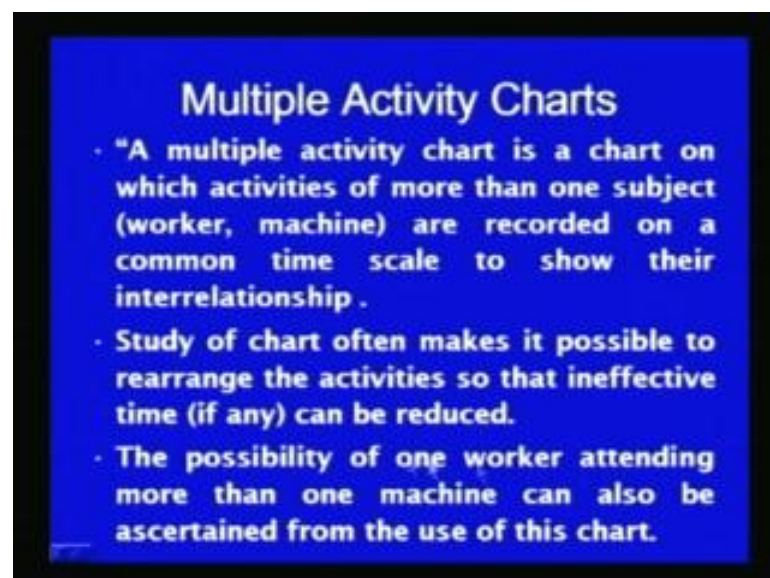
So, if we see that the maximum number of being visits which is being made from to and from the station number 2 that is the busiest station, second busiest station is the station number 5 and the third busiest station is the station 3. So, busiest route we can say, if we

see in total the 5, 2, 3 if we see the 5, 2, 3 visits from station number 5 to station number 3, station number 5 to station 3 there are 18 visits that can be seen from 5 to 3 there are 18 visits.

And from station number 3 to station number 5 there are 20 visits, that can be seen station number 3 to 5 there are 20 visits in total and then from station number 6 to the station number 2 there are 16 visits. So, if you see the entire body of the text we can see the busiest stations are 2, 3, 2, 5 and 3, so accordingly if this data is checked with the layout of the flow diagram or plan of the plant it can be seen that what is the possibility of shifting the station number 2, 5 and 3.

If the station number 2, 5 and 3 are located far apart from each other, then decision regarding the shifting of the station 5 and 3 to 2 or decision regarding and the bringing the station number 2, 5 and 3 close to each other can be taken if it is feasible. So, that unnecessary extra movement between and the different station 2, 5 and 3 can be reduced and the productivity of the system can be increased. The multiple activity chart is another chart, which is used to show the activities of the different subjects on a common time scale, this is one chart which uses a common time scale Simo chart is another chart which uses the common time scale.

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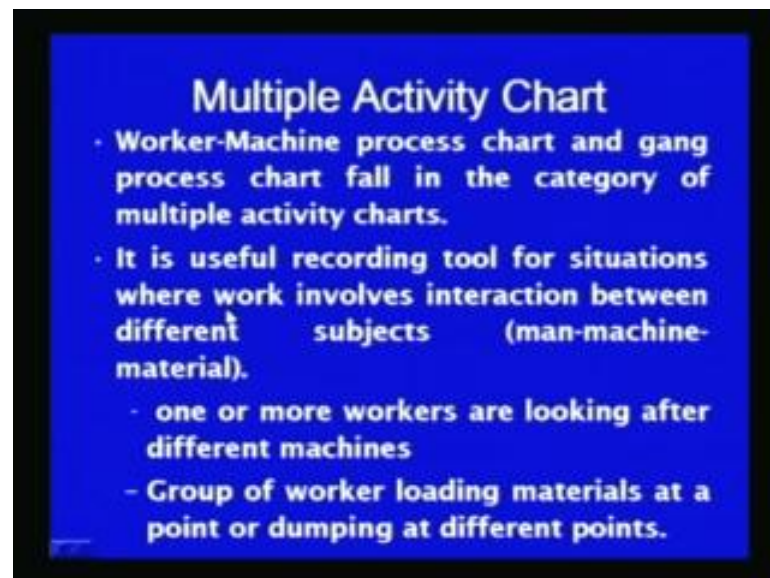
So, if you have to define it ((Refer Time: 30:53)) a multiple activity chart is a chart, on which activities of more than one subject, like men machine are recorded on a common time scale to show their relationship with each other. The study of the chart often makes



it possible rearrange the activities, so that ineffective time can be reduced, when the various activities of the different subjects are recorded in a common times scale, it helps to show the relationship between those activities in sequence, whether they are being performed in sequence or they are being performed at the same time.

At the same time it also reveals the presence of ineffective time is any, so that provide the venue for the improvement. So, the possibility of one worker attending more than one machine can also be ascertained from the use of this chart, if the worker is free for the time longer than required for operating another machine, that time can be used to see whether he can operate another system at the same time also or not, so that possibility can be ascertained using the multiple activity chart.

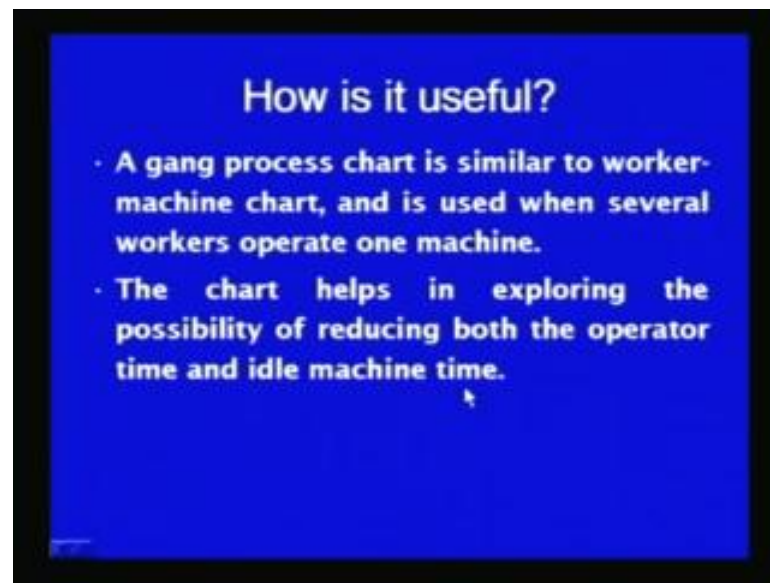
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The worker machine process chart or gang process in gang process chart fall in category of the multiple activity chart. And it is very useful recording tool for the situations, where the work involves the interactions between the different subjects, means during the work either different machines are being operated by a worker or one work one machine is being operated by the number of workers.

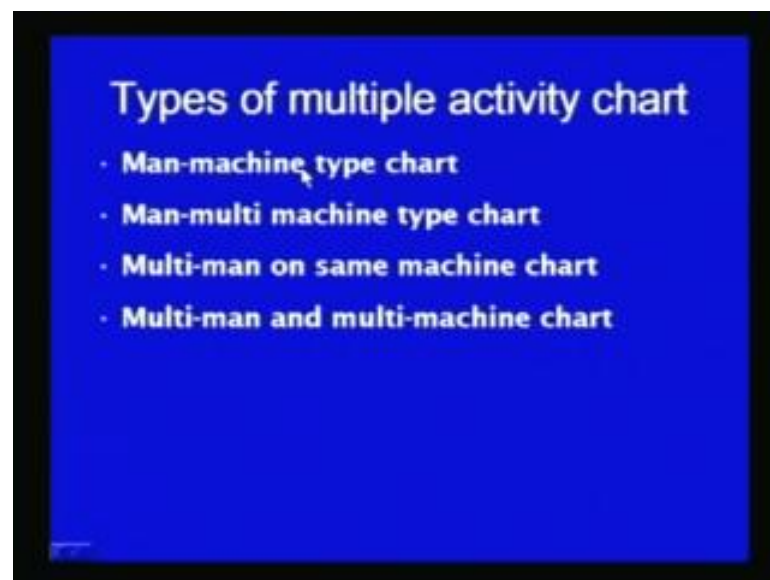
So, in case where the interaction between the different subjects is involved in carrying out the given job or given work, these multiple activity chart if found very useful. One or more workers are looking after the different machines or group of workers loading the material at a point and dumping the material at different points are the typical situations, where multiple activity chart can be effectively used.

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A gang process chart is similar to the worker machine chart, and is used when several workers operate one machine. This chart helps in exploring the possibility of reducing both the operator time and ideal machine time by looking in to the interrelationship between the activities of the different subjects during the job.

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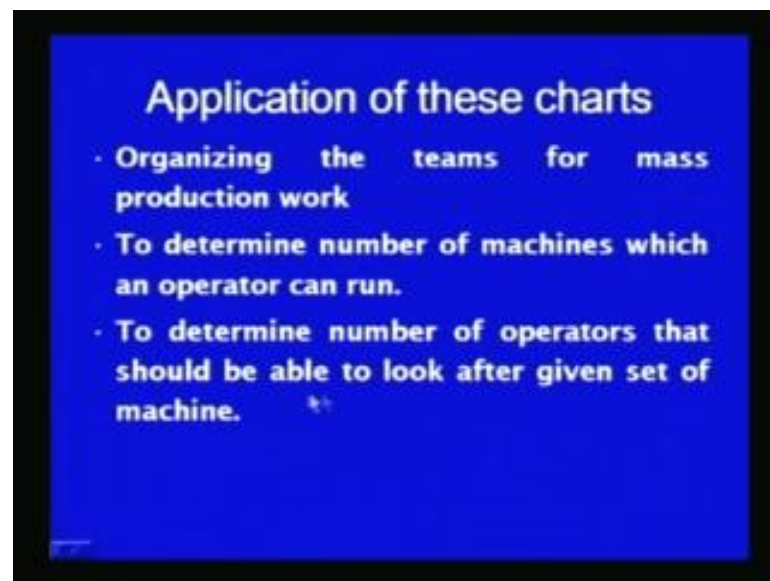


The different of the multiple activity chart are prepared the typical ones are like man and machine type, multiple activity chart, man and multi machine type chart and the multi man on the same machine chart and the multi man and machine chart. Here, one man is operating a machine and the activities of the two are recorded on a common time scale,

in the second case one man is operating number of machines and the activities of the man and machine are recorded on a common time scale.

And when the different man's are looking after the same machine, the interrelationship between the different workers during the job on the same machine are recorded. And for multi man and multi machine charts, where different machines and different workers are looking after them while the job is being done, these are recorded on a common time scale using a multi man and multi machine chart.

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In view of the capability of this chart to show the interrelationship between the different subjects and a study on a common time scale helps to use the multiple activity chart for the different applications, like organizing the teams effort for the mass production, to determine the number of machines which can be operated by a worker. And also to determine the number of operators, that should be able to look after a given set of the machines.

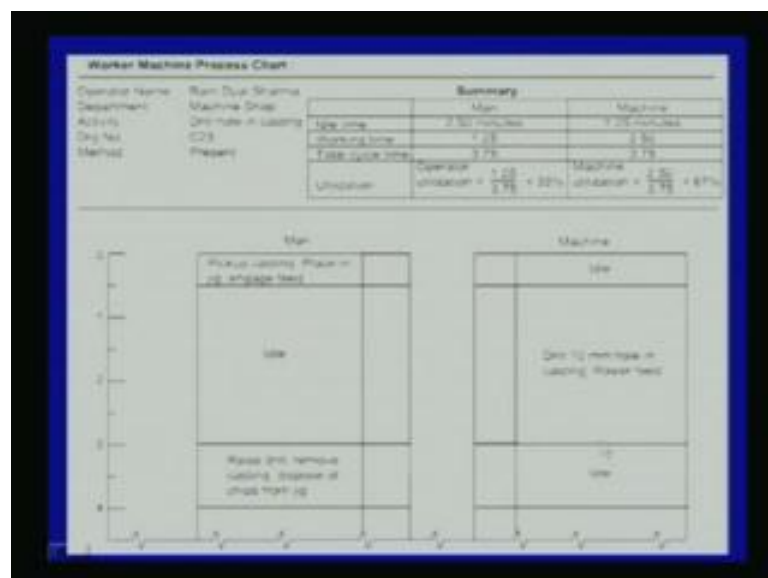
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### Making of MAC

- Record activities of the subject (man/machine) in terms of working and idle time.
- This chart is prepared in form of a table and working/idleness of each subject is recorded in a separate columns on a common time scale.

So, here for making the multiple activity chart, here the activities of the different subjects are recorded in terms of whether they are working or they are idle. A stopwatch or common hand watch can be used to show, whether they are idle or they are working and how long they are idle or they are working. So, after recording the activities of the different subjects, in terms of whether they are working or they are idle after that the chart is prepared in form of table, showing whether they are working or they are idle for each subject in is recorded in a separate column on common time scale. So, the different columns are used to show the activities of the different subjects and the first column is normally used to show the common time scale.

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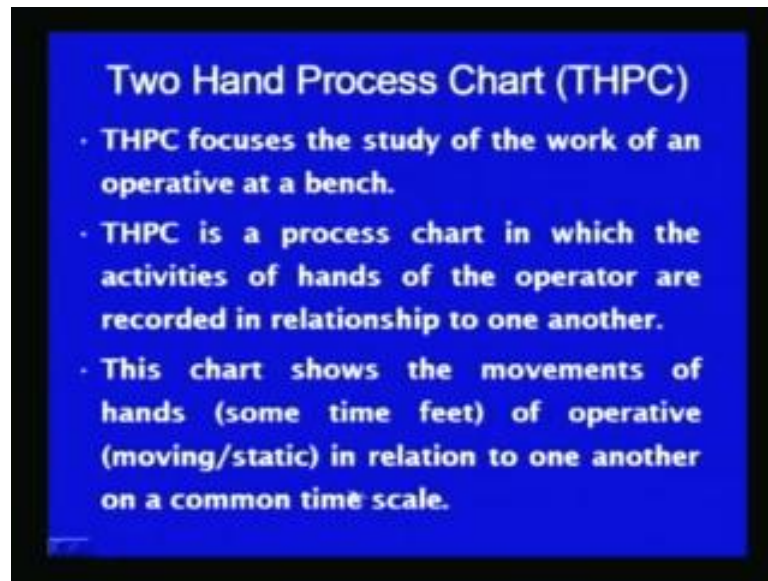
So, here you can see on the top of the chart, the general details are given regarding the operator or the time study person the activity, drawing method, etcetera. And after giving the general details about the system, which is being investigated the first column indicates the time that is in the left side. And then the other columns can be used to show the activities of the particular subject activities of the particular subject.

So, for each subject there is one column which will be indicating their activities on a common time scale. And similarly, say if here this is activities being performed by the man and here the activities in which machine is involved, the things which are being done by the machine in terms of the common time scale. So, here we can see the worker is doing something here he is picking up the casting and placing in his zig and engaging the feed, while the machine remains idle here in this period.

And after giving the feed here operator or the man remains idle, while machine carries out the required machining. After that the things are removed and work piece is and holded and the casting is removed after the machining, while in the same period machine remains idle. So, when a particular operator is working and machine is idle when operator is idle machine is working, operator is working machine is idle and this likewise if the one operator is working on the different machines, what is being done by a particular machine and what worker is doing at that particular instant, that can be easily shown using the multiple activity chart using this common time scale.

So, here once if it is disclosed that when worker is idle or when machine is idle, then the efforts can be made to optimize the order of the different activities. And the way by which the available resources in form of man and machine is to be used, so that the total idle time of the man and the machines can be reduced. So, primarily this multiple activity chart shows the interrelationship between the different subjects and the presence of the idle time. Thereafter using these inputs attempts are made to reduce the ineffective time and arrange the activities in such a way, that the total job can be completed with a minimum time and the system utilization index is also increased. The two hand process chart is another chart, it is a typical flow process chart which indicates the movement of the body parts of the human being.

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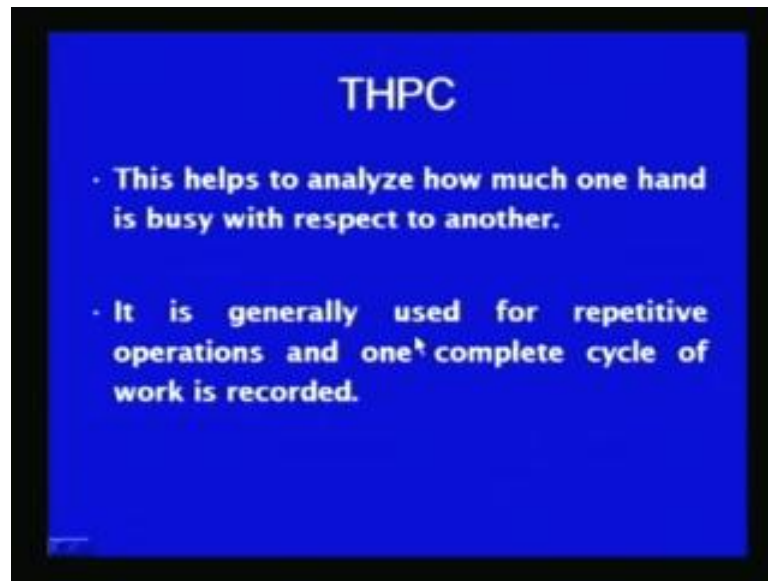
Here, if you see the two hand process chart focuses the study of work of an operative at a bench. So, far we have seen that operator is doing the job or operator means material is being handled from one station to the another in course of production, so movement of the man material machine or activities of the man or the machine, which are recorded by using the different types of charts, like multiple activity chart, flow diagram, flow process chart or outline process chart.

Here this is the first chart, which is used to show the kind of movements which are there of the operator at a bench. So, the two hand process chart the focuses the study of work of an operator at a bench, two hand process chart is a process chart in which activities of the hands of the operator are recorded in relationship to one another. This chart thereby shows the movements of the hand and sometimes feet movement is also recorded of the operator in relation to one another on common time scale.

Thereby, it helps to show that how long time both hands are busy in doing something or when one hand is busy another is active. So, the knowledge about the activities of the movement of the hands of the operator, in relation to one another helps in organizing the activities in most effective and efficient manner. So, that it the job takes less movement and effort of the operator for completing the same job.

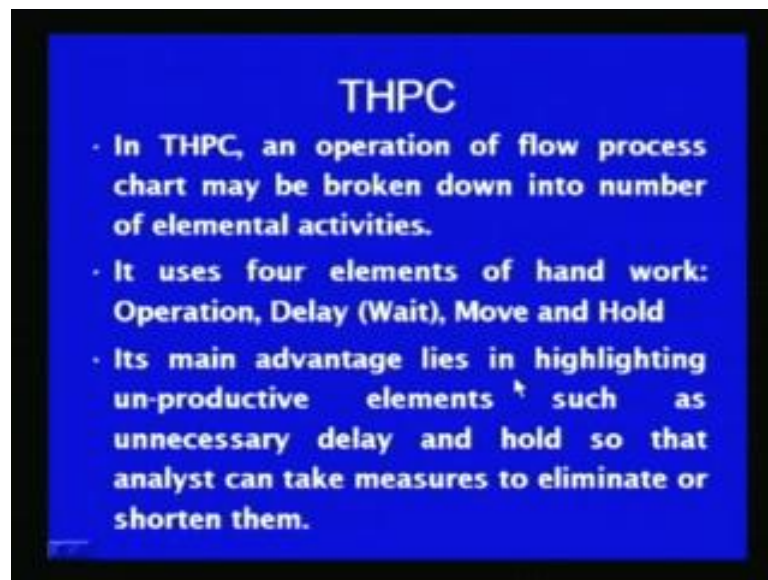


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The two hand process chart helps to analyze how much one hand is busy with respect to another. And it is generally used this two hand process chart is normally used for repetitive operations, and where one complete cycle is recorded to see and to study the movement of the hands during the operation.

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Then, in two hand process chart an operation is a flow process chart in which activities are broken down in a very fine manner, where an operation which can be shown as an operation in flow process chart. But, in two hand process chart that operation can be

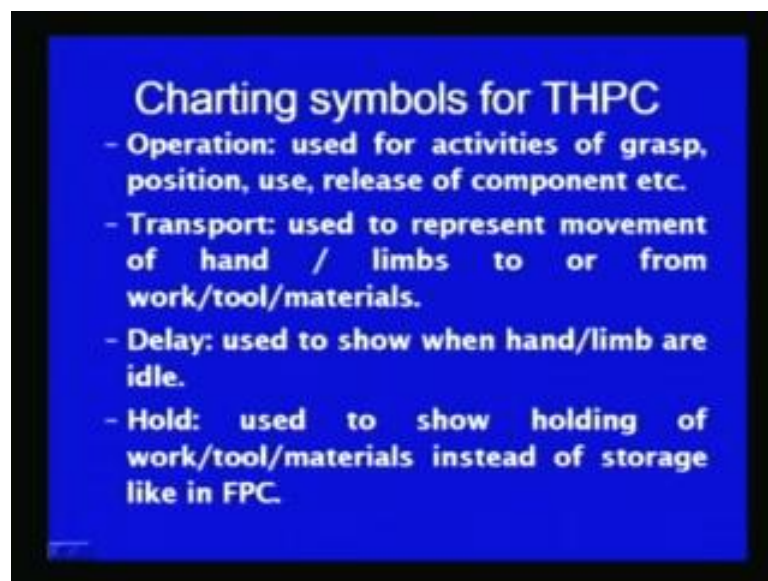


broken down in number of elemental activities and that is why it provides the greater detail of what is being done actually at the bench for completing a particular job.

It uses four elements of the hand work these are operations, delay, move and hold because, the two hand process chart records the things in greater detail, that is why the significance of these elements is also different from that which have been used in case of the flow process chart. It is and about the significance of operation delay and move and hold will be covered in the coming slide, the main advantage of the two hand process chart is in highlighting the unproductive elements such as unnecessary delay and hold.

If the unnecessary delay and hold are revealed, then that helps in taking the suitable steps to eliminate or reduce the extent of unnecessary delays and hold, which unnecessary will be increasing the time required for carrying out the same job.

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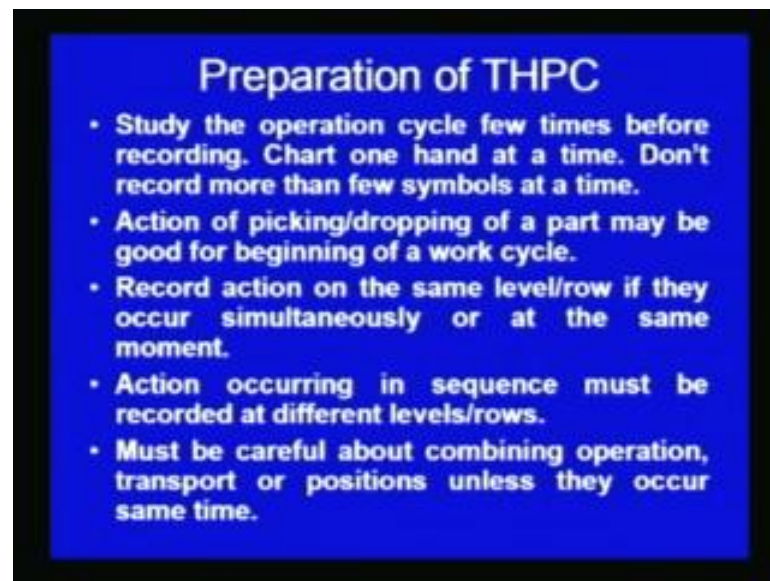
For charting purpose the symbols different symbols are used for making the two hand process chart, for operation, operation includes those activities such as the grasp, position, use release of the component. So, if activities of the grasp position use and the release are being done, then they will be included or they will be considered as a operation. Transport is used to represent the movement of the hands or the limbs to or from the work material or towards the tool.

So, the movement of the man and material in course of the production at a bench is not considered in the flow process chart as a transport. But, in two hand process chart transport is used to show the movement of the body parts to or from the tool material and

the work piece. So, a delay on the other hand indicates, when hand or limbs are idle or they are not being used.

Well in flow process chart delay indicates, the temporary storage the, when objects are kept, aside under authorized condition. The hold is used to show the holding of the work material or tool instead of a storage like in flow process charts.

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For preparing the flow process chart, the study of the operation cycle for few times is made before starting the recording and the one hand is charted at a time and the similarly not many symbols are charted at a time, do not record more than few symbols at a time, this will help to record each element with clarity in the two hand process chart. So, of after a study of the operation for few cycles, only one hand is recorded first on a common time scale and at a time only few symbols are used for recording purpose.

Action of picking or dropping of a part is good to begin the work cycle for recording purpose. And the recording action on the same level or row is carried out, if they are occurring simultaneously at the same movement if they do not occur, if the activities are not occurring at the same movement or they are not occurring at simultaneously, then they will be recorded at a different levels in different rows.

So, actions occurring in sequence must be recorded at different levels and rows and care must be taken to avoid unnecessary combining the different elements, like combining operations, when transport or transport and positioning, unless they actually occur at the same time. In today's presentation I have covered four different recording techniques,

which are commonly used in method study for investigating the kind of activities, which are being carried out during the course of production.

And after recording these can be used effectively for a critical analysis and development of the new method. And these recording techniques, were a string diagram, travel chart multiple activity chart and the two hand process chart, the string diagram and the travel chart is mainly used to investigate the kind of movement, which is taking place between the different stations of the man and the material and to find out, if any extra unnecessary movement is taking place or not.

And also to find out that how the unnecessary extra movements can be reduced, the multiple activity chart can be used to record the activities of the different subjects on common time scale. So, as to find out the presence of ineffective time if any and also to organize the different activities of the different subjects, in such a way that ineffective time is reduced and total time for carrying out the job can be reduced.

Two hand process chart, on the other hand shows the movement of the hands or the limbs of the operator, who is working on a bench and that is used to show the activities of the body parts, like hands in course of production. And also to show the movements on common time scale, so that it can be seen that how long both the hands are busy or one hand remains idle. So, the investigation of both the hands movement can be used to improve the method in such a way that the idle time of the hands can be reduced. And the operator can be used effectively for carrying out the job with minimum time.

Thank you for your kind attention.