Work System Design
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Lecture - 18
Method Study: Recording Techniques

Namaskar friends. Welcome to Session 18 in our course on Work System Design. And currently we are in the 4th week of our discussion. And if you remember in the previous session we have seen the various steps involved in the process of method study. Just to have a brief glimpse of what we have been discussing just to have overview of how our course is flowing about.

In a very first 2 weeks, we had discussion on productivity which laid a foundation that why do we need to study the work; why do we need to analyze the way we are doing the work; why do we need to find out the time that we are taking for doing a particular work using a particular method. So we have seen that the productivity is dependent upon the sequence of operations that we adopt. It is dependent upon the time that we spend in completing the task.

It is also dependent upon the worker who is doing that task or the number of workers who are doing a particular task. So therefore, if you want to improve our productivity we have seen that what are the various productivity improvements, strategies or techniques, what are the areas where we must focus in order to improve our productivity, and it was concluded that if you are able focus on the way we are doing the work we can certainly improve our productivity.

And for that reason only we are now studying methods study and we are currently in the 4th week of our discussion. The third week was dedicated towards the basic concepts of work study; the work content determination; how excess work content is added to the basic work content; what are the reasons thereof; how those reasons can be addressed, what can be the remedies so all that was discussed during the work study.

Also we have seen that when we are conducting a work how man can be used as a productive value meant. We service how a machine can be used as productive value meant. So with all that discussion now we are currently trying to understand that how to conduct the method study in a

more systematic manner. What is the need of studying method study that we have already understood?

In this week, already we have 2 sessions, the first session was based on the basic concept of method study the definitions in which we concluded that we have to find out one best way which is economical which is safe which is less tiresome for the workers, worker enjoy doing the job following that standard method. So we have to find out that standard method which is efficient, effective as well as productive. How we can find that? There is a systematic technique.

And we have seen in the second session the various steps involved in that systematic technique that we are calling here as Methods Study. So no win today's session we will try to understand that how method study can be conducted. So we have already seen the various steps involved. Now we will see that how we can record the information, how we can keep whatever is happening on our piece of paper or how we can try to depict what is happening sequence of operation, what are been followed or which are been followed to complete the work at hand.

We will try to pick them on a piece of paper. How? By using a specific approach, it can be through some charts; it can be through some diagrams so what are the charts, diagrams that are used for record for systematically recording the way the work is currently being done is called recording of the facts. And how it is done, we will try to see just have an overview or a glimpse of the various types of diagrams or charts how they will look like.

Then in our subsequent weeks we will focus on each one of these and we will try to understand how a problem is solved. Basically, if a work is being done, if you remember in one of our previous sessions I have taken an example of investment casting process. So all the diagrams were shown that where the fax has been put into the-- drawn out from the mole, how a ceramic coating is put on the fax pattern so all those were shown with the diagrammatically.

But here we have certain symbols which we use to depict the operations which use these symbol to depict the transportation, we use these symbols to depict the inspection so all those symbols combined together we make a chart and that chart then we will try to analyze. We will see how

things can be combined together; where a particular operation is redundant can be eliminated. So it will help us in order to properly depict the actual work that is being done on the shop floor.

So whatever been done on the shop floor we will try to understand assimilate it and then try to draw a diagram using a standard approach, standard symbols and then look at the chart and try to understand try to analyze that how better we can do this work. So what can be the standard approach? We have seen in the previous session that first we need to go look at the various possibilities where we can conduct the method study, few guidelines were given, we have seen the Pareto's example, Pareto's technique also in the last session.

So we will try to identify that which work can be analyzed; where we will be benefited; the work which will give us some benefits in terms of money or in terms of employees moral and motivation or in terms of time saving so we will try to find out that work where if we took the concepts of work study, method study we will be able to derive some benefit, so first part is selection.

So suppose we have now selected one particular work on which you want to apply the method study, the second step if you remember is recording. So we will try to record all the facts and figures related to that work. So basically our prime motive here is that we will try to put what is the current way of doing the work on a paper in the form of a chart. So chart can be different types that we will see. But first in the broadest sense we must try to understand that what we are planning to do or what we are trying to do.

We are trying to first find out that what work we want to analyze, which work element is our focus area, after identifying that we are going to focus for example there is a workshop we want to focus primarily on the foundry section only so we will then see that foundry section is our work domain. We are not going to go to the carpentry or we are not going to the inspection or we are not going to go to the machining.

We are going to go to only in the foundry shop and apply the principles of method study. So we have selected one work area, second is we will try to record. Now in recording we will see how

the raw material is entering; where it is going first; where it is getting melted, how it is transported from the furnish to the mold what is the mechanism of transportation whether it is a automatic mechanism or it is a manual mechanism.

Then we will see how the material has been poured into the mold whether it is a gravity feeding system or there can be an improvised feeding system also. How much time we are giving for cooling the mold cavity; how we are trying to take out solidified product or the solidified part from the mold whether we are breaking the mold what is the technique we are following to do it to break the mold.

So all these we will try to analyze and when we analyze this we have to record this, and when we record this we have to use certain symbols which can be called as the language of engineers. We need to find out some standards symbols. Suppose I am working for the company if I draw a process chart any other engineer who joins after me must be able to understand just by looking at the process chart that what is the sequence of operation being followed in the industry.

So maybe the whole operations of the company or the whole sequence of operations of the company can be easily depicted on A4 size sheet with the help of these symbols. And what are these symbols that we will try to understand today. So the most important part what I believe is that we must know that we are going to learn and then we can use our mental faculties to understand that yes this is the thing which was discussed in the beginning of the session and this is what the actual thing all about.

So basically in our different steps today our focus is primarily on the second step that is the recording techniques. Also must I tell you, that we will be now be focusing on the recording techniques one by one in our subsequent sections for subsequent discussion. When we discuss a technique, we will do the complete method study based on that technique, we will take example.

For example, if we talk of operation process chart we will see this was the problem that was identified that is selection, this is the way decoration process chart was made or was drawn then these many numbers of operations where these many number of transportations are there these

many numbers of inspections are there, these many number of delays are there, so we will plot it, we will draw it.

Then the next stage is what we have to examine and develop a better method, we have to look at the various alternative then we will say this is the current way of doing the work; these were the possible alternatives available after maybe discussion among the employees and after discussion after examining all these alternatives we develop this method which is the better method as compare to the current method.

So once the better method is developed we have to define it, install it and then maintain it. So for different techniques we will see the first 4-5 steps which are common to all method study techniques or whatever not the techniques I must call all the method study recording techniques. For example, operation chart we draw the first thing will be this have to identify the work area where you want to apply the method study, then you have to record it using the operation process chart.

The next thing is you have to see examine what is the current way of doing the work by looking at the number of operations, number of inspections then using your mental faculties, creativity, innovation you can use any word you have to list out alternatives possible then based on that alternatives you will select one best alternative then you have to define the best way or the best standard method doing the job then you have to install it and finally maintain it in the company.

So this is the sequence of steps that are followed in method study. For each of these charts we will try to see one or 2 problems related to different types of recording techniques. So, today our very brief discussion is just an overview or an outline of the recording techniques. So, first we must know that why we are recording the data because this will help us to systematically compare the current method of doing the job and the developed method of doing the job.

So how the developed method is better than the current method we will be able to find out. How we will be able to find out? Suppose in the current method of doing the job we are having 5 operations, 3 inspections and in the new method suppose we have 2 operations and one

inspection only, so we will say that the number of operations have been clubbed the technology has been developed so that the 5 operations can now be done in 2 operations only.

Also the inspection task has reduced so the new methods take less time, it is less time consuming, less labor effort is required so the new method is better, that is only possible if we have systematically recorded the current method of doing the work and then systematical in a tabular form we can compare the 2 methods for our concluding remarks or for growing logical conclusions of the method study.

So we will see what are the various recording techniques. So on the screen you can see just whatever I have already explained is now put into words, so I will read.

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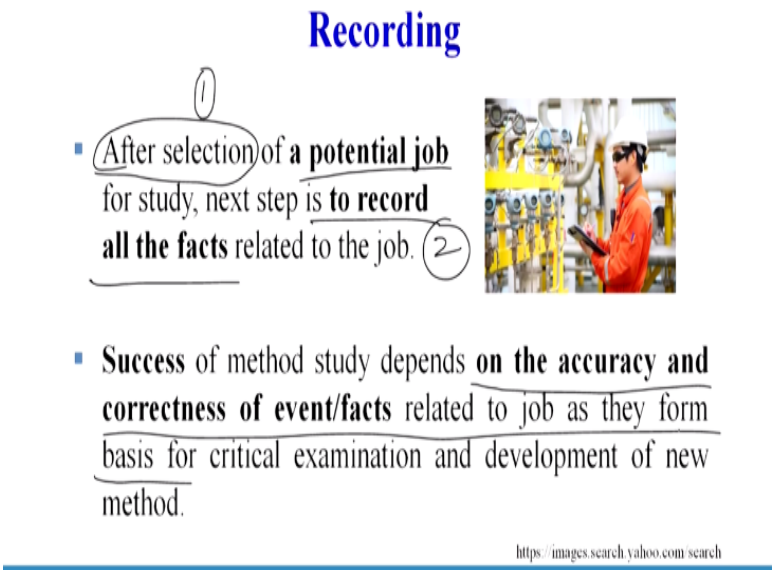

After selection—so already I have highlighted recording is the second stage of—first stage first method is selection so first we have to select the work that we want to analyze using method study. After selection of a potential job the area where we want to apply the principles of method study. Next step is to record all the facts, so this is our second step of method study.

Success of method study depends on the accuracy and correctness of the events related to the job as they form basis for critical examination and development of the new method. Already I have highlighted all facts figures data information related to the current method of doing the job must

be logically, scientifically established and examined. For examination it is seriously required that whatever data is related to the job that is depicted properly that is documented properly or in other words I must say that must be recorded properly.

If you do not record the all the information properly then at a later stage, we may not be able to develop the better method because the better method is dependent upon the exact representation of the current method of doing the job. So if we are not recording the current method accurately automatically the better method that we are trying to develop when it is based on an inaccurate information, non-precise information the best method or the better method also not be accurate.

So it is always important, and the best method depends on the accuracy and correctness of events related to job as they form basis for critical examination. So we cannot be lacks, we cannot be careless in recording the information. We cannot leave out certain important facts related to current method of doing the job.

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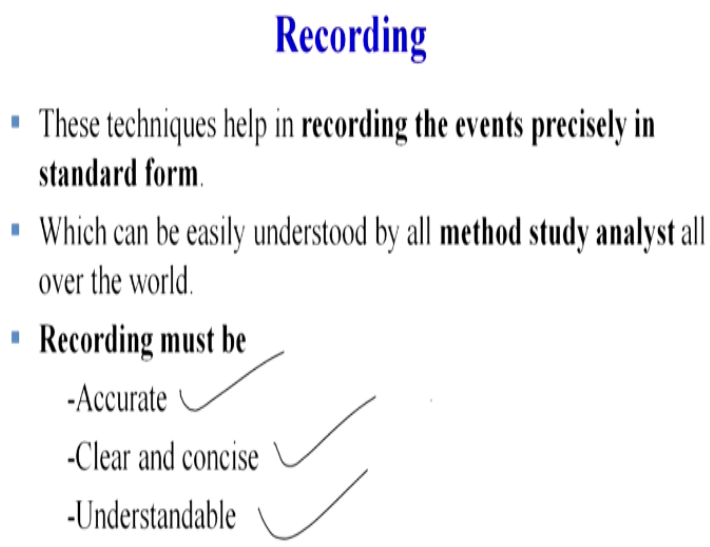

So recording-- these techniques help in recording the events precisely in standard form. We will try to see some of the standards forms today which can be easily understood by all method study analyst all over the world. So basically, you can say that it is standard practice of depicting the way the work is being done. And anywhere in the country or across the globe everybody follows the same system.

So you can have a standard method of representing or recording the facts and figures related to the work being done or the sequence of operations involved in the work being done. So recording must be the – these is very important again I am highlighting Accurate, Clear and Concise and Understandable. So when you are recording all inform must be accurate, it must be clear and concise as well as understandable.

Now this is important because we will be using these symbols quite often in our discussion on method study so these are standard symbols as it is given.

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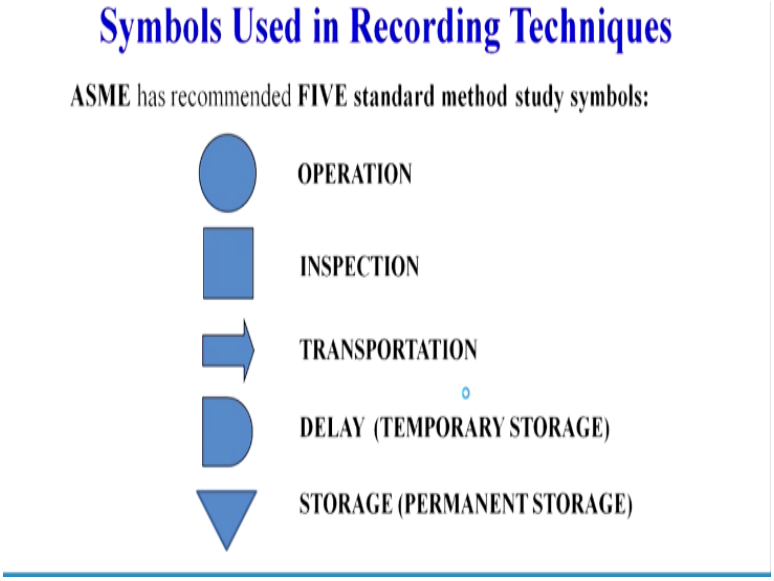

ASME has recommended 5 standard method study symbols. So all these symbols you can see the first one is Operation, for example you are doing a drilling in a steel plate so it will depict on operation or you are cutting the key way or maybe you can say that you are pouring the melted metal into the mold so all examples are related to mechanical engineering since I am a mechanical engineer.

So all wherever the work is being any operation is being done we will say that it is it can be represented via circle. Inspection is usually represented by a square. So you can see, different examples of inspection, so inspection can be when you are weighing for example a company is manufacturing 1 kg tinned packages of Ghee so once the package after packaging the packet is

coming or the tin is coming you weight on the weighing scale and record the value whether it is 1 kg or 1.01 kg so that is basically the inspection you are doing.

Or if you are making the cricket bats the weight of the bat you want to control so for every cricket bat being manufactured you can weight so that will represent the inspection. Then the transportation, in transportation what is done the material is moved from one place to another place so it can be depicted by the symbol on your screen very, very self-explanatory symbol. Then delay which is a temporarily storage.

For example, the worker has completed his task he is just waiting for the supervisor to issue the next instructions to him so that is that will cause the delay or there is a work-in-progress which has piled up before the machine because the machine has broken down so that can also depict delay can be depicted in our process chart using this symbol the kind of a D symbol you can see. And then the last is just storage inverted triangle, so this is for permanent storage.

For example, the inventory or the material is stored in the warehouse or a store so that will storage so wherever material is permanently stored that can be depicted by inverted triangle. So quite often we will see all these symbols being used for representing the work or the current method of doing the work and then when you develop a new method also you maybe using the same symbol.

Some of you may be wondering that if 2 or 3 activities are being done simultaneously how to depict that so for that also there are combined activity symbols.

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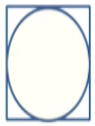
Combined Activities

- A combined activity occurs when two activities occur simultaneously.
- In such situations, the symbols for the two activities are combined.

Example : The circle within the square represents the combined operation and inspection.



A combined activity occurs when 2 activities occur simultaneously. In such situation, the symbols for 2 activities are combined. Example, you can see the circle within the square represents the combined the circle represents operation and the square represents inspection. So now the 2 maybe activities of operation and inspection are depicted by a single symbol only. So we can have this type of symbol which can depict 2 different activities.

So these are the symbols sorry we will in our subsequent slides that how these symbols are combined together to make a recording technique or a recording process in the form of a process chart or a diagram. So quickly we can see.

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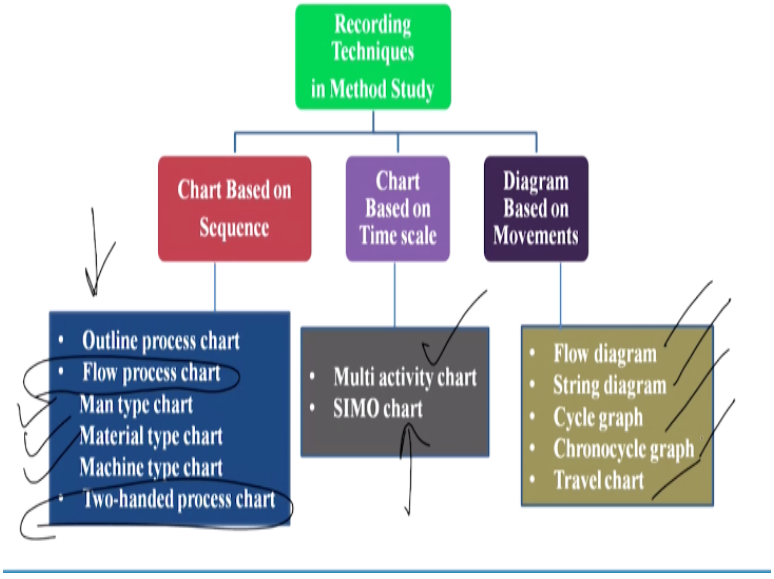

This is the classifications of the recording techniques used in method study. So there can be chart based, in chart based we can see here there are number of techniques Outline process chart we will see how a outline process chart looks like in today's session then there is a Flow process chart and in flow process chart it is of 3 types one is Man type, Material type and Machine type flow process chart and finally the 2-handed process chart.

So we have 3 types of charts of chart based on sequence so these are outlined process chart, man type sorry flow process chart and 2-handed process chart. Similarly, there are charts that are based on timescale which are Multi Activity charts and a Simultaneous Motion Cycle chart SIMO chart, we will what is the SIMO chart also. Then the diagrams based on movements we can see Flow diagram, String diagram, Cycle graph, Chronocycle graph, Travel chart.

So you can see that where can be depending upon the type of work being done we can choose depending upon the level at which the work is being done, like for example if you need to have a bird's eye view of the whole organization that how the work is being done so we way outline process chart, we can just focus on the maybe broader activities that are being done in the organization, so we can an outline process chart.

For example, we want to focus on 2 operator operating 2 machines so we are now focusing on a particular area of the work domain, so we will use a different type of chart which can be a multi activity chart. So depending upon the requirement we will choose among these. For example, somewhere time is very important we want to optimize the time used for or time required for completing a particular task.

In that case, we may focus on charts based on timescale because we want to have a time as our reference method or reference criteria for comparing the 2 different methods. For example, there is a current way in which the work is being done but we feel that it is taking lot of time so we want to develop a better method which is less time consuming. So there we need to compare the 2 methods based on the timescale.

So in that case which will help us the charts based on timescale will be helpful to us. So depending upon the requirement we will choose which type of process chart or which type of recording technique we must use. In charts based sequence of operation being done, we still have 3 operations, we have outline process chart, we have flow process chart and we have 2-handed process chart.

So based on sequence, based on time we have multi activity and SIMO charts, based on that movement we have flow diagrams, string diagram, cycle graph, chronocycle graph diagrams. So this is based on different application area. So quickly let us see one-by-one. What are process charts?

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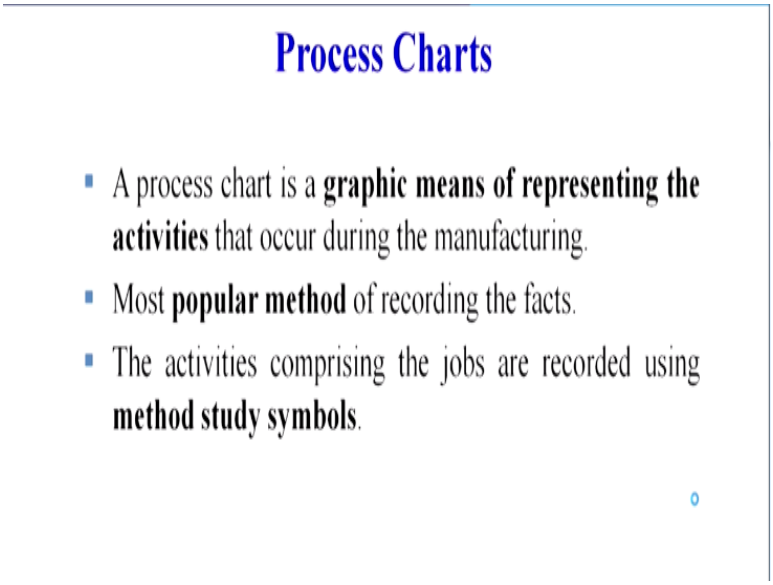

A process chart is a graphic means of representing the activity that activities occur during the manufacturing. As I have already told that it is an overall picture a bird's eye view of what is happening in the industry. Most popular method of recording the facts. The activity comprising, the jobs are recorded using the method study symbols. What are the method study symbol? Just now we have completed.

A circle, a square, an inverted triangle, transportation symbol and arrow so all these symbols are used to depict, so let us quickly see.

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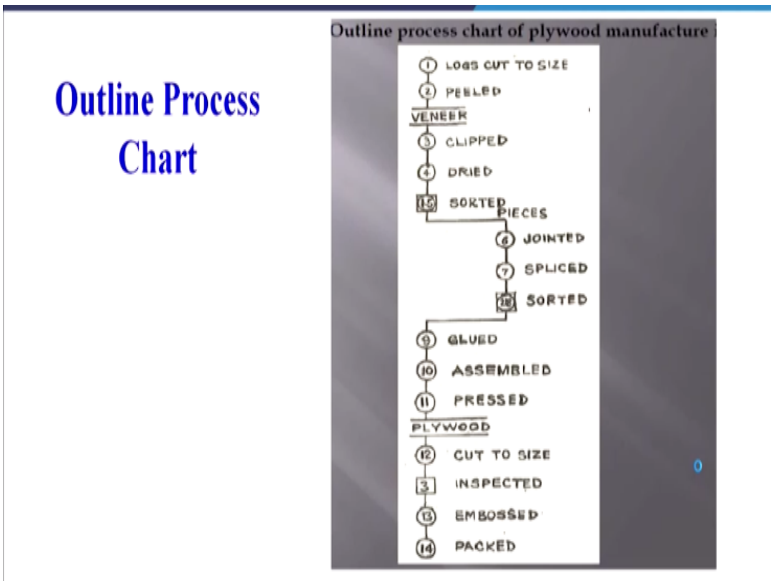

On your screen you can see outline process chart of plywood manufacturing. So you can see different type of symbols are there, there is a circle here and there is a combined symbol here you can see as we have discussed. So there will be operations that are happening then there can be inspection at some places so we can see here there is I cannot see any delay here so there is another inspection happening here clearly it is depicted it is an inspection.

So gluing is an example of operation, so you can see that you can have different operations but the symbol remains a circle only then different stages inspection is being done but the symbol is a square only. And in case of operation I have told the symbol will be circle only.

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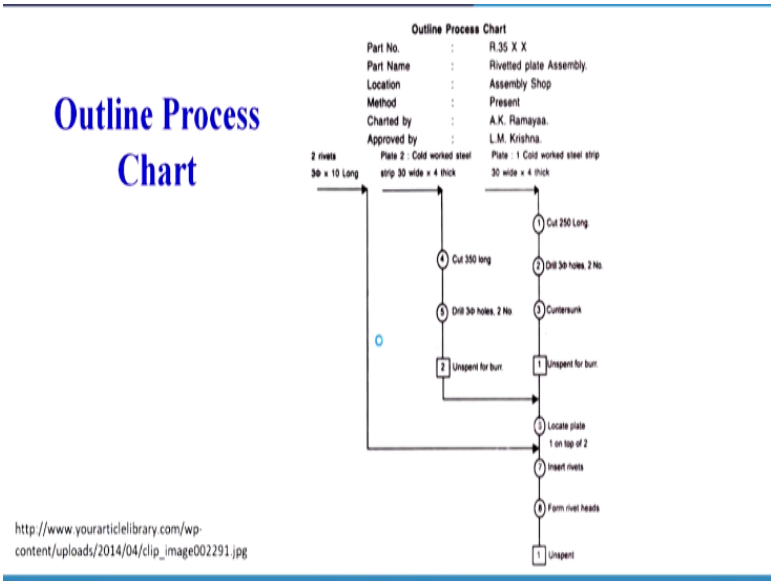

So this is another way of representing outline process chart so we have 3 roots and you can see here if you can see Cut, so cutting represents an operation and therefore depicted by a circle and then if you can see square will represent an inspection, so we can easily see that 2 symbols are only used here, the operations have been done and then inspection is been carried out.

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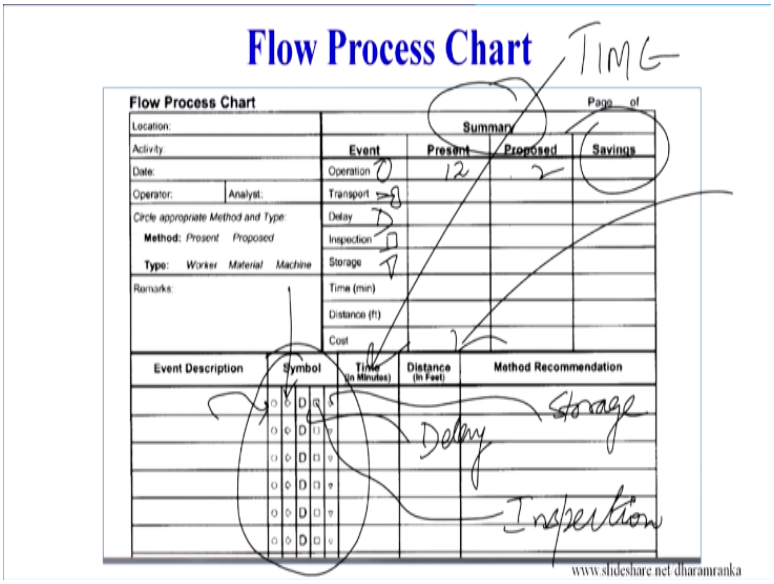

Now this is the flow process chart the second type of chart which can and all these symbols are here. You have a circle here a transportation this is representing transportation, this is representing delay, this is representing storage and then there is an inspection symbol also. So you have all the process chart symbols here also, but what is the difference in process chart, outline process chart also you have seen that in our we have used all the symbols.

And we have depicted the process that what is the sequence if you remember this flow process chart and outline process chart or the chart based on sequence of operation. So we have been able to depict the sequence in case of outline process chart. But here you see there is another key element which is depicted here which is time. So time is also taken into account. Then there is another thing which is here which is distance that distance traveled maybe for completing the activity. So this is basically a flow process chart in which we can see a summary is also possible.

So we have event is operation depicted by a circle then transportation depicted by arrow, delay, inspection and storage. So if you see this is-- here we will write the number present maybe in the

present method you have 12 operations but in the proposed method you have 2 operations only and then we can compare the savings. So this is a standard way of drawing a flow process chart.

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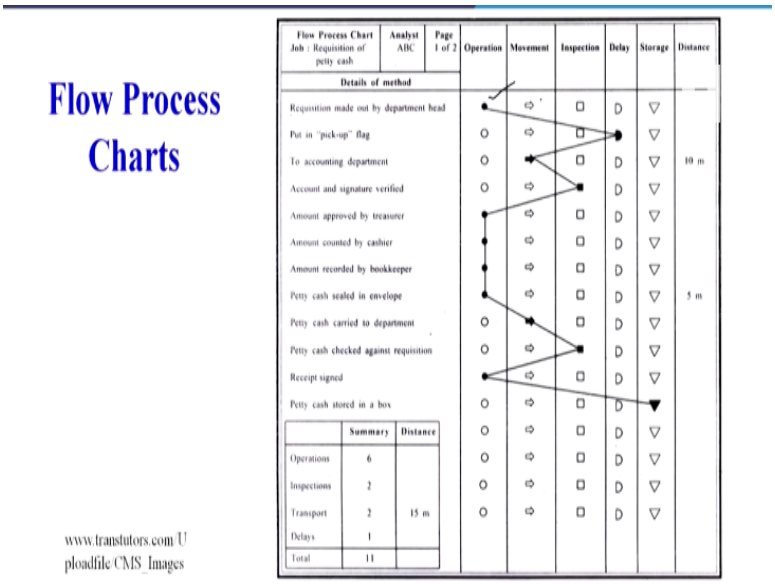

And then this is one example you can see all the symbols are there operation symbols is there, transportation symbol is there and then it is written also inspection, delay and storage and the distance traveled is also given. So we can have different flow process chart as you know it can be man type or a material type or a machine type.

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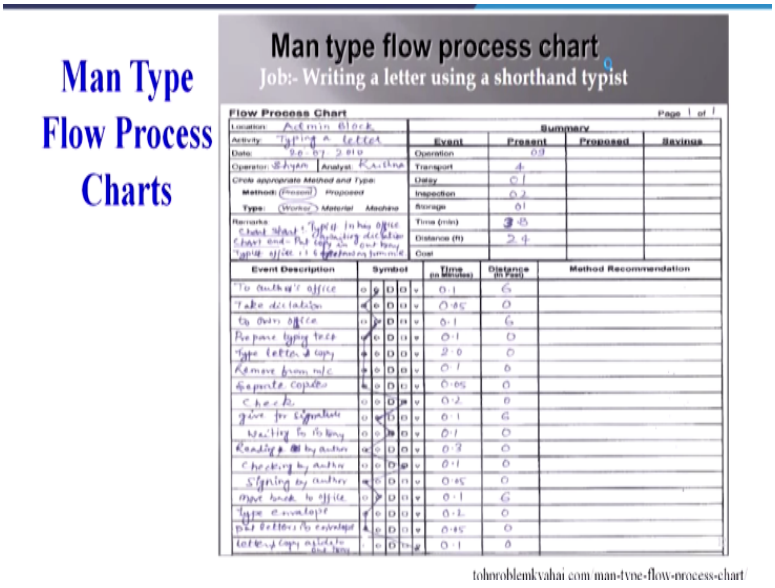

So this is one example of man type of flow process chart. You can very clearly see time is mentioned distance is mentioned and you have to we will see when we come to man type process

chart that we will try to understand with the very simple problem so that you are able to draw during the discussion you can easily draw it you can draw a chart and you can see that how it has to be drawn.

So here you can see there is a complete sequence which is been followed depending upon the description of the work. So if you see first just I will read it for you. 2 authors office, so it is movement so we can say this transportation, take dictation operation so circle is taken into account and here we can see it is a present method so everything is recorded. How many operations? 9 operations.

Transportation is 4, so the current method has been time also in minute it can be calculated and distance in meters can be calculated man type. Similarly, this is another example of man type flow process chart.

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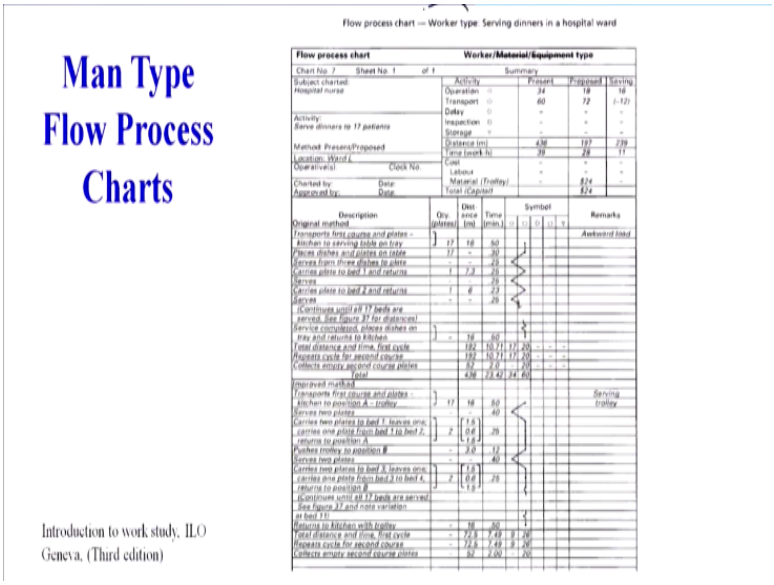

This is worker type clearly mentioned here. There can be material type clearly mentioned here, it is a material type how your material has been moved.

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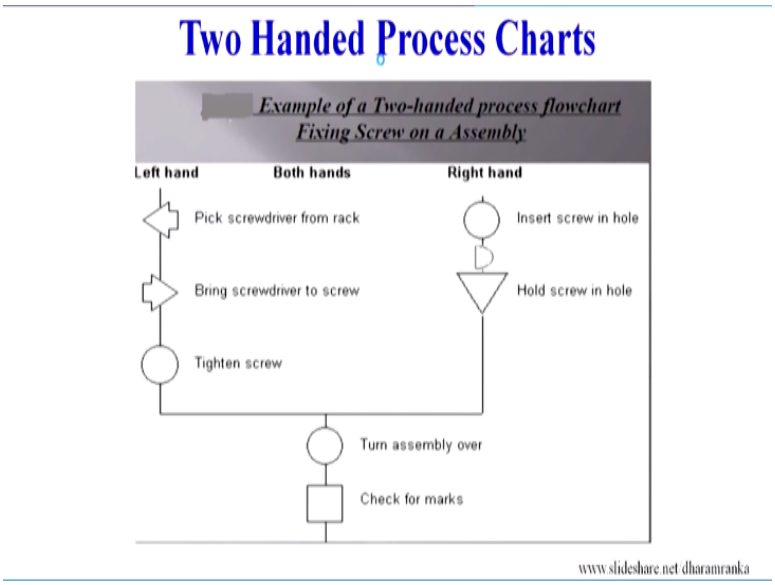

Then there is 2-handed process chart you can have a left chart what is the right hand, so you can see pick screwdriver from the rack, insert screw in the hole so the right hand is inserting a screw in the hole and left hand is going to pick up the screwdriver so this is the 2 process chart.

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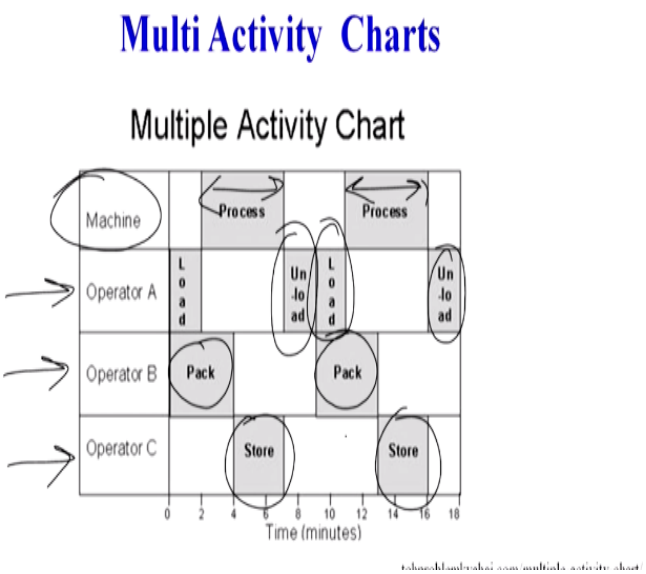

Then this is a Multi Activity Chart. We can see here we have operator A, operator B and operator C. So process is in the operator A is doing the process is loading the machine and this is the machine so he is loading the machine then the machine is doing the process in this much time then unloading done by operator A again loading done by operate A again the process is being done on the machine and again unloading is being done.

So operator A basically is operating the machine. Then operator B is packing whatever is been produced, so you can see operator B he is packing. Once is process is completed the work has been unloaded again operator B is packing and then he is ideal. Then operator C is storing. So operator A is performing the task on machine the machine is doing the process it is producing some product operator B is packing the product and operator C is storing the product.

So we can see we can calculate we can find out the optimal utilization of these 3 people, and in many case we can see whether all these 3 are really required, cannot we combine the packing and storing so that only one operating is doing the packing and storing so very easily we save the labor effort required by an operator C. So such type of decisions can be taken if we systematically record all these information.

So when we record this information we can very easily calculate that in the maybe 1-hour duration how much time operator A was free, how much time operator B was free and how much time operator C was free and then we can do the calculation and find out that whether we really require these 3 people or the work can be done by 2 labor only or 2 persons only. Then these are SIMO chart just standard depiction of a SIMO chart Simultaneous Motion Cycle chart.

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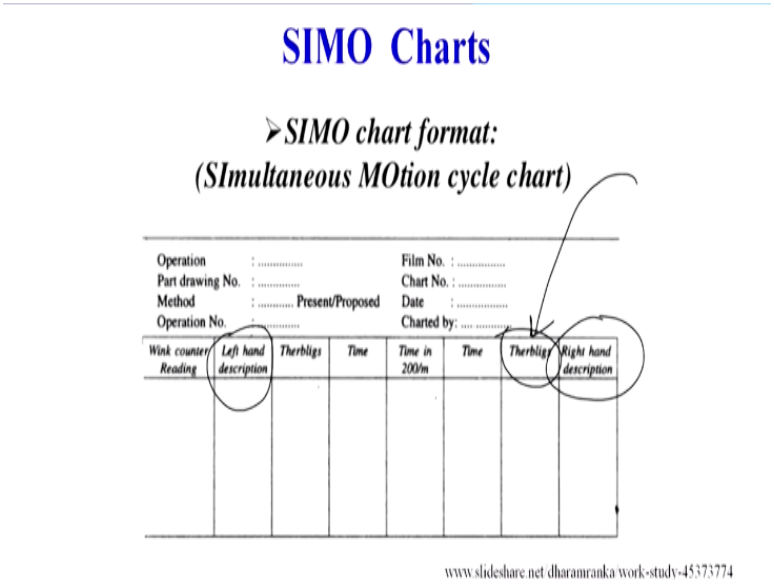

Here we can see Wink counter reading, left hand description and there will be Right hand description also and there is a important terms called Therbilgs that we use mostly micro motion

study and Therbilgs are basically these symbols which are which were developed by Gilbert. And we have already discussed about the Gilbert when we studied the historical perspective of method study or the work study, so we will see what are the Therbilgs what are the various symbols for Therbilgs.

And why do we need to use Therbilgs and how they can be used to draw the SIMO chart? Then coming onto the diagrams, lets quickly see.

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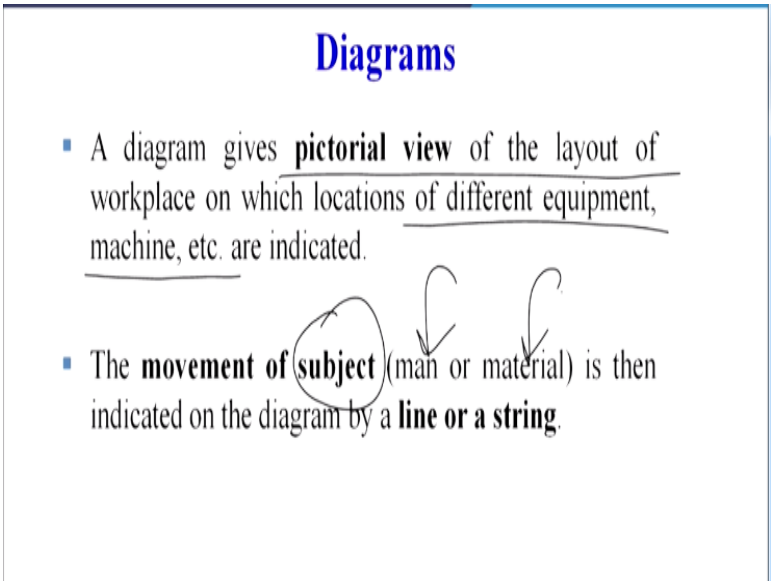

A diagram gives a pictorial view of the layout of workplace on which locations of different equipment, machine, etc. are indicated. So we will indicate the different equipment machine where we will give a pictorial view of the layout. So the movement of subject, now what is the subject here? Subject can be man or it can be a material, is then indicated on the diagram by a line or a string. So it will give us a pictorial view.

For example, there is a hospital, so if we have a bird's eye view of the hospital we can see what are the various wards, and what are the various functional areas within the hospital and how movement is done. For example, patient goes to ophthalmologist or an eye hospital so how he has to move in the various sections of the eye hospital that can be very easily depicted with the help of a string diagram.

Today we are just having an overview, we will see each one of these in much more detail in the coming weeks. The first slide was not that clear but this clears everything, so this is a flow diagram; it is a flow diagram of manufacture of Bi-cycle Pedal Axle.

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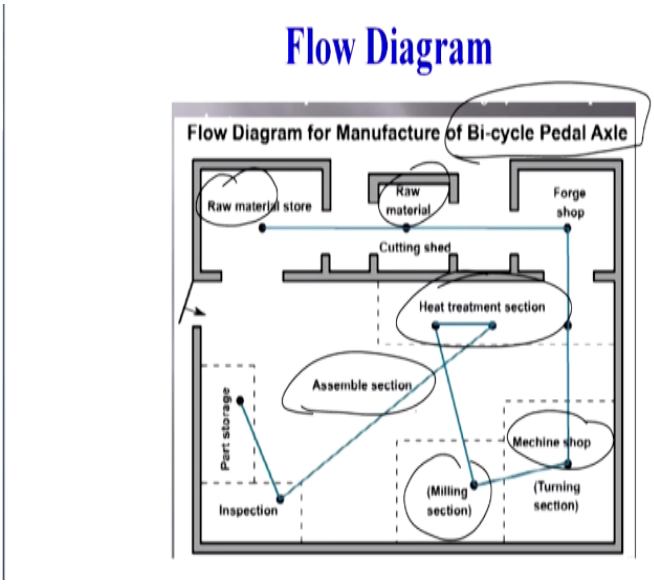

So what are the operations been done are clearly indicated raw material store, raw material store then there is a heat treatment section, machine shop, milling, assemble section, so how the material, the blue line is depicting the movement of the material, so this flow diagram is giving a bird's eye view of the Bi-cycle Pedal Axle section or the shop or the workshop and how the material is moving from one section to another section that is being depicted.

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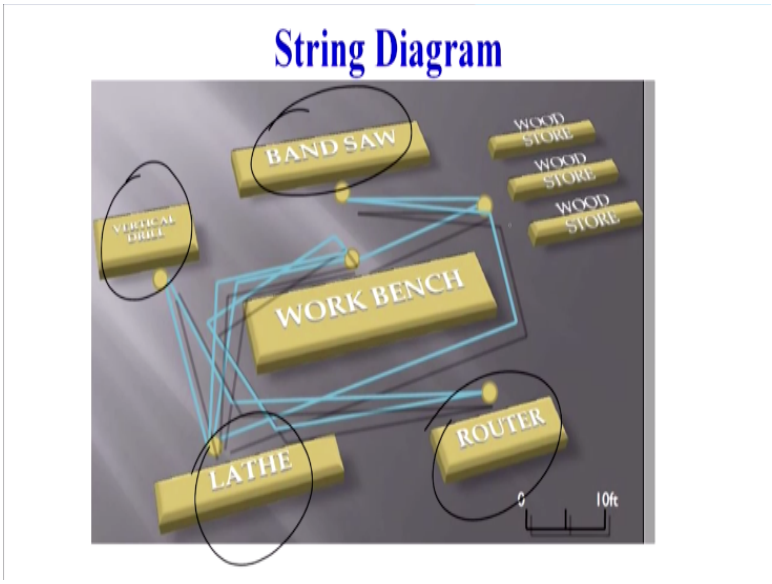

Similarly, this is the String diagram the blue line is only depicting the movement that how the work will move in case of this type of a work layout. So you have Band Saw machine. There is a Vertical drill machine here. There is a Lathe. There is a Router. So you have-- how the material moves in this carpentry shop that can be very easily seen. This can be one workshop we cannot focus only on carpentry because of the Band Saw because here we have lathe machine also and vertical drill.

So in this workshop how the material will move can be easily depicted using this blue line which is a string diagram. Very easily we can measure the length of the string and try to find out that if we improvise on the sequence or if we propose a better method whether we are able to reduce the length of the string or not.

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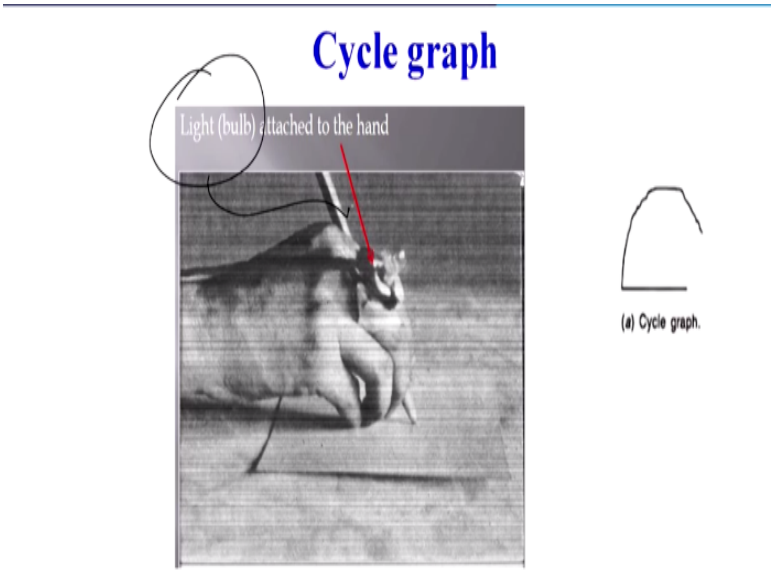

This is a Cycle graph. You can see a light bulb is here it is depicted here. So this is how the cycle graph will look like when the person is writing or drawing something how, what is the movement, micro movement of the hand that can be very easily found out here.

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Chronocycle graph

(b) Chronocycle graph.

This is a Chronocycle graph, you can see here this dotted line represent the flickering of the light and depicting the movement or the various lens if it is connected to hand it can depict the movement of the hand because this has to be done in a slightly dark room because the camera captures the kept here is the blinking of the bulb or the bulb being fitted on the hand to see how the movement is being done, so this is a chronocycle graph, you can see here.

This is the direction of motion and this is a blinking symbol how the movement is being done.

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Travel Chart

From \ To	Raw Material Store	Dept # 1	Dept # 2	Dept # 3	Insp. & QC	Finished Goods Store
Raw Material Store		8000	2000	5000		
Dept # 1			4000	2000	1000	1000
Dept # 2				3000	3000	
Dept # 3		500	500		4000	5000
Insp. & QC		1000				8000
Finished Goods Store						

Unit : kg per day

Finally, this is a Travel chart you can just focus here 2 things from to, so how the material is moving which section to which section and this is specific example is for the based on the weight

kilogram per day. So this is just an example that how much kilogram of material is moving from one section to the other section in a given day. So this type of chart can also help us to see and optimize on the layout of the workshop.

And find out to minimize the travel because if the travel is there it will take time it will take effort so we can focus on analyzing that is the movement of the material among the various sections and how we can optimally utilize the space available with us in order to improvise this type of movement or in order to optimize this type of movement. So with this we conclude the today's session with just 2 lines that we have lots and lots of recording techniques available with us.

We can apply them based upon the type, the way and the time that we are spending on doing the work. So based on the specific application we will choose a specific recording technique. And to close till our next discussion whatever discussion we will have in the next 3 weeks on method study our focus primarily will be 2 understand each one of these techniques with specific examples and case studies. Thank you.