Design Practice
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Lecture – 33
Motion Study

Hello. Welcome to the course Design Practice, lecture module 33, from the previous lecture modules we are discussing about design of a work system, in a previous lecture module. We have already covered the basics of work system, the elements involved in a work system design, and job description what are the approaches to job design, and what are the method analysis which you can perform for a designing in a job in a work system, in this current module I will discuss remaining topics for this work system in design ok.

Now I will start covering the motion study. What is the motion study?

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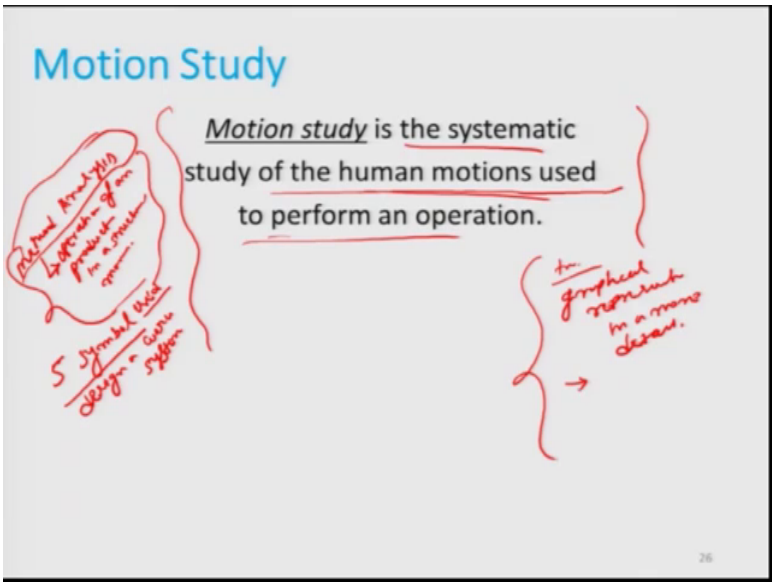

Motion study is a systematic study of the human motion used to perform an operation, in previous module we have already learnt method analysis, in that analysis what we did we performed operation of a product in a structured manner. So, this analysis helps in a structuring of your operation. Now in a motion study you are focusing now on the human motion used to perform an operation. Again it is a type of making a chart in a process for a work design, for in a different way in a here you will also count time and your graphical representation in a more detail.

Because in method analysis there were only five symbols which were used to design a work system, here you will get variety of representation to represent your operation in a more elaborate way.

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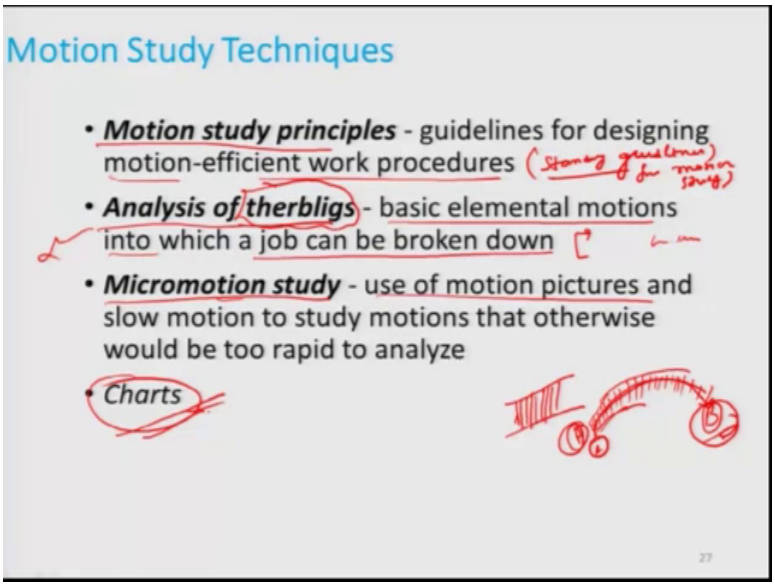

So, there are variety of techniques already available in a motion study. So, motion study is the first technique motion study principles analysis of Therblig's macro motion study, and charts again charts is also available here for in a motion study also. So, motion study principle it guidelines for designing motion efficient work procedure, this is for standard guidelines is available for motion study analysis of Therblig.

Therblig is a set of graphical pasteurization of operation and various movements, so that it from using this you can make a graphical representation of any process or operation, it basic elemental motion into which a job can be broken down ok. In this analysis a job is divided in a several parts, and each part is represented with a unique graphical picture, here in a macro motion study use of motion pictures, and slow motion to a study motion that otherwise would be too rapid to analyse. In this study what happens each operation is recorded at a very slower rate, continuous images, each frame is recorded for a certain operation suppose that you are your hand is somewhere here, and you want to move it from there so.

And you are taking one product from here to this one. So, whatever path you are following to reach this product to that point b. So, those image path is recorded in a camera, and multiple continuous picture is recorded, and each after that each picture is analyzed to see what is the

actual time is required to transport this part to here, from a point a to point b, and also charts is also available for a motion study.

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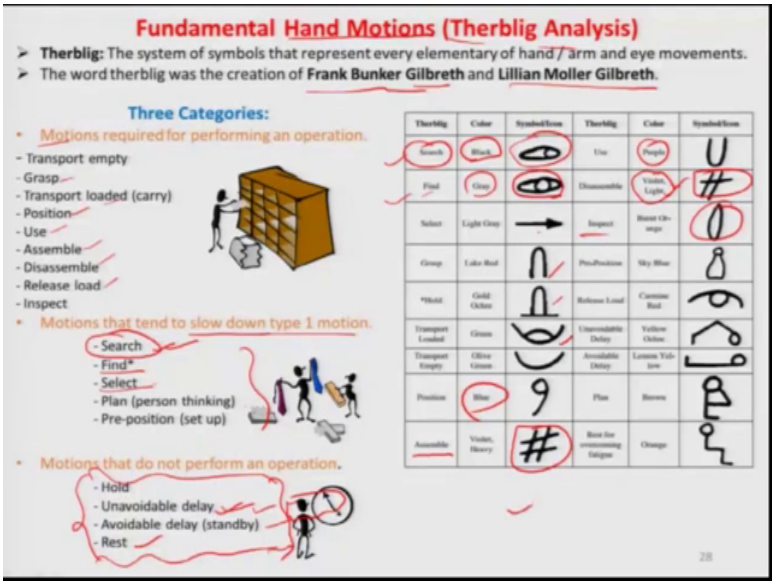

So, I will explain method of Therblig's first. So, here fundamental hand motion that is Therblig's analysis also called hand motion ok, that is a system of symbol that represent every elementary of hand, and arm, and eye movements the word Therblig's was first proposed by frank bunker Gilberth and Lillian Moller Gilberth. So, inspite of those people these hand motions are known as Therblig.

There are three categories of Therblig, first is motion required for performing an operation. So, in this category what are the motions which is required to performing an operation. So, each operation will have some specific graphical symbol here, there are variety of motions which is required for a performing an operation, first one is transport empty grasp transport loaded, a carry, position use assembly, disassembly, release load, inspection, etcetera here, there is the one graphical here you can say that if you are placing a one paper in this box. So, you will have to perform various operation, second type is motion that tend to slow down type one motion ok, this one is related to search find select plan and pre position, if you are searching something. So, it will take time.

So, what happens suppose that you are transporting something from here to here you have to transports, one product from one place to another place, and somehow you have missed that

product where it has placed. So, you have to make a search for that product. So, it takes time. So, what happens it slows down your motion of transportation motion.

Second one is find selection this takes time, and third one is motion that do not perform an operation, at the hold unavoidable delay avoidable delay rest, these are the motions which is for permanent you can storage or delay kind of thing. So, it slows down the slows it just stops down the operation, suppose that if there is an unavoidable delay in a workshop. So, you will have to stop everything, or your whole operation will get stopped three because of this one.

So, each operation has some specific symbol that is called Therblig's, here you can see here Therblig, if you are searching something. So, there is a colour coding with that. So, that a worker can understand here you will have to make a search of that something like that. So, there is a symbol for search operation again find. So, it is a colour is grey and find there is a unique symbol for find, select, grasp hold transport loaded, transport empty, position, blue colour.

If for assembling something so as line use if I using something. So, its colour code is purple and colour code may vary to industry to industry, it is not a stick to that if you are making a assembly, but so in most of the cases these are the standard colour coding. So, everybody can understand. So, that the colour is most probably this colours there for this motion study, your assembly something you are the symbol will be like this one inspection this one. So, they are the various operations, and each have a specific colour code with their symbols, and these symbols, and colour code is used in a motion study.

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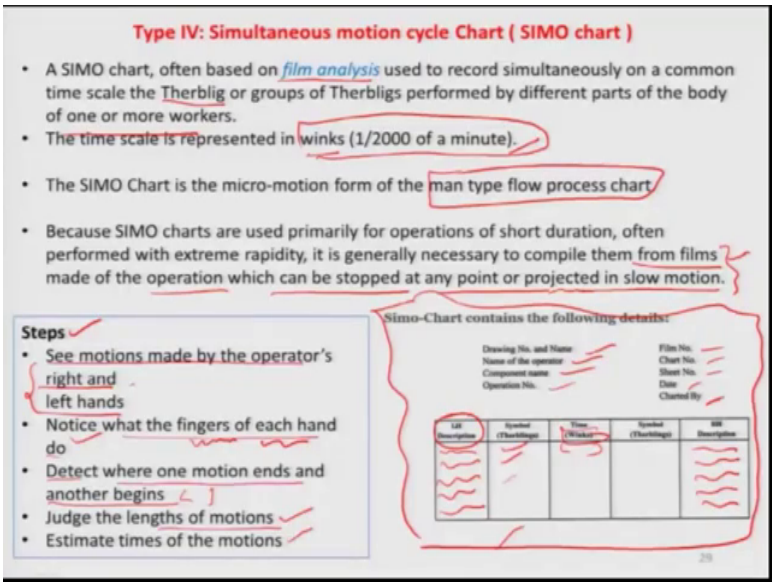

We will use in this chat that is called simultaneous motion cycle chart, and is called SIMO chart here, we will use those Therblig's to make a SIMO chart what is the SIMO chart it is a chart often based on film analysis used to record, simultaneously on a common time scale the Therblig or group of Therblig's performed by different parts of the body of one or more workers ok, here is a kind of film analysis. So, first film is recorded and all job is broken in various part, and each part is assigned operation is assigned using a Therblig's, and we will explain in a table.

So, time scale is represented in a wink, and wink is a one is to by 2000 of the minute that is the time scale in a SIMO chart generally used, and the SIMO chart is the micro motion form of the man type flow process chart we have already discussed man type flow process chart in a previous lecture module, because SIMO chart are used primarily for operation of short duration often performed with extreme rapidity. It is generally a necessary to compile them from films made of the operation which can be stopped at any point or projected in slow motion. So, if you are doing film analysis. So, you can stop your recording any time and also if you want to analyze in a detail. So, that you can slow down your video so, that you can analysis any more detail, analyze the more detailed your operation.

What are the basic step for SIMO chart step see motion, made by operators right and left hand? So, first what is happing using the video recorder motion of right and left hand is

recorded after that notice what the finger of each hand do, after that each fingers movement is not get noticed after that detect where one motion ends and another begins.

So, that you can count the time, judge the length of motion estimate time of the motion ok, length of the motion and time estimate time of the motion after that you will have to fill that table for a SIMO chart this is a one standard chart for a SIMO chart, you have to mention drawing number, name, film number, chart number, sheet number, date, who is who made this chart who is approved this chart, operation number, component name, name of the operator ok.

And here you can see that left hand description, whatever your hand is doing suppose that in a you have already seen in last previous module here, we had in a two handed chart here, we used both hand in we recorded operation of both handed using a phi symbol. Here what you are doing you have make a video of your operation of your both hand movements of your hand.

Then you just breaking all the operation in a various part, and whatever you are after distinguishing left hand right hand, then you will have to make symbol for each operation whatever you are doing by your hand, and that what the time is required for that operation. And it is in wink form. So, wink is 1 by 2000 minute of a minute of a one minute.

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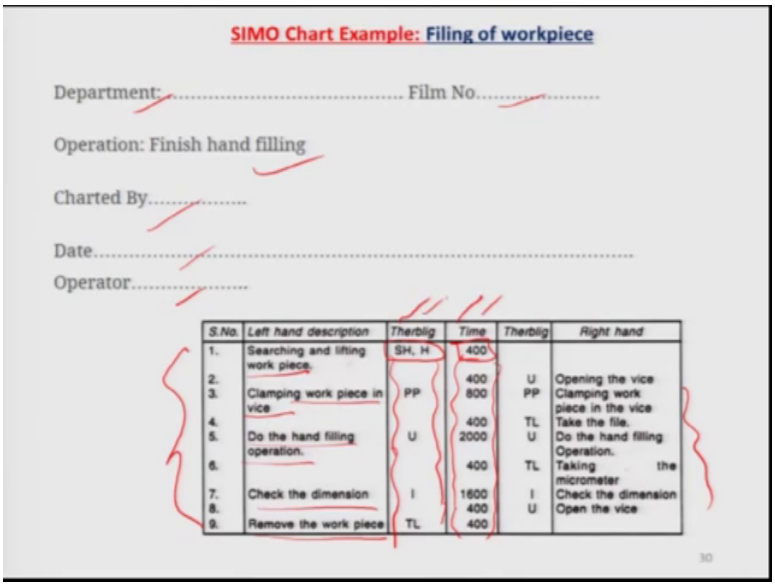

So, this is the example of filing of workpiece here again, these things should be fulfilled first department, film number, what is operation charted by date operator here.

You can see that after recording a video. So, you have already distinguished in a distributed all your operation in a left hand and right hand here you can see, searching and lifting workpiece. So, what is the Therblig's is used SH and H here, again what is the what was the time for that operation 400 wink, again clamping work piece in vice we can do the head filing operation check the dimension remove the workplace. So, again here parallely you are using Therblig's, and you are recording the time, using your film analysis. So, this is called SIMO chart here both thing Therblig and time is available for analysis.

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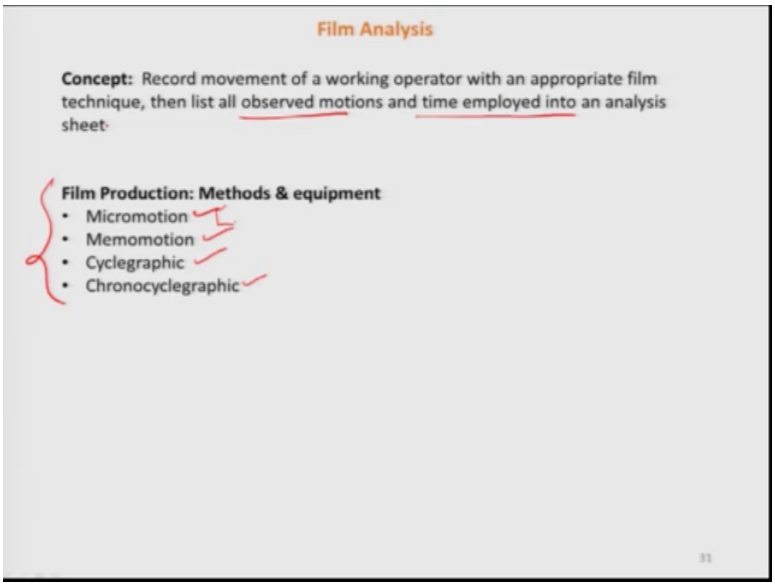

Now, film analysis how film analysis is done, at a concept record movement of a working operator with an appropriate film technique, then list all the observed motion and time employed into an analysis sheet that is the thing I said in earlier slide.

That first you will record whole operation, then you will break it in a better various motion observed motion, and then you will have to calculate time that is the whole complete process for the film analysis. These are the film production methods are available macro motion, memo motion cyclegraphic chronocyclegraphic macro motion is the slowing slow recording of an operation, cyclegraph chronograph I will explain some of them in next slide.

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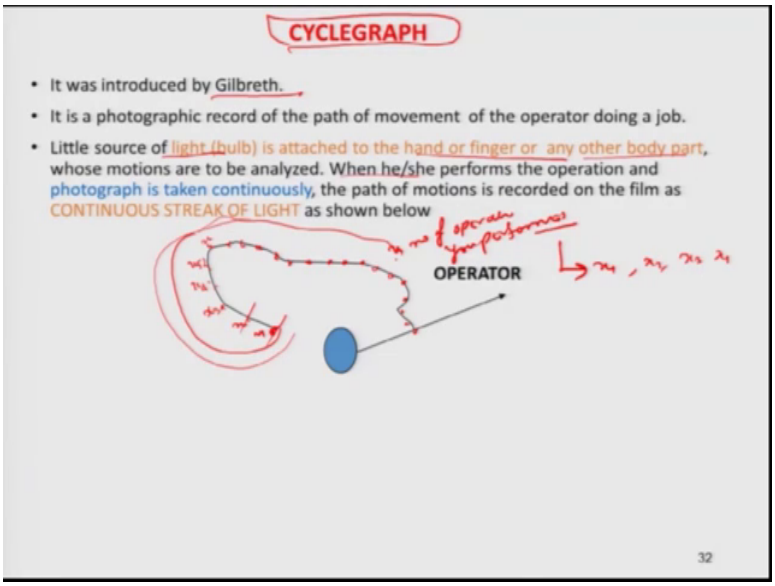

Now, cyclegraph this is the film analysis video recording techniques cycle graph, it was introduced by Gilberth first. It is a photographic record of the path of the movement of the operator doing a job, here what happens little source of light is attached to the hand of finger or finger any or any other body part, with motion are to be analysed.

When he or she performs the operation, and photograph is taken continuously, the path of the motion is recorded on the film as continuous streak of light as shown below here, you can see that here suppose that you have started working from this point, and you have done several kind of things here, here, here in suppose that each point, this is the main path you have followed to complete that process.

And camera is one light bulb is attached to your finger or some or you can say your hand. So, that this path is recorded ok, and this is called cyclegraph whatever you path you path you have followed, it is recorded in a camera ok. So, that after that suppose that here a variety of suppose that x number of operation, you performed ok. So, first what you will do you will break operation into x1, x2, x3, x4, you can write here x 1, x 2, x 3, x 4, x 5, x 6 like that.

Then after suppose that here from x1 to x2 whatever you have done. So, this will you have to make if you are making SIMO chart, then you will use Therblig's symbol, and as well as what is the time required from this operation to this operation ok. So, everything you can analysis after recording this cycle. So, this is called known as cycle graph, and this is very useful method in a motion study.

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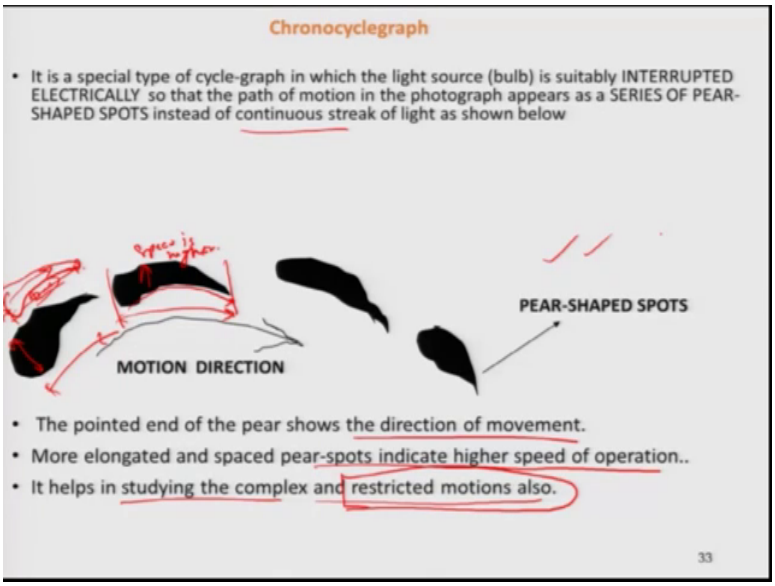

Second one is chronocyclegraph here, it is a special type of cyclegraph in which the light source bulb is suitably interrupted electrically. So, that the path of the motion in the photograph appears as series of pear shaped spot instead of continuous streak of light as shown in below, here this is a different from cyclegraph here, what you are doing, you are just you are making shadow of light you are using shadow concept in with the light.

So, they suitably interrupted electrically so that path of the motion in the photograph appears as series of pear shaped. So, if pointed end of the pear shows the direction of movement. So, this point suppose that this is the actual shadow light. So, this is the point directions. So, it shows the direction where from where you are moving your hand from here to there ok, and length of this one it denotes the time, it is calibrated by time. So, whatever if length is more than, suppose that if length is more than, the time required from for this operation is higher.

And more elongated and spaced pear spot indicate highest speed of operation also time, as well as speed is very high, because here you can see that the width is higher as compared to here and length is so, here speed you have moved speed is higher, you have moved your hand rapidly in this is for this area as compared to previous one.

So, now it helps in studying the complex and restricted motion also ok. So, that if suppose that some where it is very difficult to for your hand to make a recording that is at a by camera that is attached to your finger. So, this technique is very useful because its make a shadow

light, it technique of shadow light. So, that shadowing some anything can be possible so, restricted motion can also be performed using chronocyclegraph.

Now, after recording of your images, then you can make a SIMO chart for your motional study now.

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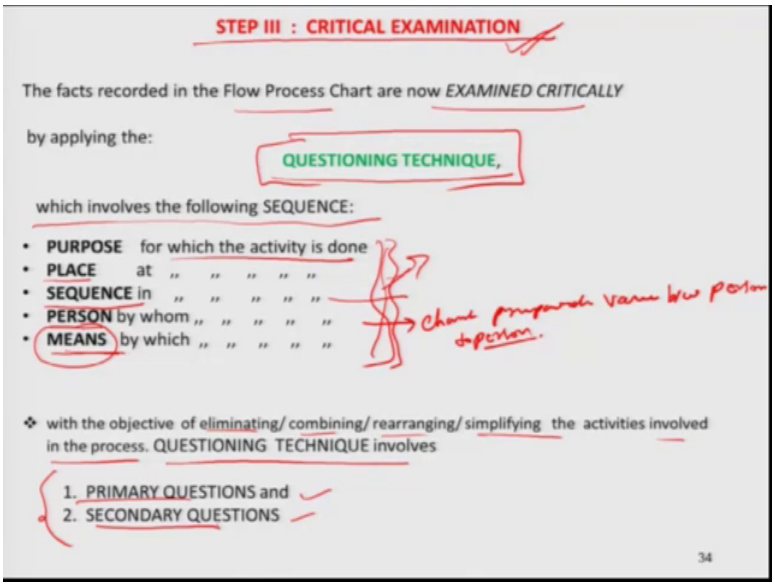

I will explain now third step of work system design that is the after method analysis and motional study, then this is the critical examination. Suppose that if you are prepared already a chart, then how you will you will have to judge it critical examined, whether you have made it actual in an actual way or something wrong is there.

So, the fact recorded in the flow process chart are now examined critically, by applying the various questioning techniques, these are the one of the techniques which is for critical examination ok, questioning technique is very preliminary stage of your examination purpose. So, here following sequence you will have to follow for examination purpose. For which the activities done, then you will have to check which place at which the activity is done.

Then sequence here sequence is followed properly or not again person, and means by which because sometimes chart preparation is varied between person to person skilled, and experienced person may be more suitable for your making a chart, and he will make more efficiently means by which and what for what means you are making this chart. So, these are

the several questions you should have arrived in your mind while your you are examining the chart.

With the objective of eliminating combining rearranging simplifying the activity involved in the process, questioning techniques involve primary question secondary question. So, this is the trial and error method, suppose that you are you have made something you realise that you have made wrong sequence in your chart preparation, then you can again you will improve your chart, then you will have to again you will follow these steps to for examination of your chart. So, in a board way they are these questions are divided in a two-part: primary question, and secondary questions.

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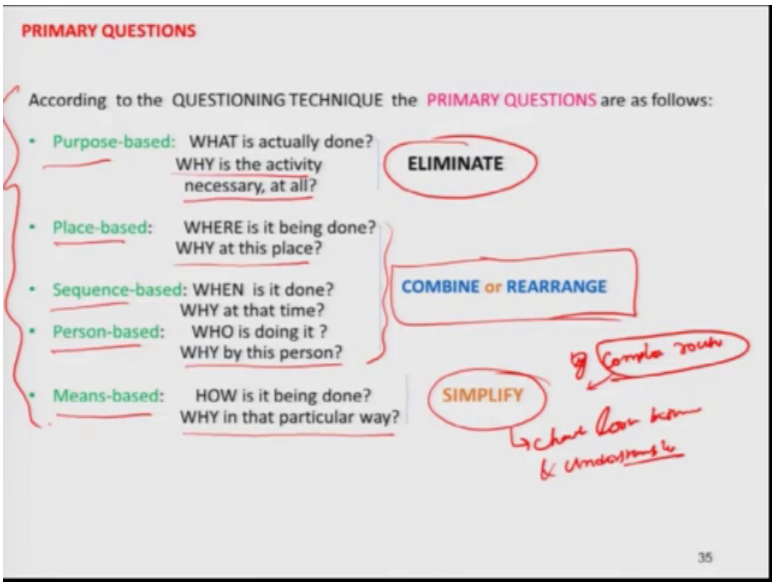

What is the primary questions? According to question technique the primary question is as follow purpose based, what is actually done why is the activity necessary at all if you have you have found that this activity is not necessary then you just eliminate it place based, where is it being done why at this place sequence based, when it is done why at that time person based who is doing it and why by this person. So, this all parameter you just combine or rearrange you can rearrange the things. So, that your chart will get improved ok, means based how is it being done why in that particular way ok, suppose that you have made a good chat in a right manner, but in a complex you have you went through complex route.

So, if this route can be simplified further. So, that chart look better and understandable ok. So, these are the primary questions you will have to keep in mind while doing your examination critical examination of your chart.

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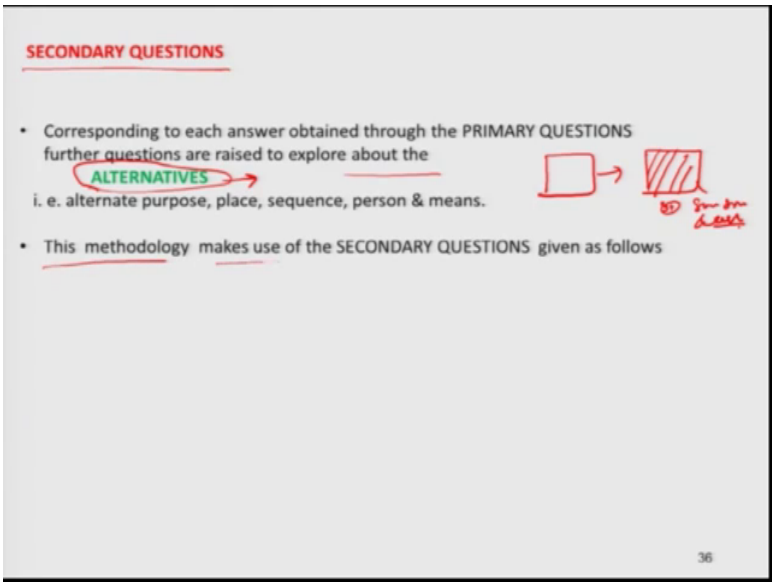

Now, secondary questions secondary question corresponding to each answer obtained through the primary question, further question is raised to explore about the alternative. Now if after that suppose that you have already examined your chart, then you will have to look for alternative, whether there any alternative is available whether it suppose that if you have made a one chart, and there is an already alternative chart is already available in your workshop.

And so it what will happen just it will simplify, it will save your time, and cost. This methodology makes use of secondary question given as follows.

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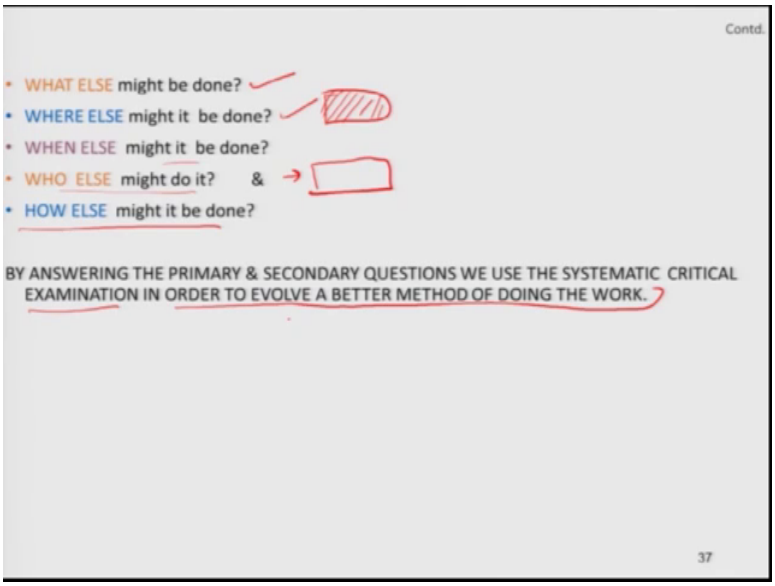

These are the secondary question what else might be done, they are for alternative looking for where else might it be done, you can change your place suppose that you cannot fix in a one place suppose that in a that place somehow work is not going on then how your production is will be continue. So, you will have to look for another place, when else might it be done who else might do it suppose that you have a one-person, skilled person for a chart preparation and he is on leave.

So, what who is the other person who is capable of doing this? So, you will have to take a one already backup for that ok, how else might it be done, by examining the primary and secondary question we use the systematic critical examination in order to evolve a better method of doing that work. So, critical examination is always necessary for designing a work system.

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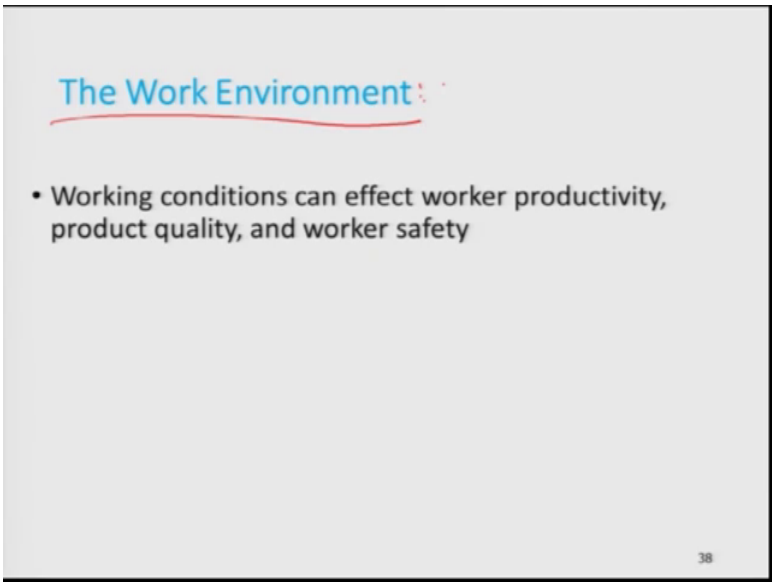

Now, I will explain the work environment, after examining, after making your chart preparation, job designing, now you will come we will have come to work environment this is also a very important factor, here working condition can affect worker productivity product quality and worker safety.

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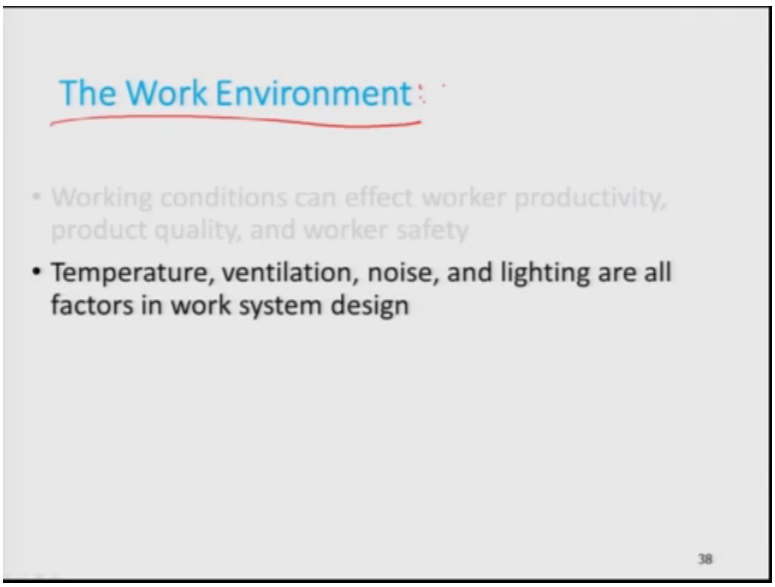

Temperature, ventilation, noise, and lighting are all factor in work system design.

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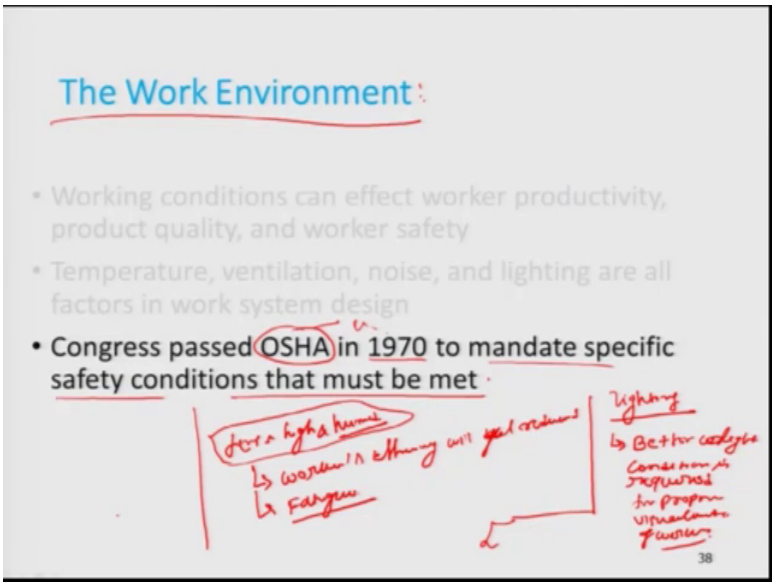

These are the congress passed OSHA in 1970 to mandate specific safety conditions that must be met this is was proposed in America USA for working environment, these are the some in this guidelines there are some standard guideline protocol is there for a to a make a working better work environment.

So, here you can see that work environment quality, if there I suppose that you are working in an environment, where temperature is high and humid. So, what will happen worker's efficiency will get reduced, because of that because fatigue will be there for each worker.

So, lightning condition you can also say lightning that is the working environment. So, better lightning condition required for proper visualisation of worker ok, suppose that a worker is assigned to work in a machine, and lightning is not proper. So, he may face some he may face some accident so, that he may get injured.

So, these are the very critical factors which is involved for you have to take consider in a work design. So, work environment is also necessary part.

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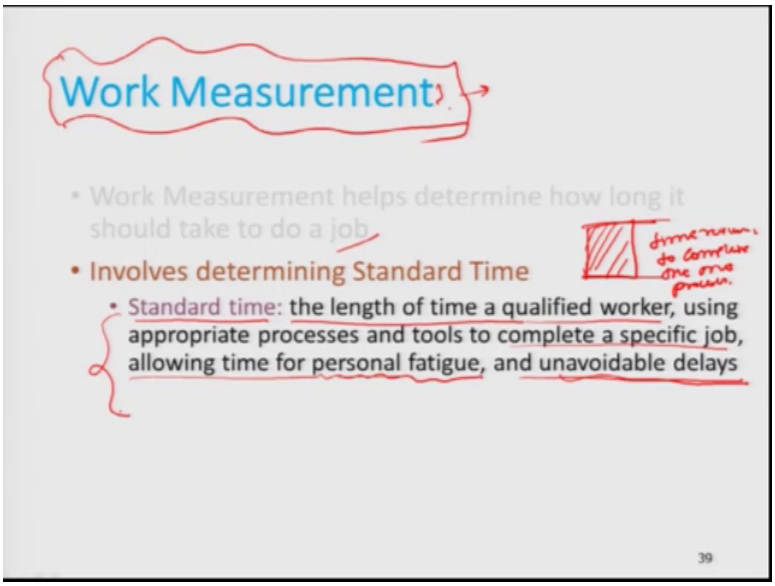

Now, work measurement after your designing your method analysis motional study, and designing of taking consideration of work environment, then you will have to consider you have to technically measure work measurement. So, work measurement what you will have to measure the effort of your workers.

So, that you can grade your worker or your process or you can if you want to measure your productivity of your system, then you will have to measure it. So, work measurement will helps determine how long it should take to do a job in a standard way suppose that a one worker is doing something on machine, and if you want to calculate what is the machining timing suppose that. So, you will have to measure how much time required to complete the one process.

So, in work determining standard time and standard time for each; one for job for process the length of the time a qualified worker using appropriate process and tools to complete a specific job, allowing time for personal fatigue and unavoidable delay. So, you will have to take all consideration in personal fatigue, and unavoidable delay, idle time in a calculation of standard time.

Till now, we have already learned through in a work system design, where we learnt what are the elements to be followed in a work, so involved in a work system design. And what are the methods available to make a proper system work system, for an industry. Now I am closing this module here, and in a next module I will cover some other topic.

Thank you very much.