Industrial Engineering
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Module - 03
Lecture - 07
Recording Techniques & Critical Examination

In this presentation I shall be talking about Recording Techniques, which are used in method yesterday, these recording techniques are basically based on the photographic films, cine camera films and the photographs which are taken using the conventional cameras. In addition to the recording techniques, which are based on films and photography, I shall also be covering the critical examination technique, which is used to investigate the recorded details of a given job by the various techniques, for the purpose of improvement of the existing method or developing the new method.

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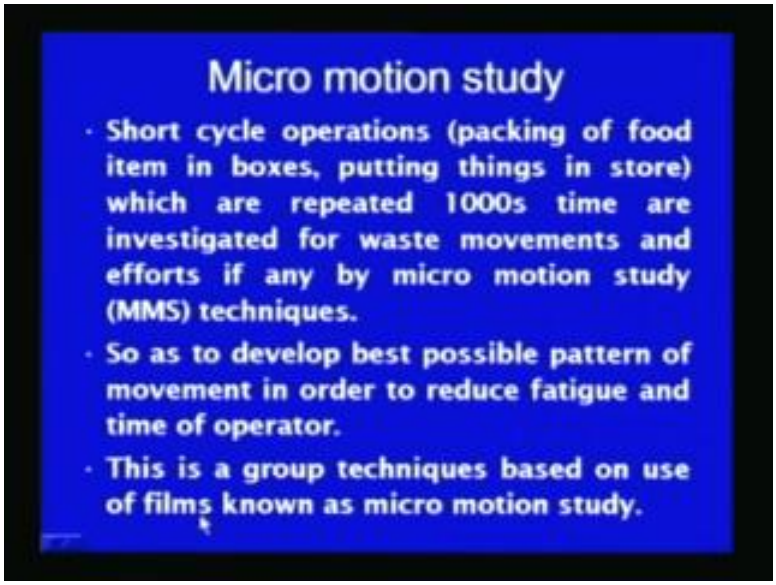

The techniques which are based on the film one of them is the micro motion study technique, this technique is mainly used for the short cycle operations, which are repeated 1000's of the time in a day and these are carried out very quickly in form of say packing of food items in boxes putting of the things in a store. So, for investigating that whether any irrelevant, unnecessary movement is taking place while carrying out these

short cycles activities or not a systematic investigation using the micro motion study technique can be carried out.

So, for the short cycle operations micro motion study technique is mainly used purpose of the micro motion study technique is basically to find out the best possible pattern of the movement. And if it is not there, then to develop a method in such a way that ((Refer Time: 02:21)) possible pattern of the movement can be obtained, so as to reduce the operators fatigue and the time required for completing the same job. Under the micro motion study, there are various techniques and that is why it is called as a group of techniques, which is based on the use of films for the study purpose. And therefore, this is a group of techniques based on the use of the films known as micro motion study.

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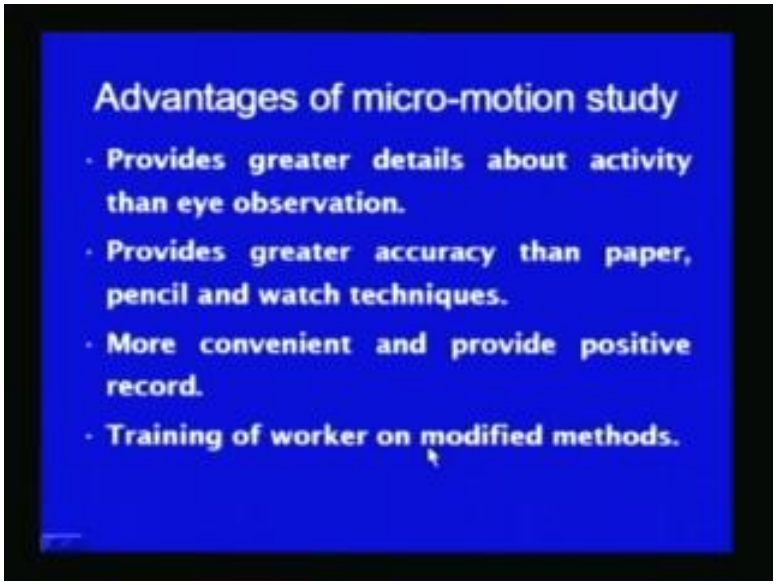

Advantage of the micro motion study technique is that, it provides the information in detail about the job, which is to be carried out as compared to the I observation. And it is more accurate compared to that what can be obtained using pen and pencil and watch techniques. And it is more convenient and at the same time it provides a positive record of the method, which is being actually used for carrying out the job that can be used as a evidence of the existing method and later on if a it is improved and the same can be used for the training of the workers after it is modification. So, these last two points are very important that it provides a positive record and which can also be used for the training of the workers on the improved method subsequently.

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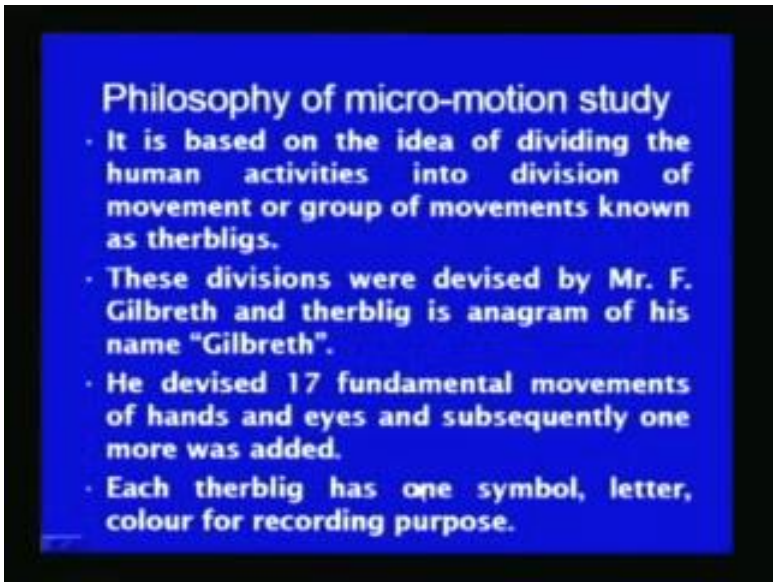

It is the principle of the micro motion study is based on the idea of a dividing the human activities into the small division of the movements or group of the movements. So, like a picking up the of job it can be divided into the reaching up to the job grasping it and then transporting it to the position where it is required; so one operation of picking up of a job can be divided into three or more number of a small division of the movements.

So, similarly simple operation can be divided into large number of the division of the movements or the group of the movements, these division of the movements or group of the movements are known as therbligs. And these were proposed by a mister Frank Gilbreth, which is the anagram of his name Gilbreth, so the therbligs are the anagram of his name Gilbreth. So, these therbligs were devised by the mister F. Gilbreth and these were 19 fundamental movements, which were devised by him related to the hand eye movements and their coordination subsequently one more therbligs was added.

Therbligs have been extensively used for dividing a small short cycle operation into the number of a small division of the movements to critically analyze, whether some of the movements are really required for completing the job or not. So, in that way the use of therbligs, which are a division of the movements or group of the movements help in very closely looking into the method, which is being actually used for performing the job.

Each therbligs has been assigned one symbol, one letter and the color for the recording purpose. Because, each therblig has it is own has a specific significance and these therbligs are systematically used for recording purpose.

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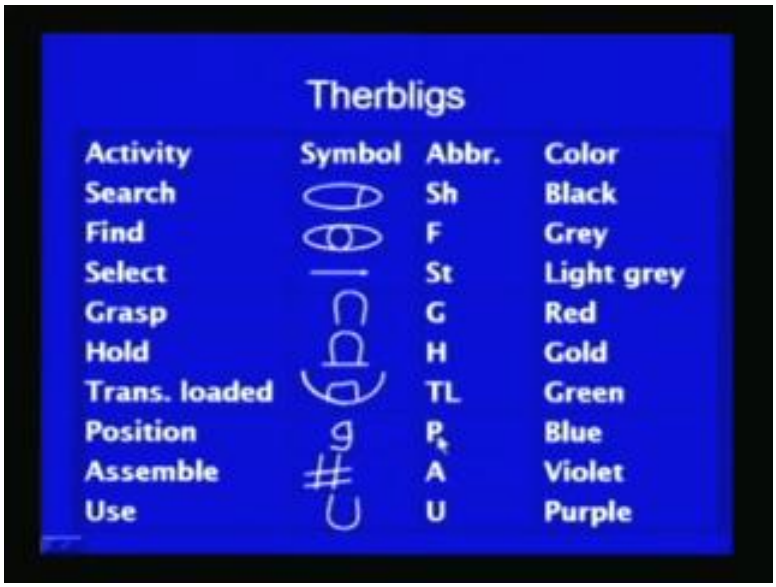

These 17 therbligs are like the search activity here in the first row can be seen, the activity these are all activities and the symbol which is use to show these activities and their abbreviation and the color which is use to show these therbligs. The search is indicated by this sign and the abbreviation is S h indicated by a color black, search therblig is used when operator is used is a looks for a particular kind of the object, which is required for further processing.

So, he will be looking here and there to find out, where a particular item or the type of item is available. Once, he gets that he will find that particular item, the is about when he is able to see, where is that particular item or the group of the items, if there are many items then these will be shown by the select and the select symbol for the select is arrow and it is represented like S t and the color is the light gray.

After selecting the object which is to be picked up and there it will be grasped by hand, the grasp is shown by the symbol of this kind and the abbreviation is G shown by the red color. After grasping it is required to obtain full control just putting the things fingers around the object is grasping and getting control over it is the hold, which is represented by H and color is gold. Transport loaded when something is been controlled firmly by

hand it is moved from one place to another and that is shown by transport loaded therbligs and the symbol for Transport Loaded is this one and the abbreviate is TL shown by the green color.

The position putting one particular component in the main assembly in the position, where it is required is the position and it is shown by this symbol and abbreviation is P shown by the blue color. Assembly putting the two things together to get the final product is two or more things together to get the final product is called assemble and assembling therbligs where like putting nut and bolt together is an example of assemble shown by the letter A and the colour is violet. And the use using about a particular tool or the machine is indicated by the symbol of this form and the letter is U and the color use to show the use therblig is purple.

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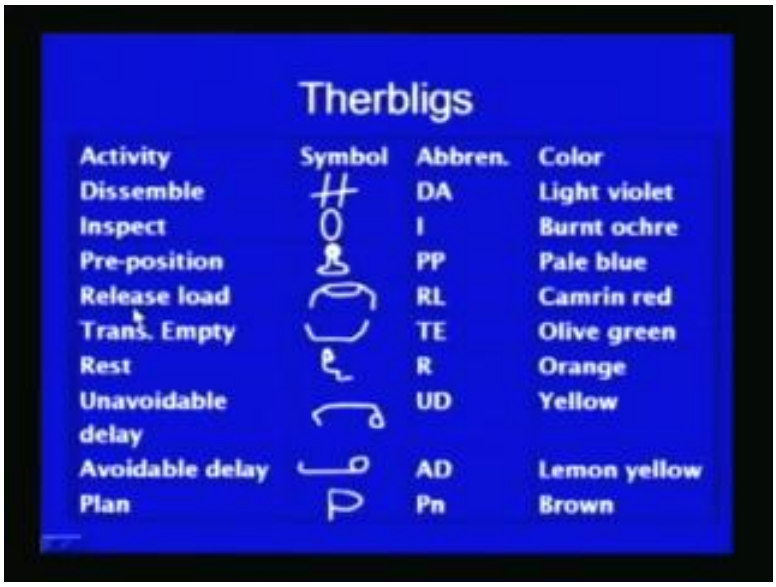

The similarly other therbligs, like dissemble putting the sub assembles apart from the main assembly and the dissembling the things is represented by was symbol of this kind and the abbreviation is DA it is shown by the light violet color. The inspect is checking for the quantity or the dimensions represented by the abbreviation is represented by this symbol and abbreviation is I and burnt ochre. And here pre position putting the things in place from where it can be positioned and thus abbreviation is PP and the pale blue is the color which is used to show.

The release load is just after reaching to the destination the things are released with the control of hand, from the control of hand when things are released it is shown by the release load and the symbol is like this and the abbreviation is RL and a camrin red is the color, which is used to show the release load. Transport empty, when hand is moved from one place to another without any resistance or the load in it is represented by a symbol of this form abbreviation is TE and olive green is the color, which is used to show the transport empty.

And the rest, rest is when the operator is not working he is idle and recovering from the fatigue and becoming ready for the another cycle of the work. Here, abbreviation for rest is R and shown by the orange color and unavoidable delay, the period when work is not done due to the host factors like, work cannot be done because of the machine failure by the workman. And un avoidable delay will be represented by the symbol like this and UD is the abbreviation for Unavoidable Delay, the yellow is the color which is used to show it.

Avoidable delay means, which is being caused due to the factors which are within the control of the worker or of the management, which can be avoided from stopping the work. So, here this Avoidable Delay is represented by a symbol of this kind and AD is the abbreviation, which is used to show avoidable delay lemon yellow color is used to show the avoidable delay. And a plan when operator is thinking about what is to be done next for in course of production or the operation, the P the symbol of this kind is used to show the plan and P n is the abbreviation that is used and brown is the color, which is used to show the therbligs.

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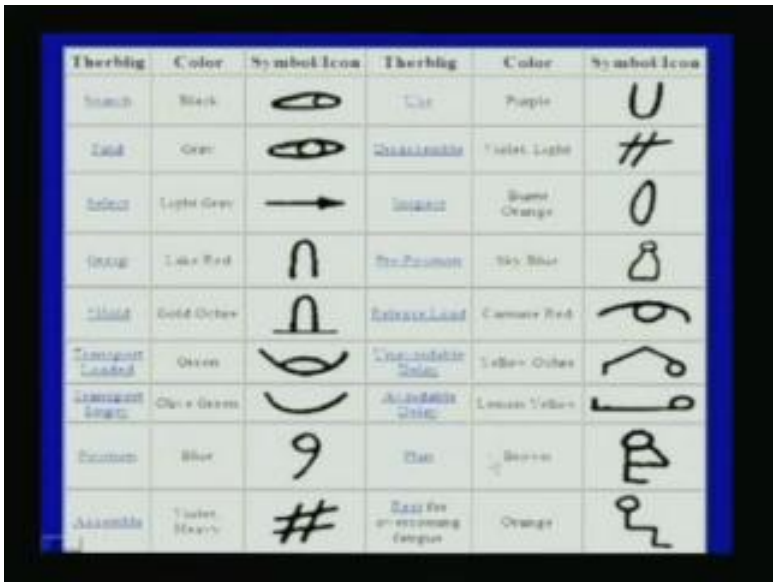

These, therbligs can be clearly seen in one sheet itself along with their symbols and the colors.

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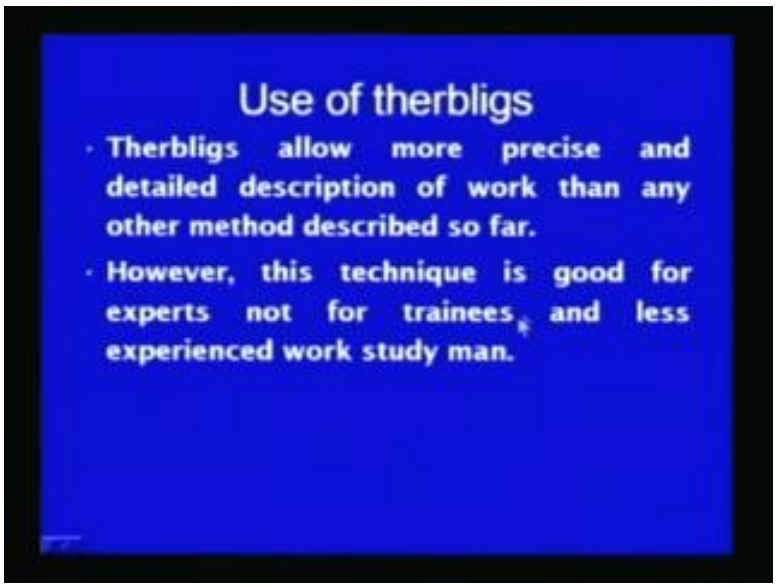

Use of the therbligs means, if one is aware of the different therbligs and if is has a recorded the activity, which is to be investigated. Then, he will be able to see the things more clearly what are the different divisions of the movements or the group of the movements being used for performing the job. If the therbligs are used then it will help to provide more precise and detail description of the work, than any other method which

has been discussed earlier or so far. However, this technique is good for the experts only it is not good for the trainees at it as it needs lot of expertise that is why the new comers or the less experienced work study man should not try it out.

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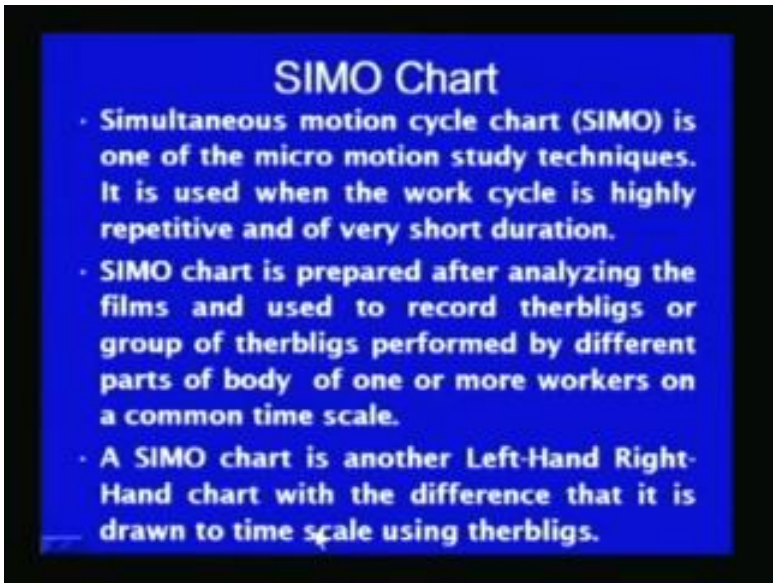

The one of the techniques of the micro motion study is the SIMO chart, where the short cycle operations are recorded using the cine cameras and the activities are then broken down into the different therbligs into the small divisions of the movements or group of movements, using therbligs and they are recorded on a common time a scale. The SIMO chart is abbreviated form of the Simultaneous Motion cycle chart is one of the micro motion is study techniques it is used when work cycle is highly repetitive and of very short cycle duration.

It is prepared after analyzing the film used to record the therbligs or group of therbligs performed by the different parts of the body of one or more workers on a common time scale. So, basically it records the different therbligs which are being used for carrying out a particular job on common time scale by one or more workers, it is another form of the left hand, right hand chart with the difference that it is drawn to the time scale and using therbligs.

So, therbligs provides the things in greater detail of very shot cycle jobs, while into an process chart or left hand right hand process chart therbligs are not used, where only the four elements of the work are used which are operation delay a hold and the transport.

However, their meanings are different from compared to what is there in case of the flow process chart. So, the left hand compare to the left hand right hand chart, the SIMO chart provides the greater detail on common time scale using therbligs.

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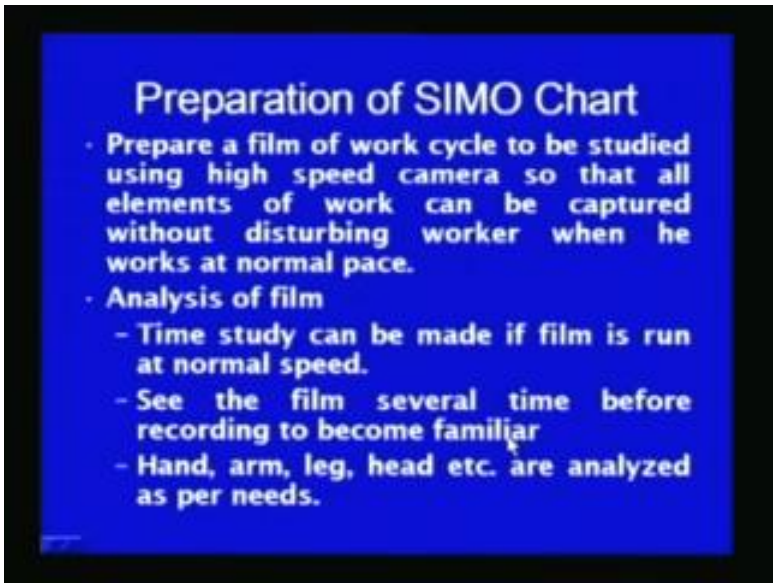

For preparing the SIMO chart film of the work cycle is prepared first and that is studied and that film is prepared using the high speed cameras. So, that all elements of the work can be captured without disturbing the worker, so this first step for preparing the SIMO chart the film of the work cycle is captured in such a way that no element of the work is lost and this is done without disturbing the worker when work is being carried out at normal pace.

And when the film is analyze it helps to give us various information and that analysis can be used to find out to see that how much time is being taken by a particular activity or the therblig or group of the movements. So, the time study can be made if the film is run at a normal speed and seeing the films several time before to become familiar, so before recording the films before breaking down the short cycle operation into the small group of the movements, film is seen number of times to become familiar what are the exact movements being used for carrying out a particular job.

And thereafter the efforts are made to break up the short cycle operation into the small group of the movements and that is known as dividing entire work cycle into the therbligs. So, see the films several times to familiarize yourself first and then start the

recording of the different therbligs, like hand, arm, leg and head movements are analyzed as for the requirement. So, film is studied if at the normal speed and that it can give the time required for carrying out a particular job in form of group of movements.

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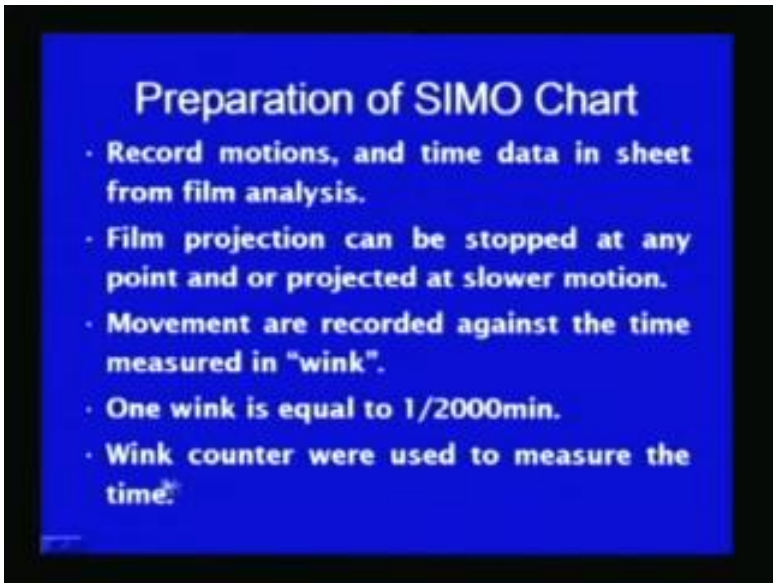

And time data in study sheet from the film analysis, in the film projections can be stopped at any point or projected at slower motion and movements are recorded against the time measured in wink, wink is a time unit which is used for recording the various therbligs and this wink is very small one wink is equal to 1 is 2000 of a minute 1 by 2000 of a minute.

Wink counters have been used earlier for recording the time, but now a day's various advance time recording techniques are and at devices are available. Memo motion photography is the another technique of recording the various activities, which are being carried out in course of the production. But, it is different from the micro motion study instead of using the high speed cameras or the common cine cameras, the photography in memo motion study is carried out interrupted manner.

The photographs are not taken continuously or at the rate of 24 frames per second, but the photography is carried out that the say half one photograph in half second or one photograph in 4 seconds, so there is a the photographs are taken at the certain interval of time.

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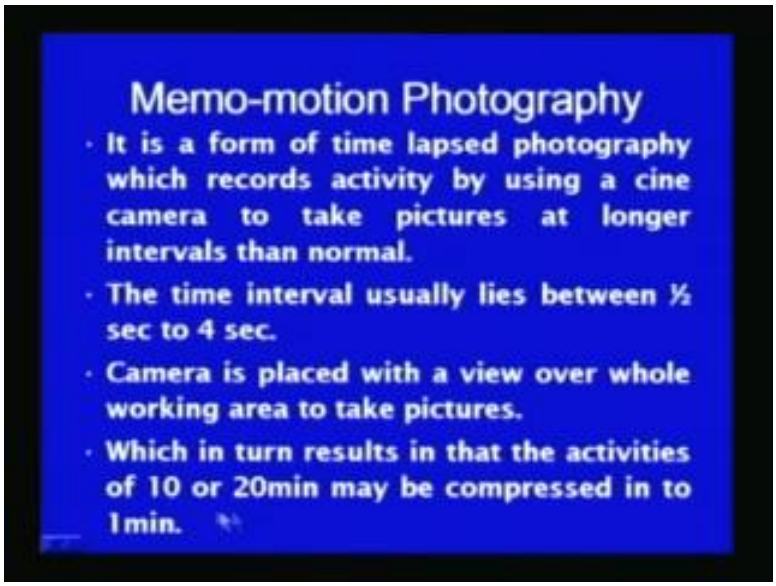

So, it is a form of time lefts to photography which records the activities using a cine camera to take the picture at a longer intervals than normal. And the time interval usually lies between the half seconds to the 4 seconds and the camera is generally placed with the view over the whole work area to take the pictures and which in turn results in that the activities of 10 to 20 minutes can be compressed into 1 or 2 minutes.

So, this is the advantage that our long durations jobs can be easily recorded in 1 or 2 minutes and these can be scanned to see the general pattern of the movements in the shop floor or of the worker or the material movement. So, as far as use of the memo motion study is concern, because of it is interrupted nature of the recording very short films are made of the work cycles, which may continue for long duration.

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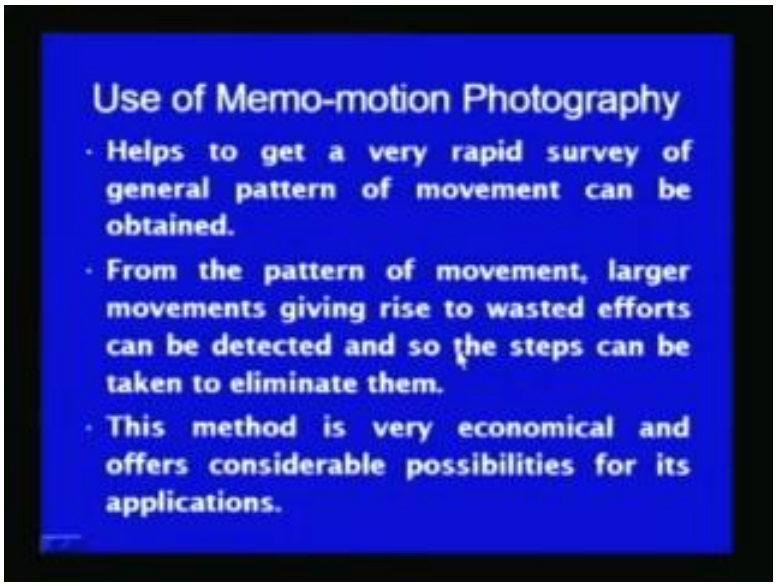

It helps to get a very rapid survey of the general pattern of the movement and the from the general pattern of the movement, where larger movements are taking place and where wasted efforts are being taken place that can be detected. So, the presence of any wasted efforts or ((Refer Time: 21:48)) extra movement, they for detected then the suitable steps can be taken to eliminate them. This method is very economical and offers considerable possibility for a it is application, because, it can be a very quickly analyzed and immediately gives the general and the rapid survey of general pattern of the movement in the shop floor.

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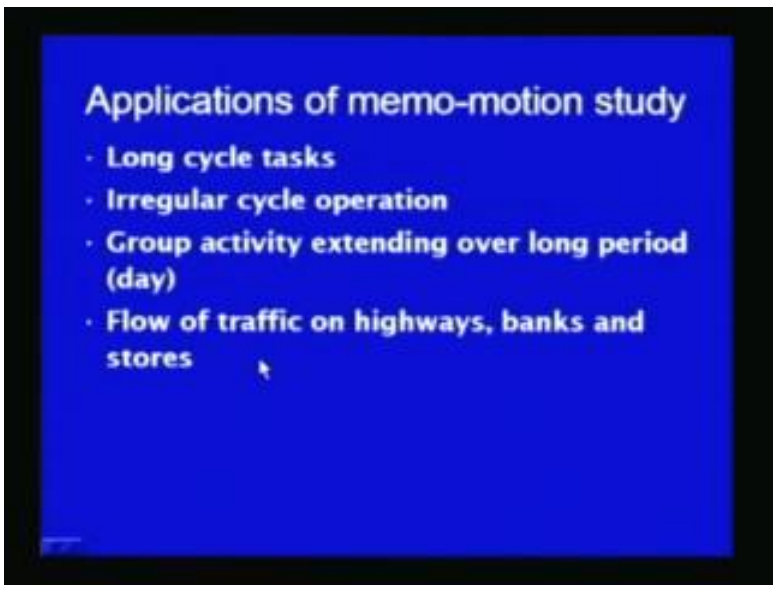

It the memo motion study that is why can be effectively used for long cycle tasks, which can continue for 2 hours or 4 hours. So, regular cycle operations also it can be effectively used for the study purpose, group techniques extending over long period say whole day can be studied using and the memo motion study technique or the flow of the traffic on highway banks or the stores can be studied using memo motion based study technique.

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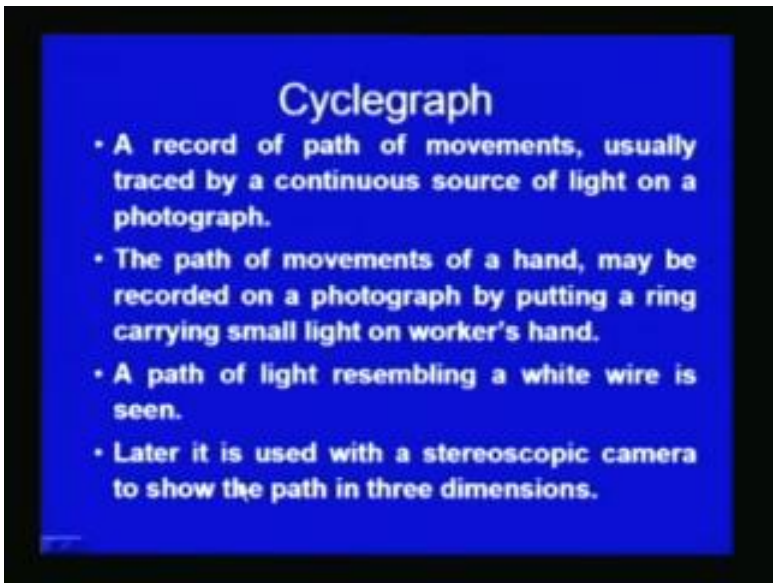

Cycle graph is another recording technique, where general pattern of the movements of the hands is recorded and that is traced using with the help of light source, which is mounted in on the hand in form of wrist watch or as a ring in the finger or light source which is mounted as on the helmet of the individual, which is wearing during the operation. So, the position of the light source helps to trace in which way either individual is moving in course of production or his body parts are moving in course of production.

Cycle graph is a record of path of the movements, usually traced by a continuous source of the light on a photograph. So, a continuous source of the light is used to trace the path of movement of either body parts or of the human being in course of production, path of movement of a hand may be recorded on a photograph by putting a ring carrying small light source on the workers hand or path of light when traced it resembles like white wire, and later this can be used with a stereoscopic camera to show the path in three dimensions.

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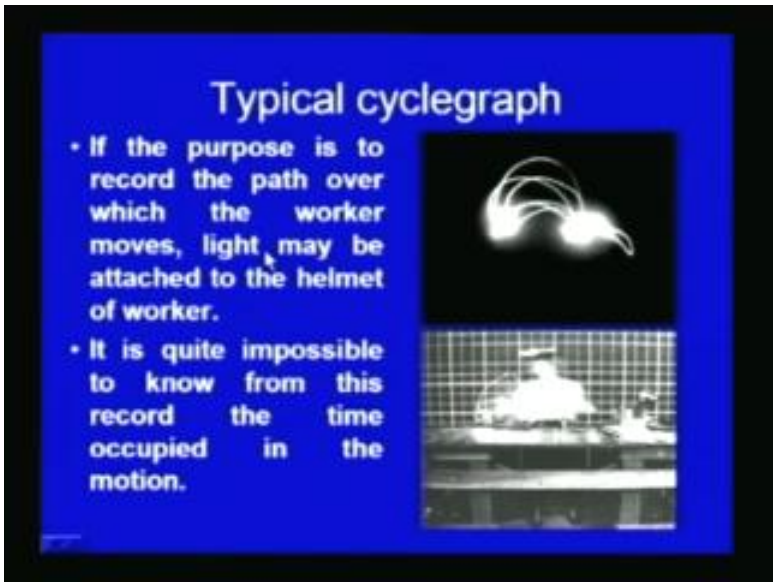

The typical a cycle graph can be seen as a white lines indicating the path of movement of hands during the work. If the purpose is to record the path over which worker moves light may be attached to the helmet of the worker, so if general pattern of the movement of the human being or of the operator is required and light source is fitted in the helmet of the worker, which will give the general pattern of the movement of worker in course of production. But, it is difficult to find out how much time is being taken to move the hand from one location to the another. And that is why the speed of movement or the time required for performing the movement from one position to the another of performing one task to the another, how much time it will take that cannot be recorded using cycle graph.

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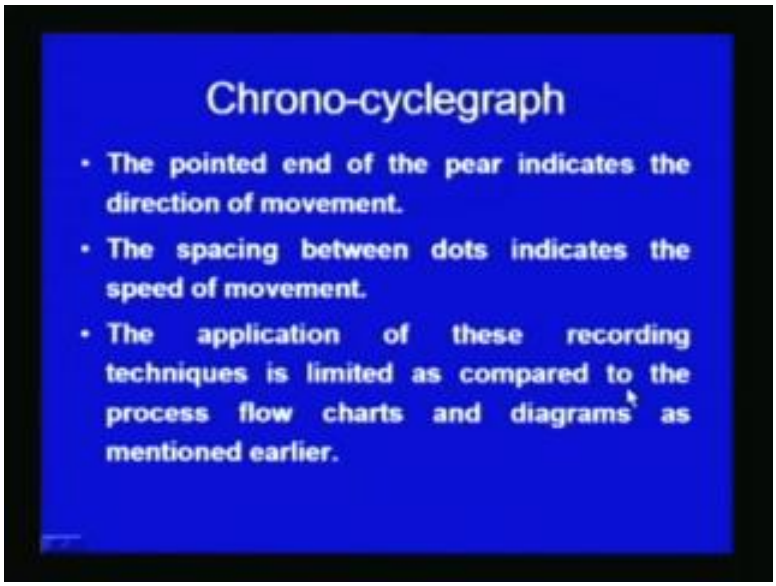

The chrono cycle graph in that way very effective because, it helps to find out and that what is the speed of the movement, in which direction movement is taking place and these information are in addition to what can be obtained from the cycle graph. Cycle graph simply shows the path of movement of the human being in course of production or path of movement of the body parts, like the finger during the operation on during the work.

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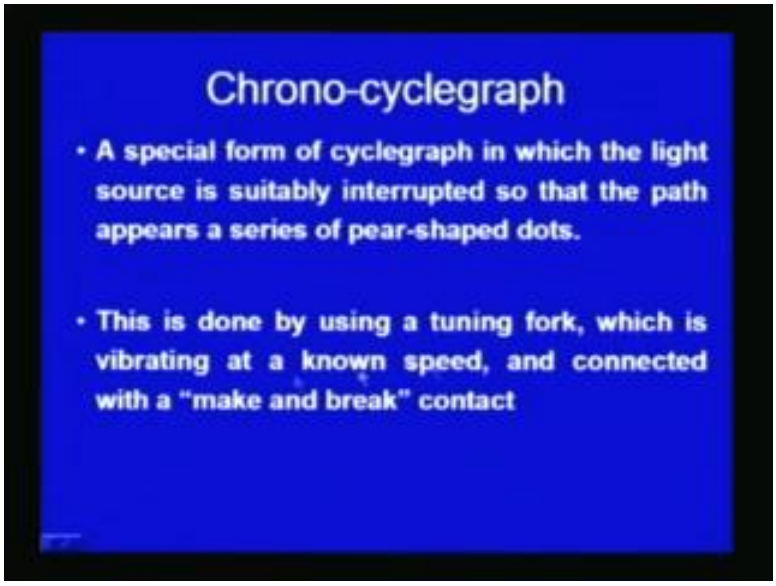

It is a special form of the cycle graph in which light source is suitably interrupted, so that the path appears as a pear shaped dots. In which the light source path or light source indicates the path in which the body parts are moving, but that path will appear in form of pear shaped dots. And this is this pear shape dots are obtained, because of interruption in the light source and that interruption in light source is obtained by a tuning fork, which is vibrating at known speed and connected with make and break contact.

So, the lights are a light source is made to make on and off at a particular frequency and the light source may be fitted on the helmet or in form of a ring or in form of wrist watch on the hand of the worker to trace the path of the hand movement or the workers movement in general. So, speed and the direction of the movements can be easily scanned and studied using the chrono cycle graph.

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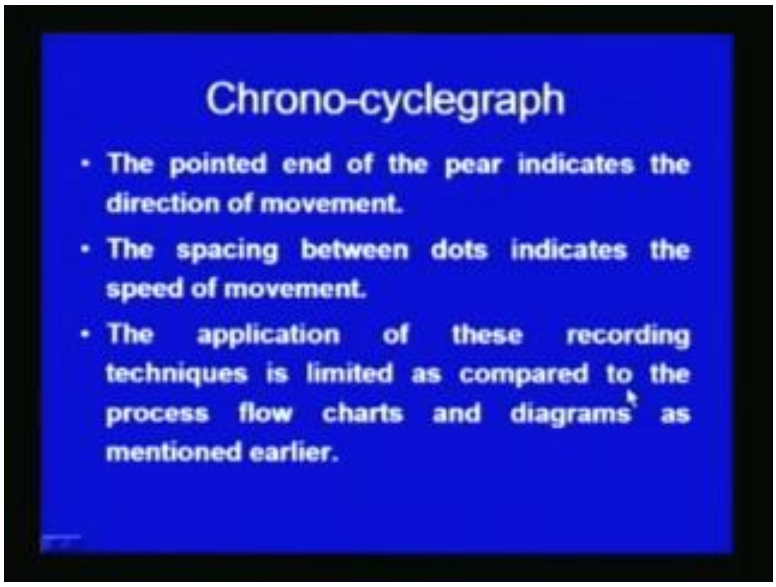

The point and of the pear shaped dot indicates the direction of the movement and spacing between the dots indicates the speed of the movement. So, these are the two important information which can be gathered from the chrono cycle graph. And the application of these recording techniques is limited as compared to the flow process chart and the diagrams as mentioned earlier, because these techniques are for the experts and lot of improvement can be made using the outline process chart, flow process chart, two hand process chart, flow diagram, a travel chart a string diagram.

These techniques which have been discussed earlier provides lot of scope for significant improvement in the productivity of the organization. But, the micro motion study based techniques and the cycle graphs and chrono cycle graphs will allow the increase in improvement of the productivity. But, that will be very marginal and that is why efforts are made to use those techniques, which can result in significant improvement of improvement in productivity of the system and subsequently these advance techniques are used.

So, once the recording of the activities which are being used for performing a particular job is over after that it is important, that what is being done actually for producing a particular product is investigated critically. Whether, the method being used is correct what are the extra unnecessary movements taking place, what is the scope for using the same equipment or designing it in such way that it needs less effort and less time. So, what are the various possibilities related with the existing method that is investigated by the critical investigation or examination of the existing method. So, existing method which has been recorded is critically examined to see what is correct and what is incorrect with the given method or existing method. And this examination forms the bases for the improvement or development of the new method.

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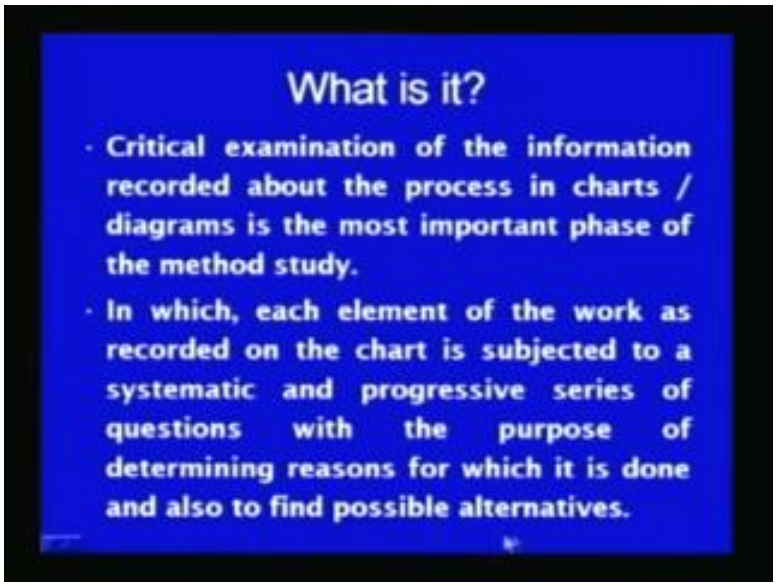

So, what is the critical examination, critical examination of the information recorded about the process, in charts and diagrams is one of the most important phase. Because,

successful critical examination leads to a very good solution for improved productivity or improved method. And in which the each element of the work, in critical examination each element of the work as recorded on the chart is subjected to a systematic and progressive series of the question with the purpose of determining the reason for which it is done and also to find out the possible alternatives.

So, whatever activity or the step is being done in existing method is challenged for it is existence and also imposed with the series of systematic and progressive questions progressive series of question with the purpose of determining what for that activity is carried out, whether it is necessary or not. And if it is necessary, then what are the possible alternatives for doing the same step using some other means or other method.

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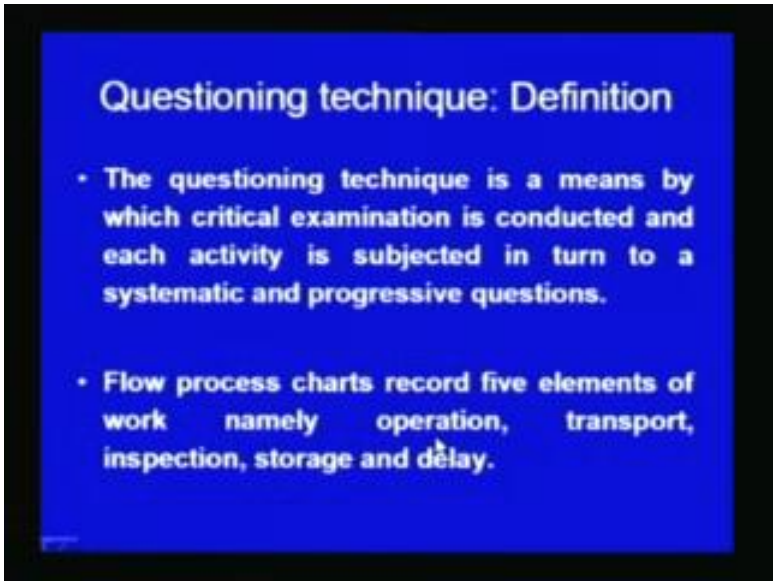

When critical examination of the recorded activities is carried out it reveals that what are the productive and unproductive elements in carrying about a particular a job. The if in the systematic questioning technique is applied, it reduces the possibility of missing any information, which may be useful for a development of the new method, means it is, so systematic when applied in sequential manner it reveals all the possibilities related with the existing job.

And also reveals that what are the unproductive elements related with the work and where there is an improvement for developing a new method. It is defined as the questioning technique is defined as a means by which critical examination is conducted

and each activity is subjected in turn to a systematic and progressive questions. So, here the critical examination of the recorded method is carried out using a systematic and the progressive series of the questions and these are systematic in progressive series of question is imposed on each activity, which is a part of the work or the step, which is required to be done for a doing a particular job.

The flow process chart, we have seen records the five different elements of the work namely operation, transport, inspection, storage and delay. The significance of these elements have already been elaborated, here only the operation leads the product closure to the leads raw material closure, towards it is completion, transport is about the movement of the man and material, inspection is about checking the quality and quantity of the product, storage is about the putting the things under some sort of authorization and that delay is when material is kept under unauthorized conditions and as I say it is waiting to be unpacked or it is waiting for further processing.

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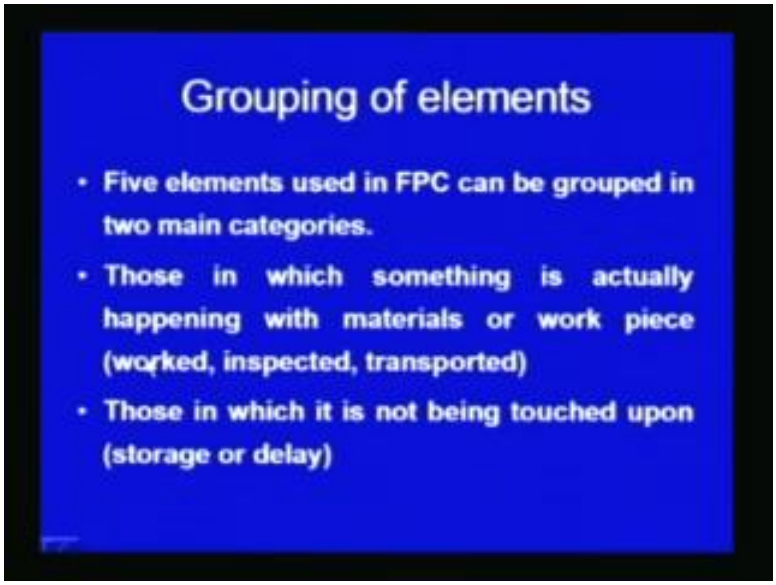

These five elements of the work, which are part of the work in all types of the activities are divided into the two broad groups, these are the those elements in which something is carried out with the work. Those elements in which some thing is carried out with the work piece, which helps for it is completion as a product and these elements, like material is being worked it is size and shape is changed, it is composition is changed or

when the material is being inspected for it is dimensions for finish or when material is being transported.

In all these cases the material or the semi processed product it touched during the operation. So, those activities in which something is actually happening with the material or the work piece, like the transport operation and inspection, these are the three elements grouped with this category. While in other two categories where a storage and a delay elements are these are those elements in which the work piece or the raw material is not being touched upon, when these elements are involved.

So, they are certain elements like, operation, inspection and transport in which work piece is touched to and something happens which helps it to complete it is progress or which helps to move the raw material in forward direction towards completion. While in other two elements the work piece is not actually touched it is just lying here or there under either authorization or without authorization.

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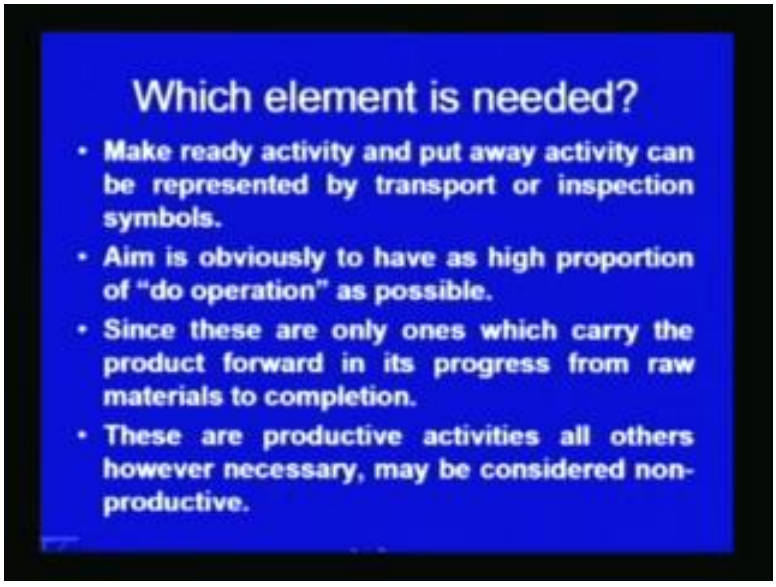

The further grouping of these elements is made on the bases of like, make ready activities those activities which helps to prepare the job for further processing. Make ready activities may be very important for producing a product or for doing the job like, setting and holding of the raw material tools, degreasing the product transporting and clearing the things. These are the make ready activities and which will be important for further processing or for carrying out any operation on the product.

Do operations are those which actually change the shape, size or the composition or the physical condition of the object. Do operations carry the product forward, towards it is completion, while the make ready activities may be very necessary for doing the do operations. But, these does not carry the product forward towards it is completion, on the other hand the third category of the activities are those which are carried out after completion of the do operation like, put away activities work is moved aside.

Putting away activities for one operation may be the make ready activity for the another operation. Out of these three groups of the elements, if you see the make ready activities and the put away activities may be very important for completing the job, but these do not bring the product forward towards it is completion, only the do operations take the product forward towards it is completion.

The elements, which are required in course of production and which are in kept to the minimum side are efforts are made to eliminate them, make ready activities and put away activities may be represented by the transport or and the inspection symbols. Aim of; obviously, is to have the high proportion of the do operations because, these are the only operations which take the product forward towards it is completion.

Since, these are the only once which carry the product forward it is progress from the raw material to the completion. These are the productive activities and all other may be necessary, but considered non productive and that is why in any work efforts are always made to have the high proportion of the do operations. While other activities may be necessary, but those activities should be as less as possible as the low they are considered as on productive or non productive.

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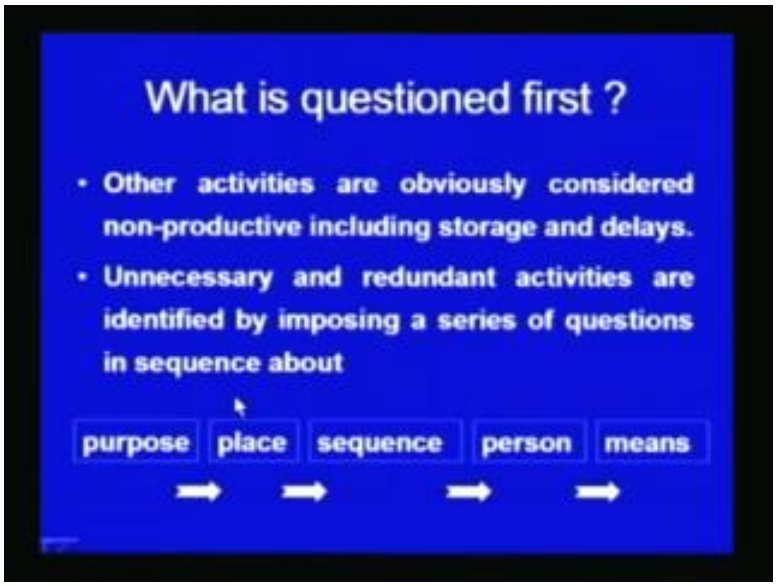

To find out that what is productive and what is non productive, what is necessary and what is un necessary irrelevant, questioning technique is applied in sequence. So, here we see the other activities which are considered non productive including a storage and delay will be targeted first, efforts will be made to reduce the non productive activities first. And the unnecessary and redundant activities are identified there after by imposing a series of questions in sequence.

These questions on the recorded data for each step and each measure activity are considered and the each activity is imposed by a series of questions, in terms of the purpose of that activity, where that activities carried out, in which sequence it is carried out, who will be doing that particular activity or how that activity is carried out. So, the each activity which is a part of the work and which is one measure step in carrying how to particular job is challenged for it is existence, in terms of the purpose, place where it is carried out per sequence in which it is done, person who is doing it and the means.

So, this is the sequence and the order which is maintained in asking the questions for a particular activity and the each activity of for particular job and the questions we asked about all these five items. And the procedure for critical examination follows the two sets of the questions, these are known as the primary questions and the secondary questions, under the primary and secondary questions both the types of the questions will be made

out of those the five objectives, ((Refer Time: 41:45)) in respect of each a given activity is analyzed.

Like in primary questions it will be ask like what is done, why it is done and the where it is done, why it is done in that place, in which sequence it is done, why it is done in that sequence. So, the justification is asked for each and everything which is being done actually at for a particular element or activity, while in the secondary questions alternatives are obtained and the possibilities are explode to see that what is to be done and what should be done for improved method.

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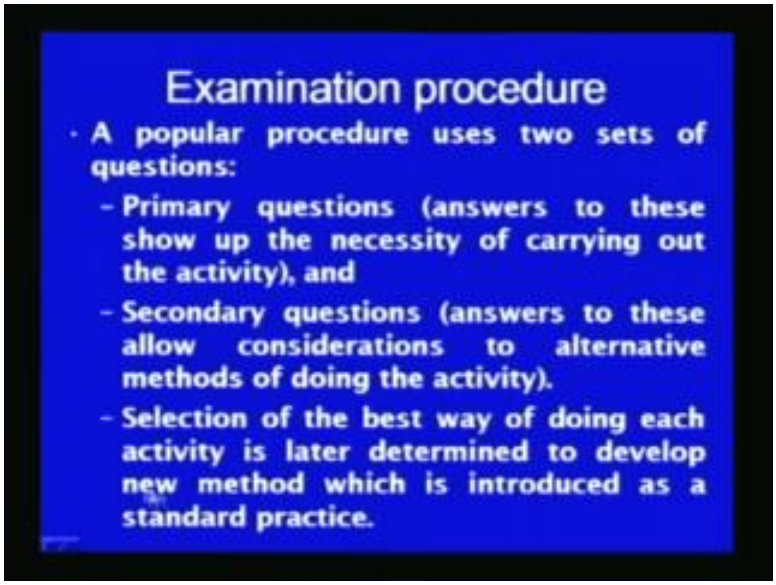

So, primary questions answers to these primary questions are asked and answers to these questions show up the necessity of carrying out the activity. While, the secondary questions when asked answers to these questions allow the considerations to the alternative methods of doing the activity. The selections of the best way doing each activity is later determined to develop a new method, which is introduced as a standard practice.

So, here when the critical examination is applied on the recorded method first of all primary questions are asked and primary question will be about why that particular step or activity is being carried out. And then what are the various other alternative and options about, which information is gathered after the secondary questions.

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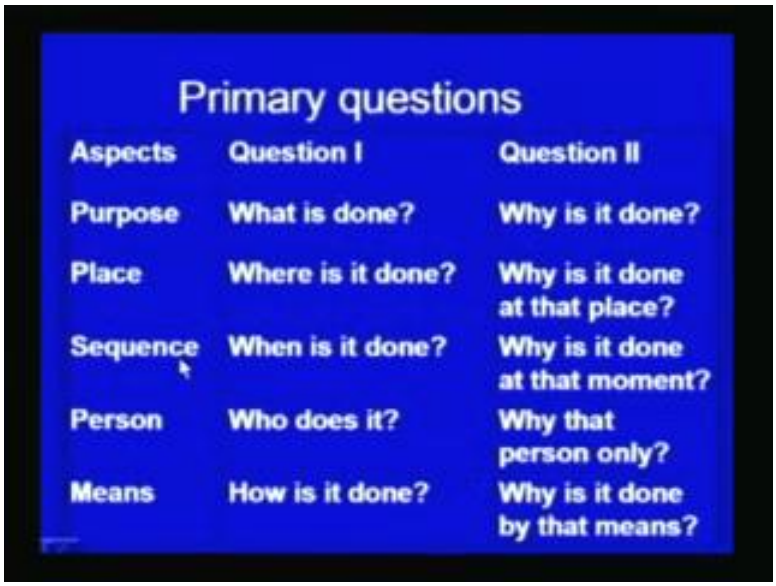

The primary question are asked like for purpose, place, sequence, person and the means, the purpose the two for primary questioning, the two questions are asked regarding this say purpose. These questioning will be applied in sequence and in known particular order and order in which it has been given the purpose, what is done, what is the purpose of particular activity and what is done when that activity is carried out and why is it done.

There after the place regarding the place, where it is done and why is it done at that place and a sequence, when is it done and why is it done at that movement the regarding the person, who does it and why that person only does it and means how is it done and why is it done by; that means, only. And these questions are asked keeping in mind that where elimination of particular activity is possible, where simplification is possible and where a combination of some of the activities is possible.

So, response to these questions are checked carefully and the possibility is explored to see, what is a redundant, what is unnecessary. So, that it can be eliminated and what are the activities which can be combined together to reduce the time required to carry out the job. And where unnecessary complexity existing that is also identify to see that what simplification can be done, so that the job can be completed easily and with the less effort.

So, based on the response to the primary questions, the secondary questions are applied further if it is found that the purpose of a particular activity is irrelevant and a not required. Then, elimination of that activity itself may be thought of and if it to be eliminated and there is no need to question about, where it is done and when it is done, how it is done and who will do it.

So, the purpose of particular activity is very important and if it is redundant and unnecessary it can be easily eliminated from the step, which is being used for carrying out a particular job. So, the secondary questions are applied after getting the satisfactory answer, that this is the purpose because of which this regular activity is required, the purpose has been justified, possibility can be explored, what else can be done to get the same results or if there are various options what should be done. The second question will help us to get that for getting the similar results or the better results, this is what should be done.

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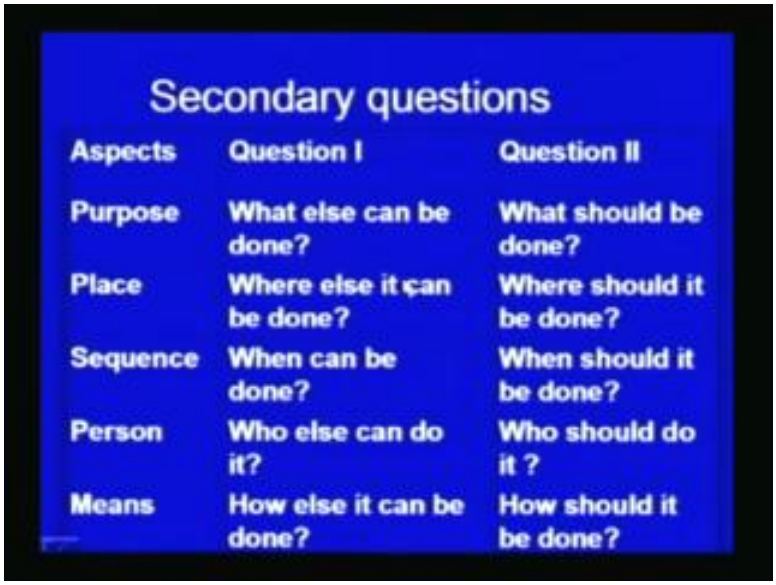

So, if we are getting various options regarding the way by which the same activity can be carried out for getting the better results in terms of the purpose, options are fixed to find out what should be done and regarding the place secondary question is asked about, where else it can be done, what are the other possibilities to see that, where it can be done and where should it be done will be fixing the place, where it should be done and thus regarding the sequence when can it be done.

Means the in which order it should be done there may be one particular order and the sequence and which it is done, what the possibilities are also explored that if you do at in this sequence or in that sequence what kind of results can be obtained or the better results can be obtained. So, what are the options as for as when can it be done and then fixing a particular solution like, when should it be done, so when should it be done is asked fixing up one particular sequence, where it is to be done.

The person who else can do it is it possible to replace him by someone else or who should do it is fixing of that person with the certain or for given characteristic should be used for the analysis. And means how else it can be done and who should do, what are the other techniques and the systems which can be use to do the same job and which should actually be used for the better results.

So, this is the way by which primary question and secondary questions are imposed and the each and every activity is challenged to see what is important for carrying out a particular job, and the what are the various options and which option should be selected in terms of the purpose, place, sequence, person and the means.

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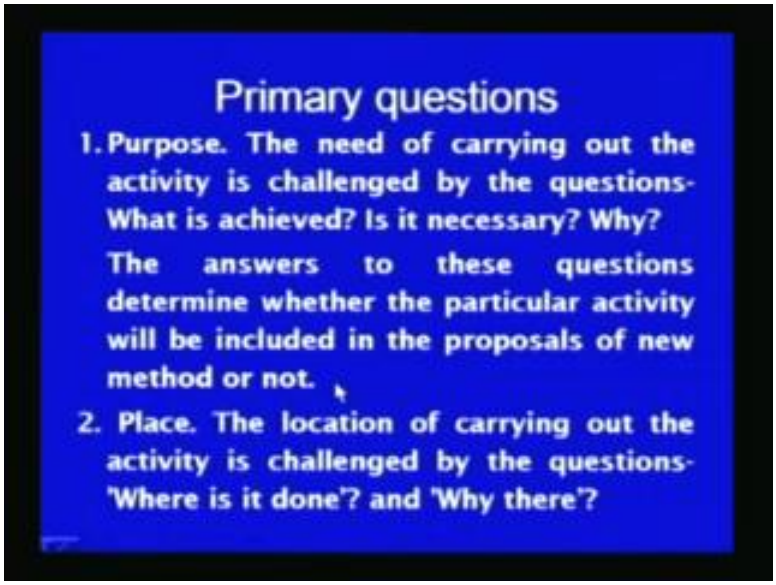

Here, in detail we will see these primary questioning in terms of the purpose, the need of carrying out the activity is challenged by questioning, what is achieved is it necessary and why, if the answer to these questions determine whether the particular activity will be included in the proposal of new the method or not. If the answers are unsatisfactory,

then the same can be eliminated also, the place the location of carrying out the activity is challenged by questioning, where is it done and why there it is carried out.

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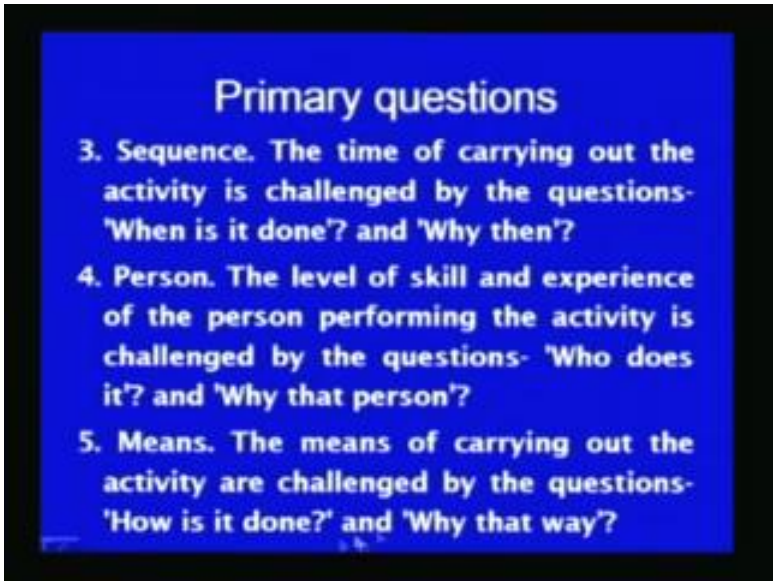

Regarding the sequence, the time of carrying out the activity is challenged by the question, when is it done and why then. If the question regarding the person is asked about the level of the skill and the person performing the acting is challenge by questioning, who does it and why that person. And regarding the means, the means of carrying out the activity are challenged by question, how is it done and why in that way.

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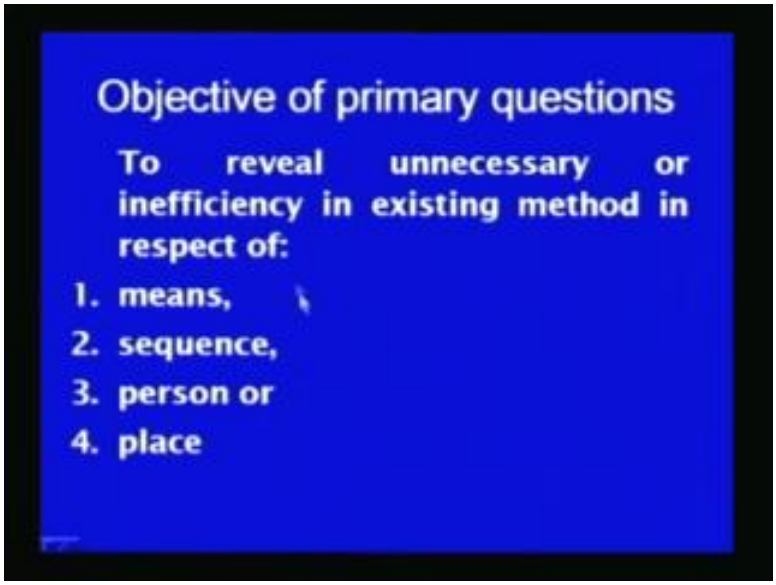

Basically, the primary questioning reveals the unnecessary and if we inefficiency in existing method in respect of the means, the sequence, person and the place where job is carried out. So, these will help to find out the various venues, where and the various alternatives which can be used to improve the existing method.

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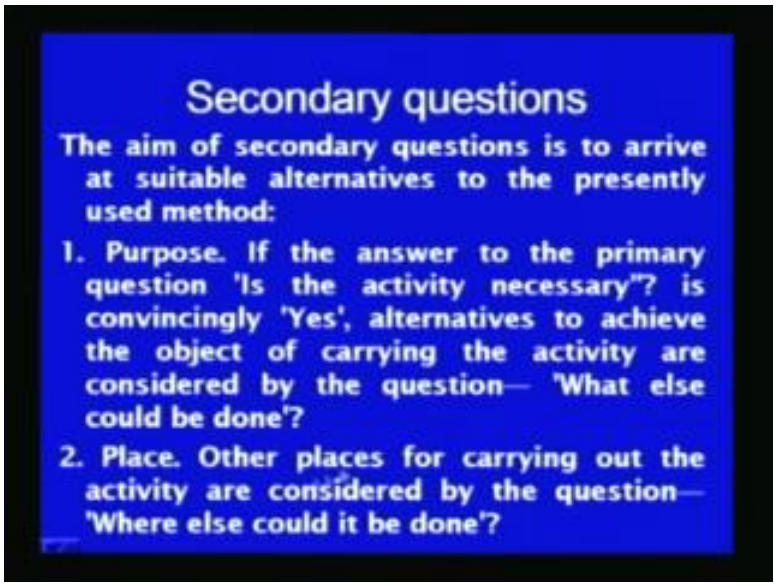

And those alternatives are explored by the secondary questions, aim of secondary is to arrive at suitable alternative to the presently used method. Regarding, the purpose if the answer to the primary question is the activity necessary, and if that question convincingly yes and alternative to achieve the object of carrying out the activity are considered by questioning, what else can be done. And regarding the other places of carrying out the activity are considered by questioning, where else could it be done.

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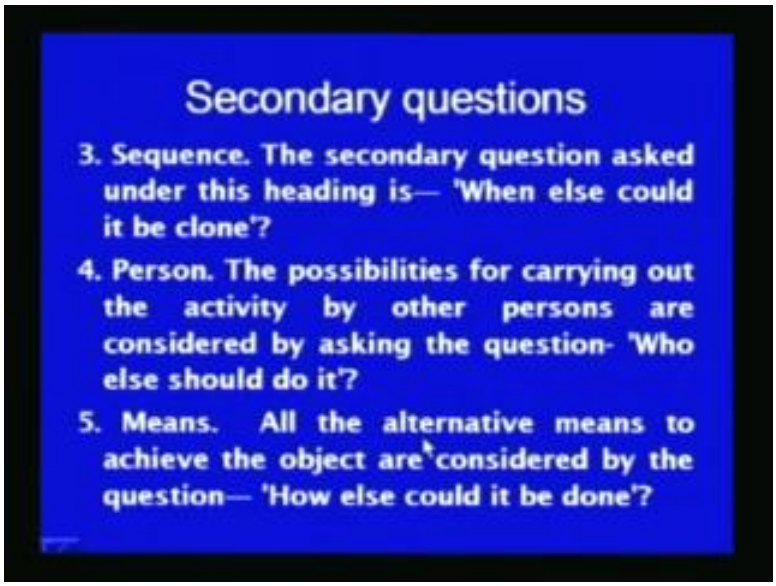

And regarding the sequence a secondary question asked under this heading is when else could it be done. And regarding the person, the possibility for carrying out the activity by other person are considered by asking question, how else should do it, who else should do it. And the regarding means all the alternative means to achieve the object are considered by question, how else could it be done.

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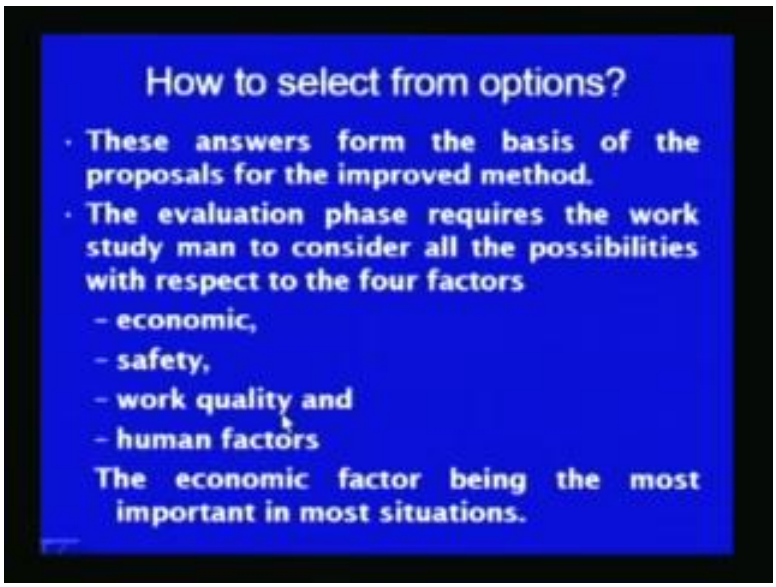

And after the secondary questions response to the secondary questions, we will be able to have certain options. And we will be able to fix up also the what are the options, which

should be taken up for developing the new method, so if the number of options are available we will have to select for developing the improved method. Answers from the secondary questions from the basis for proposal of the improved method.

And therefore, various options are available should be evaluated to for a selection of particular option in development of the new method. Evaluation phase requires the work study man to consider all the possibilities with respect to the four factors, like what is the economic importance and economic effect of particular option, what is the effect on the safety, what is the effect on the quality of the work that will be delivered after improvement. And how about the human factor influence on the human being, who are involved in carrying out the particular job. Most of the time economic factor being the most important in most of the situations, while selecting a particular option.

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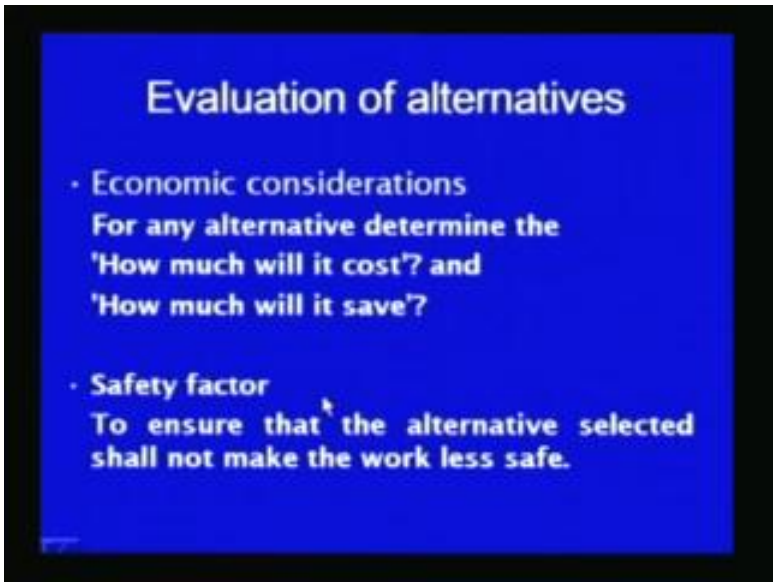

So, as for as evaluation of the alternatives on the basis of economics consideration is concerned for any alternative it is determined, how much it will cost. If particular new method is to be implemented, how much it will cost and how much saving it will result in. Under regarding the safety, the new method should not impose any kind of safety related problems to the worker, it should ensure that alternative selected shall not make any make the work less safe.

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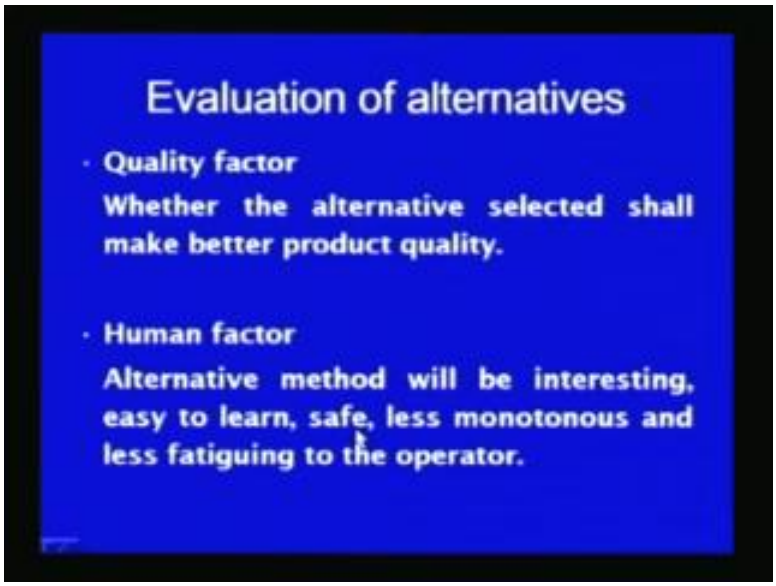

And the quality factor the new options or alternative options are evaluated in terms of the quality factor to see, whether alternative selected shall make better product quality or not. And the human factor is evaluated in the way that alternative method will be interesting easy to learn, safe, less monotonous and less fatiguing to the operator or not.

So, in this way now I would like to summarize this presentation, this presentation in the beginning I have covered some of the film based and a photography based, recording techniques for the method study. And thereafter the critical examination technique, which includes a primary and secondary questions to see, what are the unproductive steps and the productive activities being done in existing method. And response to these primary and secondary questions helps to find out, that what can be done for developing the new and improved method for carrying out the job and improving the productivity.

Thank you for your kind attention.