Work System Design
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Lecture - 36
Work Measurement: Basic Concept

Namashkar friends. Welcome to session 36 in the course on work system design. Today is an important day because we are going to shift our gears from method study to work measurement. Now if you remember we have already completed 7 weeks of our discussion on the topic of work study and work system design.

And if you remember what we have covered till now if we have to summarize that we can say that we have understood the basic concept of productivity, we have considered the causes for low productivity, we have also studied the productivity improvement techniques, we have also studied the reasons for low productivity or the causes for low productivity which I have already mentioned along with the ineffective time or ineffective work content that is added usually to the work that we are doing.

We have seen that how this additional work content can be avoided, what can be taken into account related to the product design, manufacturing, management as well as the workers. So we have seen that there are number of reasons that lead to poor productivity of an organization and how this poor productivity is going to affect the profits as well as the economic well-being of the organization is very, very important.

And in order to improve the productivity which can be in terms of labour productivity or the organizational productivity or the economic productivity, we can use certain tools and techniques which can help us, guide us, maybe move us into the right direction of improving the economic well-being of our organization. So these tools and techniques we are trying to understand.

One of them is the method study and in method study if you remember we have covered almost all tools or techniques that are used. In method study, we have covered various graphical aids or graphical tools like operation process chart, flow process chart, multi-

activity chart, 2-handed process chart, flow diagram, string diagram, cycle graph, chronocycle graph.

Then, we have studied principles of motion, economy, therbligs, simo chart. So right from the organizational level we have come down to the micro motion level and tried to understand the work being done on the shop floor or in the organization in different aspects. We have tried to optimally utilize the machine hours available with us, we have tried to optimally utilize the work force available with us or the man hours available with us.

We have tried to optimally utilize the space available with us, we have tried to see with the help of string diagram that how the layout can be improved. So different aspects of work have been analyzed depending upon the application area with the help of different tools and techniques. All these analysis has helped us to develop better, best, efficient, effective, productive methods of doing the work.

So that phase of method study is now over and now we want to find out that whatever method we have developed, is it giving us some improvements in terms of time also and for that we need to find out that what is the standard time required for doing the work using the current method and what amount of time savings we can achieve if we follow the better method of doing the job.

Now for a particular method which is a set of activities or set of jobs or set of tasks, we would like to find out that how much time an average worker would take to complete this task or the combination of task or the sequence of operation. So whatever task is assigned to a worker as a time study analyst it is my responsibility to find out that how much time must be taken by this worker to complete this task.

For example, a computer program has been assigned a task to write a program. Now it may be a 1000 lines program, a time study analyst must be able to find out that a qualified programmer or a qualified computer expert will take this much or extra amount of time to write this code. So that is basically establishing time standards for performing the task as per the standard method of doing the task.

So we have developed the standard method, we have developed the best and efficient method for doing the work. Now for that method we would also like to find out that how much time must be taken in order to complete that task to the satisfactory level of performance. So that is the basic concept of work measurement and there can be not only one objective of doing the work measurement, there can be several other direct and indirect objectives of doing the work measurement.

Work measurement will also help us to plan to schedule our activities in such a way that we make maximum utilization of the machine hours and the men available with us or the man hours as well as the machine hours available with us. Time study or work measurement will also help us to maximize the utilization of the equipment that is available with us. So it is not only related to just setting the standard time, whatever time is set will also maybe in the long run helping us for better planning and execution of our plans.

Also the time standards or the work measurement output in terms of standard time will be helpful to us in setting the jobs or setting the wages, setting the salary or defining the incentives that have to be given to the workers. So once we know that it is expected that a worker is going to make for example 20 pieces in a day and we can very easily see that what is the labour input going into the making the 20 pieces.

And accordingly we can set, calculate our manufacturing cost. On the contrary, we can also decide that how much amount of money needs to be paid to this worker who is producing 20 pieces per given day or per working day. So this is going to help us, time standards are also going to help us to define the wages and the incentive plans for our workers. So it is not only one particular objective.

There is a combination of objectives that we will see in today's session that why work measurement is important. Another important point is that how do we set the standard time. So there are different techniques, some are experiment based or in which we use some equipment to record the time taken by a worker to complete a sequence of tasks or the tasks at hand.

And then there can be other techniques which are purely mathematical in nature where we have some standard data available and based on that standard data we will calculate the time

required for doing the task. If you remember we have seen the micro motion study, we go to the very basic elemental level of the body motions in which we even go to the level of grasp, move, transport empty, transport loaded.

So with different therbligs, we go with the micro level of human body motions and if we can time those motions then when we have a different work we need not do the time study again, we can refer back to the standard data available with us and directly do the calculations accordingly and find out the time required for doing the task which is slightly different from the current method or from the method for which the time is already available.

So we will see all these I think I must not confuse you with too much of words in the very first lecture on work measurement but I want to give you overall overview of what is going to be studied or discussed in this topic of work measurement and as far as I remember next 3 weeks we will focus on various tools and techniques as well as various numerical problems and case studies based on work measurement.

So today is the introductory part, I think I have already emphasized the importance of work measurement and we will in the subsequent sessions focus on various techniques that can be used to find out to calculate to establish the standard time for doing the job. So with this background we can start our discussion now.

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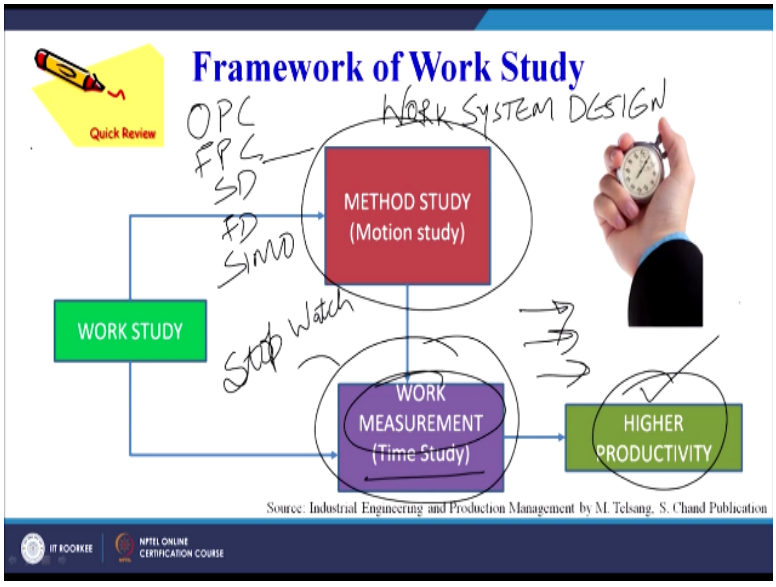

Now this is the framework of work study or we can say as our subject title goes the work system design. Now the work study has 2 major components, one is the method study which

we do through the operation process chart, flow process chart, string diagram, flow diagram, simo chart. So all this we have already discussed in the last 4 weeks of our discussion.

Now our focus primarily is on work measurement or we also call it time study and in work measurement we are going to see a stop watch of time study, then we will see standard data, we will see predetermined motion time systems, MTM, MTM1, MTM2 so motion time measurements. So this we will try to establish now and this work measurement as we have already discussed that it will help us to economize our labour utilization.

It will help us to maximize our machine utilization which will definitely lead to higher productivity and because these 2 techniques of method study and work measurement lead to higher productivity therefore only we have already discussed the concept of productivity in the beginning of our course on work system design. So we know that if we do method study that is we are able to find out a better method or a best method of doing the work.

And we are able to find out the time required for doing the work as per the best method. Both these will lead to higher productivity and higher productivity will lead to the good economic health of the organization. It may also lead to the improvement in the GDP as well as overall life standards of the society and it can further lead to on a very larger scale, the development of the country also.

So we can see that it has got big ramifications and therefore we must focus on the right methods of doing the work as well as we must focus on the right time required for doing the work.

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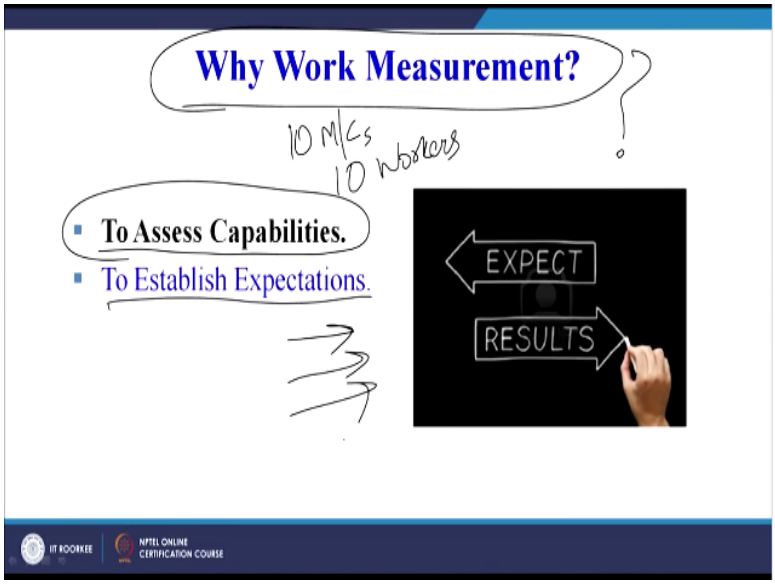

Now why must we do work measurement? To assess the capabilities, suppose we have 10 machines and 10 workers, so we must be able to assess that how much we can work out or what can be our production rate or what we can produce at the max or at the maximum level of performance. So once we know that this is the time required or a standard time required at a standard performance for an average worker to complete this task very easily we can assess our capability that what maximum we can deliver.

Also it will help us to establish the future expectations because currently suppose we are producing a particular quantity that is our capability, the current capability but suppose we have now developed a better method of doing the work, we have eliminated some of the unnecessary operations.

We have combined some operations, we have chased our layout, we have devised a better method for the worker to perform the task, we have done a multi activity chart analysis and we have now deputed one person for manning 2 machines which were earlier manned by 2 workers. So basically we may have approached the method study and we may have used the method study for doing lot of modifications.

So after these modifications our capability is definitely going to improve. So we know that this is our present capability but we can always set higher standards of performance and then it can even lead to meeting our expectations. So time measurement will help us or work measurement will help us to find out what is our current capability, what we are doing and we

can also set future expectations that what we can deliver, what we can achieve if we do the things in a different manner.

Now the introductory part, the definition part let us quickly read. I think I have explained it in the most simplistic manner. Now everyone can give an answer that why do we need to do work measurement and what is the importance of work measurement. So now quickly let us try to focus on what we can focus on now is the right definition for work measurement.

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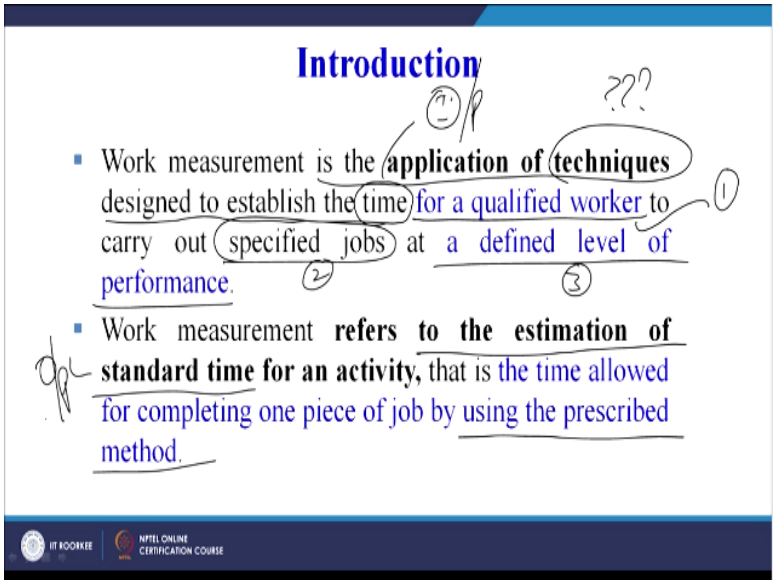

Now work measurement is the application of techniques. Now what are these techniques? These techniques we will see in the subsequent slides but it is the application of techniques designed to establish the time which is very, very, very, very important for a qualified worker. This is one thing which is our output that we want to establish the time. For a qualified worker, this is first prerequisite.

It cannot be for any worker, it cannot be a person who has just joined the organization and we put him on the task and start to time him that how much time he will take. Suppose a person is driving the car, may be he has just started driving the car may be 4 days back and you send him from Roorkee to Delhi, he may take much more time as compared to expert driver. So therefore for a qualified worker that is first prerequisite.

That the time has to be established for a qualified worker not for an inexperienced or a person who is not having a relevant degree or a relevant skill to perform the task to carry out the specified jobs. That is second prerequisite, specified jobs. So the jobs are also defined which

have to be timed and at a defined level of performance. The level of performance also has to be established by the time study analyst that is some rating also has to be established.

So there are 3 important things to be taken care of. Who has to be timed, on whom we are going to do the time study, that person must be skilled, he must be a qualified worker. Secondly, he must perform the task in the specified manner and at a defined level of performance. Work measurement refers to the estimation of standard time for an activity that is the time allowed for completing one piece of a job by using the prescribed method.

So this is another form of representing the work measurement that is the main objective remains same, estimation of the standard time which is going to be the output of our work measurement activity or of our work measurement technique, the estimation of the standard time for any activity and what is the standard time, it is the time allowed for completing one piece of a job by using the prescribed method by the skilled worker at a defined level of performance.

Now standard time is coming again and again standard time.

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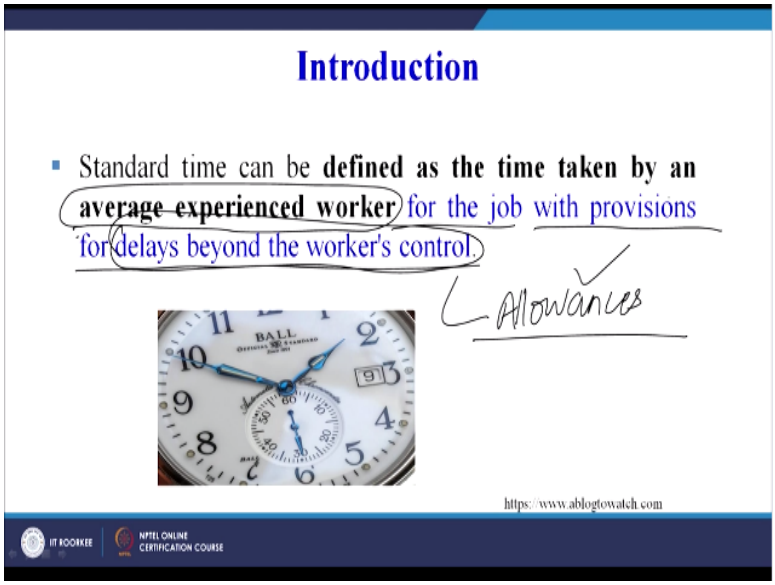

Standard time can be defined as the time taken by an average experienced worker, so instead of a qualified now we are giving another terminology average experienced worker. So another important point to note is that the worker cannot be a new worker or a person who is not having adequate experience in performing that task. When we are trying to time an operation we are trying to find out a standard time for doing an operation or a work.

The worker has to be experienced, skilled, qualified. So standard time can be defined as the time taken by an average experienced worker for the job which a specified job with provisions for delays beyond the workers control which means that we need to provide certain allowances for the delays beyond the workers control.

So we will time the worker, we will try to find out the time required by an experienced worker to perform the work in the defined manner at the defined level of performance but to that we also have to consider that what are the delays or what are the problems or what is the additional time taken by the worker because of the reasons because of the causes which are beyond the worker's control.

So that also has to be accounted for when we are going to set the standard time for performing a task.

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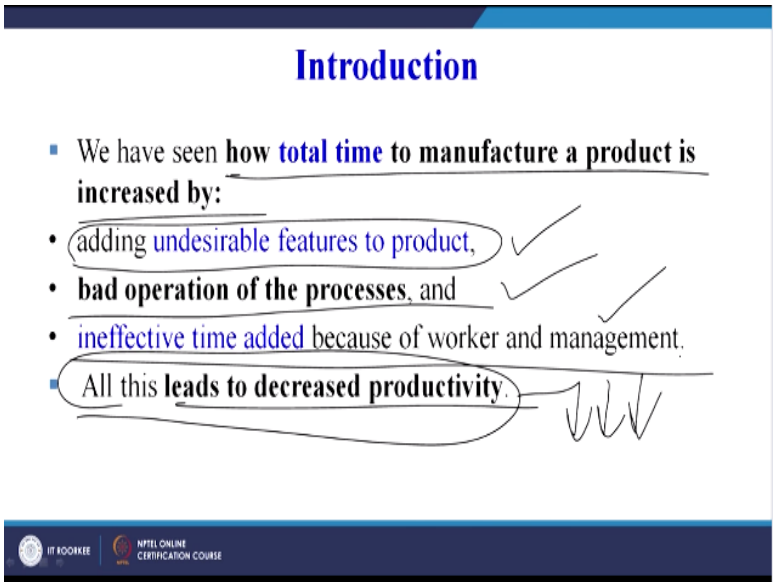

We have seen that how total time to manufacture a product, we have seen infective time, the total time to manufacture a product is increased or may be some time is wasted why because of adding undesirable features to the product, additional time, bad operation of the processes additional time, ineffective time added because of the worker and the management, ineffective time.

So all these ineffective times lead to decreased productivity, your productivity decreases why because of all these parameters, faulty product design, ineffective time because of the

worker's attitude or because the management is not able to exercise proper control over the way the work must be done or they are not able to maintain the specified method of doing the work.

So these are all the reasons in which we have seen that the time increases beyond a particular limit and when we do the work measurement, we set the standard time that the time if taken beyond this standard time it will be leading to ineffective time only means that is an additional time which can easily be avoided. So suppose we do not have any time standard what we will do?

We will assign the work as per our intuition as per our gut feeling as per our experience but once we have a standard time available with us we can very easily specify the task to be assigned to each and every worker who is working for us on the shop floor. So standard time has got lot of importance and it will help us to save all these undesirable or ineffective times because of the worker and the management.

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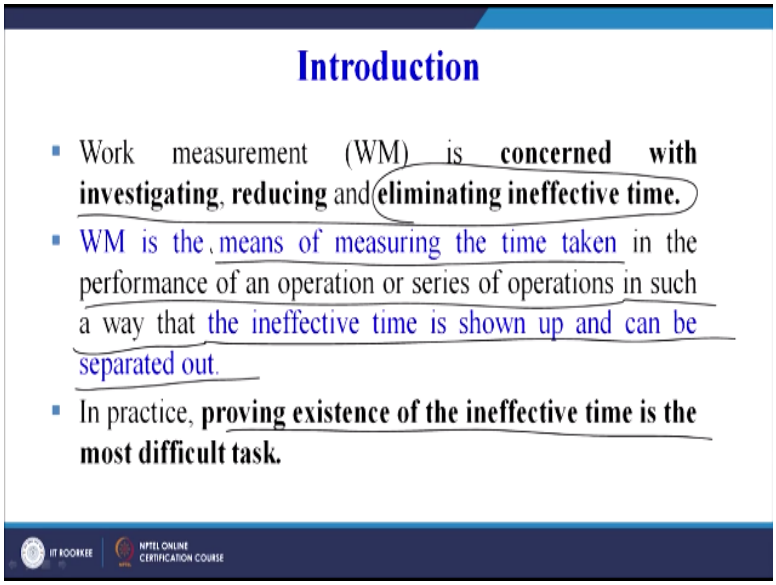

Now work measurement is concerned with investigating reducing and eliminating the ineffective time. So this for eliminating the ineffective time first we need to find out that what is the ineffective time. Work measurement is the means of measuring the time taken in the performance of an operation or series of operations in such a way that the ineffective time is shown up and can be separated out.

So during work measurement it may also help us to see that where we are spending extra time which can easily be avoided. In practice proving the existence of the ineffective time is the most difficult task. So when suppose I am recording this lecture may be there are few things which we may have repeated 2, 3 times so that is may be kind of ineffective for some of the students but for other students it may be effective that we have revised the same things again and again in 3 different slides.

So the point is it is very, very difficult establish that this is the ineffective time though there if we are able to find out that this is the ineffective time very easily we can optimize the time required for doing an operation. Now there are 2 critical issues in work study.

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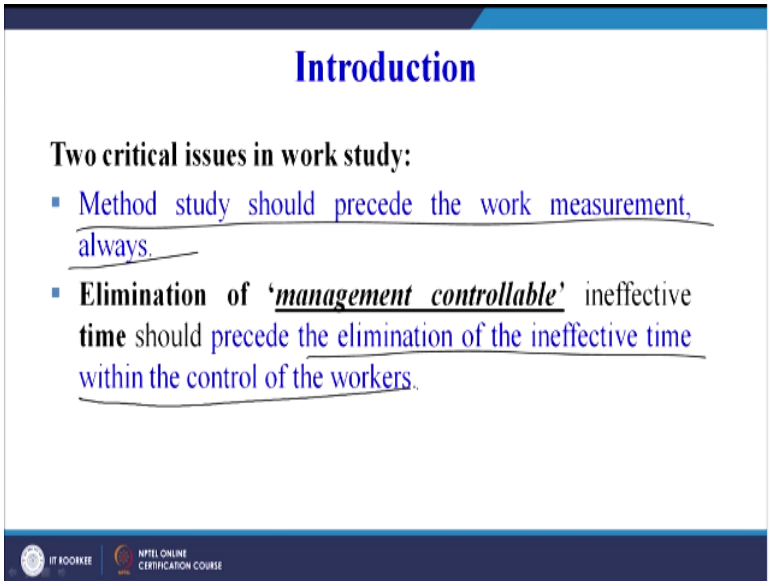

One is method study should precede the work measurement always. So this is one standard which is almost followed in the industry that first method study must be done and then we must do the work measurement. So method study should precede the work measurement which means that first we must try to set the right method, first we must try to propose a one best technique for doing the work, we must try to propose a better or a best method of doing the work.

And once we know that this is the right technique, this is the right method, this is the right sequence of operation, this is the right body motions which must be done in order to perform the task in the most effective, efficient and productive manner. After that only we must try to find out the time required for performing the task as per the standard method developed during method study.

Then, elimination of management controllable if ineffective time should precede the elimination of the ineffective time within the control of the worker. As we have seen that in many cases, it is because of the management which there is an ineffective time for doing that work or doing that task or doing the sequence of operation. So first focus must be the management controllable ineffective time and then followed by that we must try to focus on the ineffective time of the worker.

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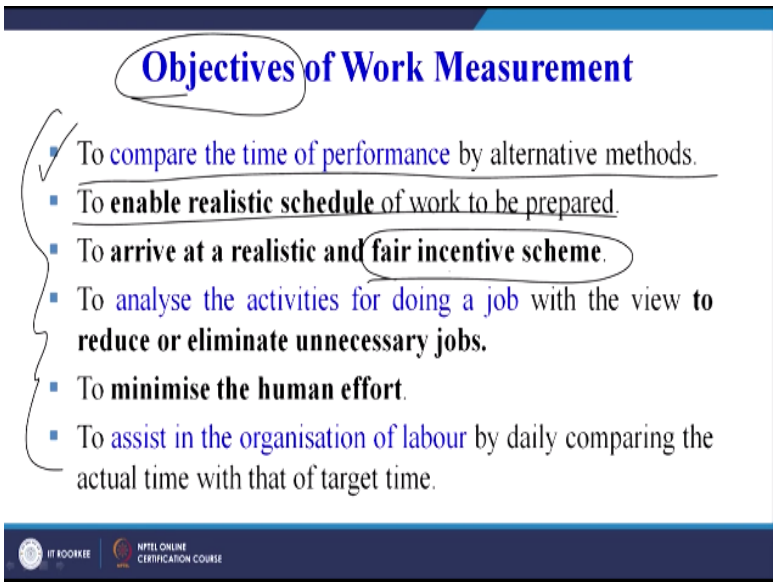

Now very quickly let us see it is a list of the objectives of work measurement. So you can see first one is to compare the time of performance by alternative methods. So this was the first thing which I emphasized today that in method study we have a current method of doing the work and then we may propose to better methods based on the analysis done using the operation process chart or a flow process chart or a flow diagram, string diagram, simo chart.

So using any of the method study technique we may propose better methods or best methods of doing the work. Now we can compare them in terms of time taken by using the work measurement technique. So it will help us to compare the time of performance by alternative methods. Also may be another dimension to this can be that we have different tools and techniques that can be used for timing the worker or for finding out the standard time for a worker.

So we can also compare the different techniques that which technique is giving us a better estimate of the standard time. So better can be it is may be if the worker is able to perform the

task as per the time specified to him and he is not delayed or he is not doing it quite early, so it means that the method of the technique which we have used for work measurement is effective in setting the standard time for performing the task.

So our first objective is to compare the time of performance by alternative method. To enable realistic schedule of the work to be prepared as I have already told if we know that how much time will be taken for each and every operation on the shop floor we can very easily do a proper scheduling.

To arrive at a realistic and a fair incentive scheme which I have already told for job, fixing the salaries or for fixing the incentive or the bonus we can very easily use the standard time data or the work measurement for may be fixing the incentives, bonus, salaries, wages for the workers. To analyze the activities for doing a job with a view to reduce or eliminate the unnecessary jobs to minimize the human effort.

So that is also indirect benefit of work measurement or with this we try to do the work measurement. To assist in the organization of labour by daily comparing the actual time with that of the target time. So we can also organize our labour in a better manner after conducting the work measurement. Now what are the uses? So work measurement there is a spelling mistake here.

Work measurement is used in planning work and in drawing out the schedules which we have already seen in the objectives of work measurement. It is used to determine the standard costs for producing the parts.

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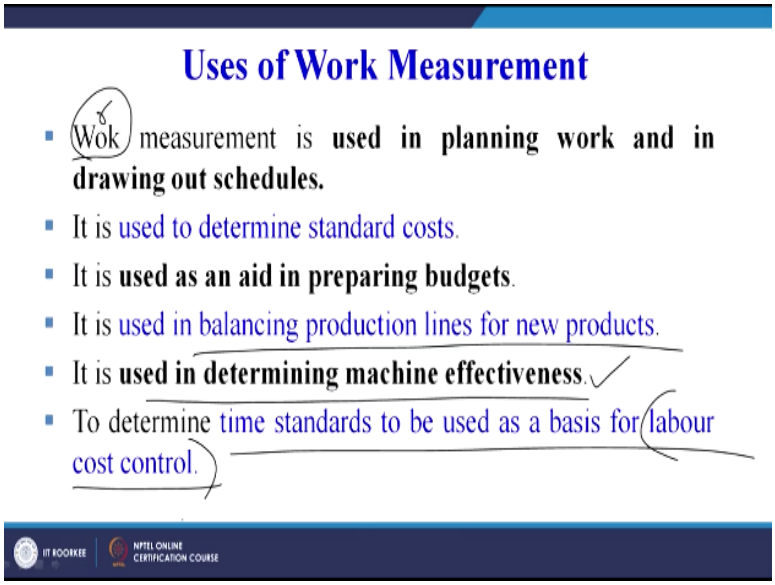

It is used as an aid in preparing the budgets because here we can very easily see that how much money has to be paid to the workers for performing the various tasks. It is used in balancing the production lines for new product. So if we know that what is the standard time required for performing the different operations on the shop floor or the various assembly operations very easily we can balance our line based on the standard time data for various operations.

It is used in determining a machine effectiveness which I have already discussed. To determine time standards to be used as a basis for labour cost control, so this is also basis for labour cost control. It is indirectly related to setting up of the wages, bonus, incentive schemes for the worker. Now very quickly let us see how work measurement output would look like.

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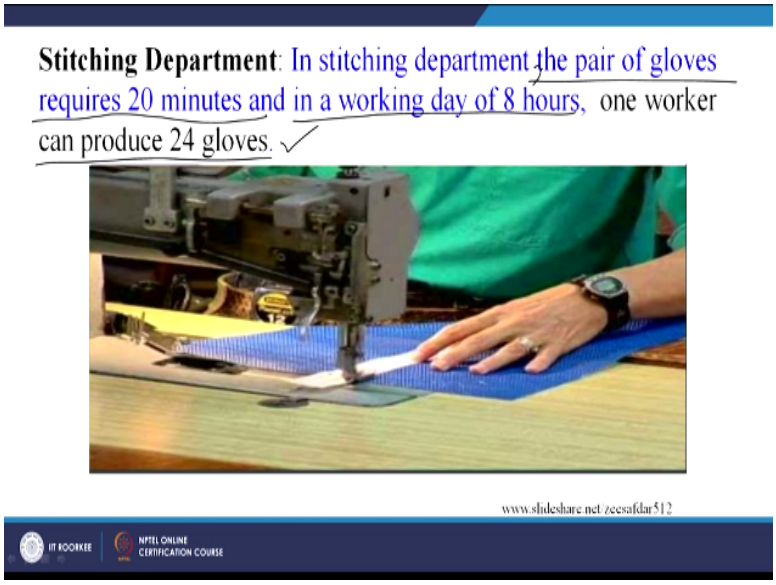

So in a stitching department the pair of gloves requires 20 minutes, one pair of gloves requires 20 minutes and in a working day of 8 hours that is 8 hours*60, 480 minutes, one worker can produce 24 gloves. So if we have a standard time required for doing a particular task very easily we can assign the work to the worker. So here it is direct mathematical division but in other cases when we will learn that work measurement techniques in detail we will see that we have to give certain allowances to the worker.

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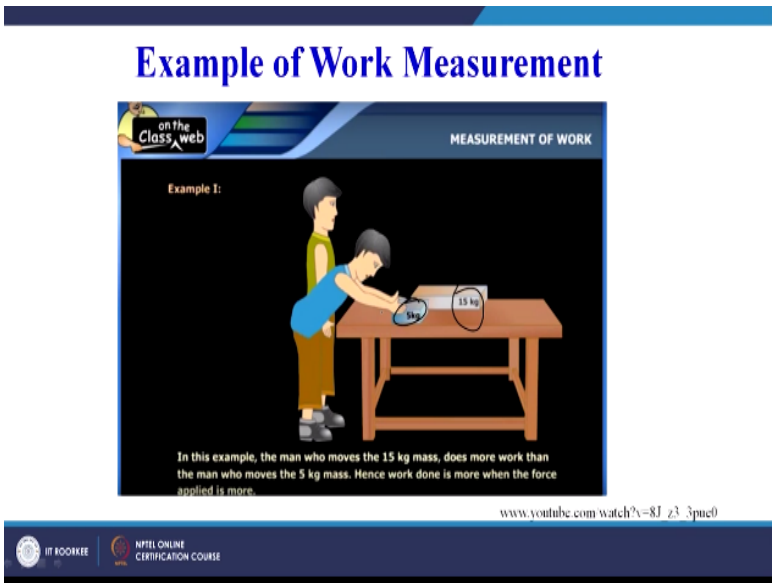

Another example, this is example of work measurement. Now there are 2 persons, one is this is 15 kg load and another one is 5 kg load. So in this example the man who moves 15 kg mass does more work than the man who moves the 5 kg mass. Hence, work done is more when the force applied is more. So maybe this is when we are going to set the standard time how much mass a worker is going to carry or what is the difficulty level of his or her task.

That is also going to be an important consideration when we are going to set the standard time for a worker. So with this I close the introductory session on work measurement. In our next session, we will try to see that what are the various types of techniques or various tools and techniques that can be used for work measurement. Thank you.