Industrial Engineering

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Module - 03
Lecture - 12
Work Measurement: Work Sampling

Dear students, you know that the productivity of an organization or of nation is important, because it is directly related with the standard of living of the people of that particular country or the community. There are various methods, which have been used for increasing, the productivity of an organization or of an economy, one of the techniques, which is commonly used for increasing the productivity of manufacturing industry is work study.

In the work study, method of carrying out the job is improved, using the method study technique and also to find out the ineffective time related with the various activities is investigated, and obtained through the work measurement techniques. We have seen that, there are various work measurement techniques, and therefore work measurement techniques, which are commonly used and these are the work sampling time study, predetermined motion time study method, and standard data method.

In this presentation, I shall be covering one of the work measurement techniques that is the work sampling. Work sampling is significantly different from, the time study technique, in which observation of the operator is directly carried out, by the work time study man, and time study is carried out with the help of a stop watch. A stop watch is used to quantify, the time being taken by worker for carrying out the job and the time study man also judges his performance, from his own concept of the standard performance.

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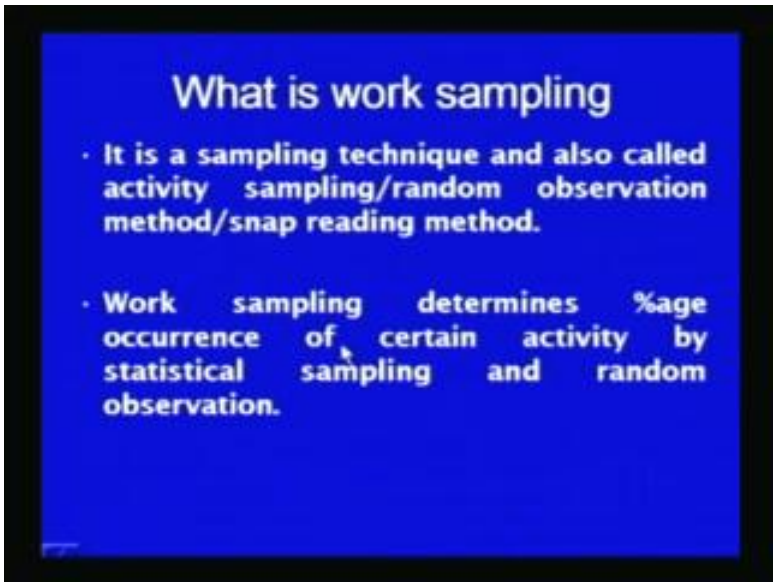

So here, the judging of the operator's performance, from his own concept of the performance, become significantly subjective and becomes some matter of the criticism. And, in that way, the work sampling is significantly different, because here in this technique work is measurement, work is measured by having the random observation of the shop floor or work area, and to find out.

How, the work is being carried out, where workers are working or machines are being run, and where ineffective time is present, due to the idealness of the machines workers this, the reason for the ineffective time, either of machine or of workers can be obtained, through the work sampling technique, by quantifying the reasons for ineffective time during the operation. So, if you have to define it or if you have to understand it, we have to see that, it is a sampling technique, and which is also called activity sampling or random observation method or snap reading method.

Snap reading method it just like a taking the photograph of the shop floor, which is to be investigated or studied for work measurement. And that, snap will indicate at that movement, how many persons are working, how many machines are being run and how many operators are engaged, in other than the activities, which are required to be done. So, work sampling actually determines the percentage of occurrence of certain activity, by a statistical sampling and the random observation. The random observation of the

work area is very important to find out, any meaningful inferences from the study and to conclude in the positive way

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As we know, that for efficient operation, and it is control of the shop floor, it is necessary to know, what is going on in the shop floor, what is the percentage of time in which, work is actually being done. So, to have the complete picture of the production time and a non production time, of the machines and workers in the work area, it is necessary to have the proper study of the shop floor. So, that the operation of the shop floor, can be properly controlled and the required output can be obtained as per plan.

But, for having the complete picture of the shop floor and obtaining the information about, that how many machines are actually being used, and how many machines are not in use or ideal due to one or other reason. Similarly, how many workers are actually working, and how many workers are not engaging them self in the activities, in which they should be working, so to find out the real picture of the shop floor.

It is there can be number of ways, one way, which can give the picture of the shop floor is the direct and a continuous observation of the shop floor, but if the shop floor is very big, and a large number of the machines and workers are working, it would require deployment of the large number of the work study. And the work measurement people, who will be noting down, what is being done by the worker, and which machine is being operated, and which is ideal.

So, this kind of deployment will not be economical or largely, it would be impossible to do, so unless, the large number of the people are employed, and which will not realistic. So, employing the large number of people to have, exact the picture of the shop floor, regarding the status of the man and machine, whether they are being engaged in the activities, which are required or not. The deployment of the large number of the people would not be economical and it would be unrealistic, therefore, to deal with this kind of situation, work sampling technique is found very useful.

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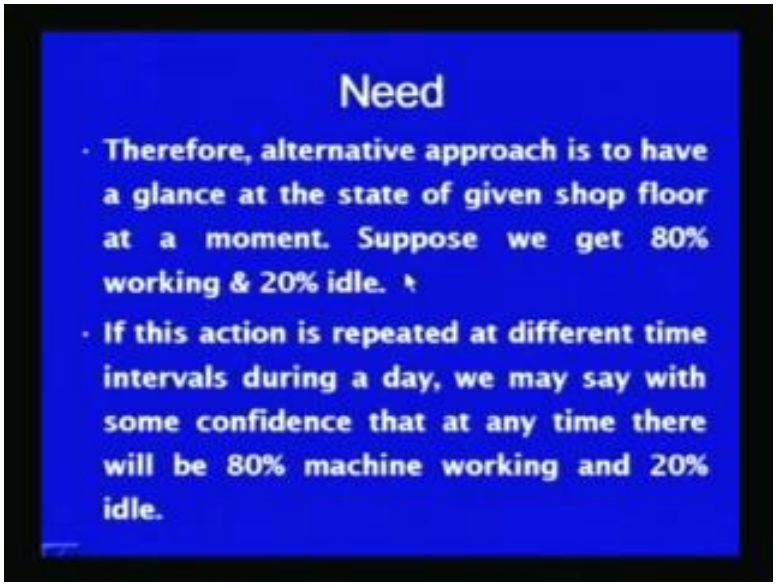

And alternative approach to have the idea about, the shop floor activities, at particular movement, what we can do is that have a glance, at a state of given shop floor at a moment, and note down what is going on, in the shop floor at a particular movement. Suppose, if we get, that 80 percent of the people are working, and 20 percent are idle, then just by1 or 2 observations, we may not be able to say with any confidence, that what is the percentage of the people who are working or what is the percentage of people or the workers, who are actually not working at any moment.

But, if we have a look, on the shop floor at different periods at different times, and that is repeated number of times, if this action is repeated at different time intervals, during the day. Then, we may say with some confidence, that an, at any time, there will be 80 percent of the machines working or 20 percent of the machines are idle or 80 percent of the people are working or 20 percent of the people are idle.

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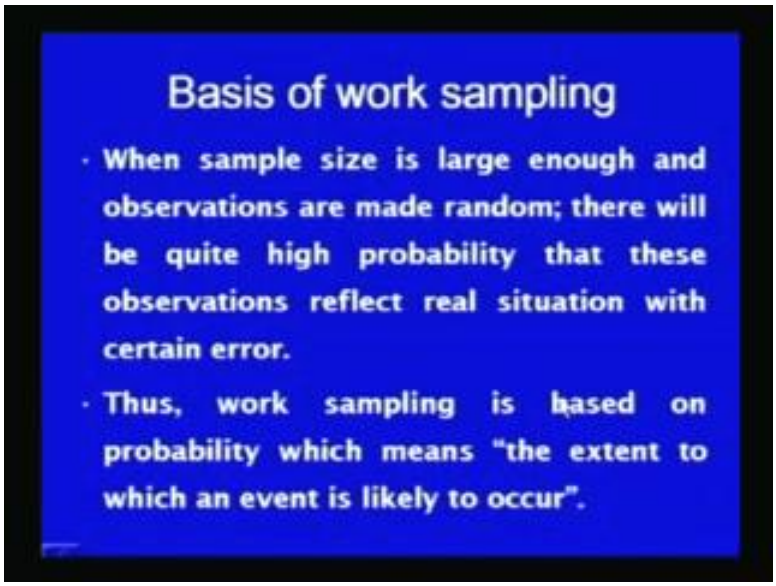

The basis of the work sampling is the probability, if and the number of observations, that we carry out, of given work area, if when the sample size is large enough, and the observations are made randomly, then there will be quite high probability, that these observations reflect the real situation, with the certain error. So, if we go on increasing the sample size of the observations, and large number of observations are carried out, at random intervals, and the these, observations can show the real situation, and with the certain percentage of error. So, work sampling is largely based on, the probability which indicates the extent to which an activity is likely to occur.

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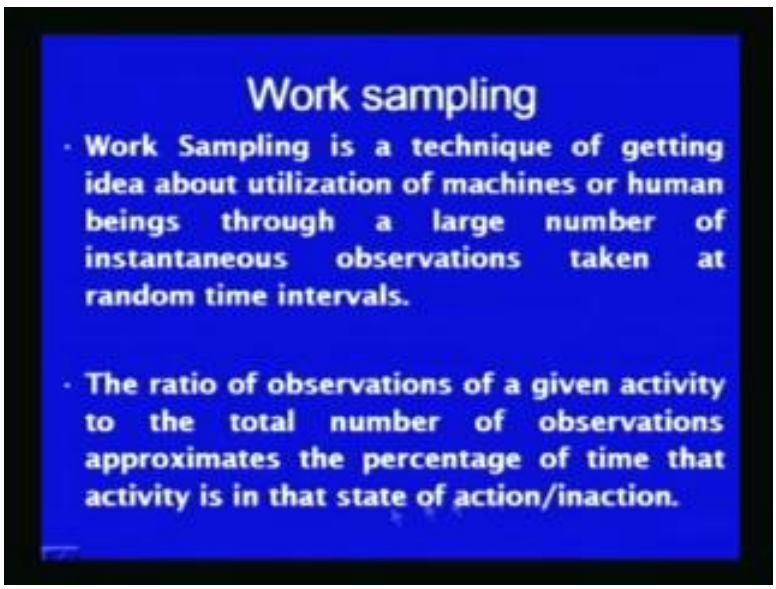

In the work sampling is a technique of getting the idea about utilization of machine or human beings, through large number of instantaneous observations, taken at random interval. So, in this technique, the large number of instantaneous observation of the shop floor, are taken, so that the real picture about, the shop floor activities is obtained, without having the continuous and direct observation of the workers and the machine. The ratio of the observations of a given activity, to the total number of observation, approximates the percentage of the time, that activities in a state of either action or in action.

So, depending upon the total number of observations that have been carried out of a shop floor, so how many times a particular machine is found to be in action or in action that is quantified. So, if we find, that 80 percent of the time machine is found to be in working condition, out of the hundred observations, then 100 percent, then 80 percent will be, then we can say with the certain degree of confidence, that 80 percent of the time the machine is engaged, and 20 percent of the time the machine remains idle.

So, the percent of observation of a given activity, in terms of the action or inaction out for the total number of observations, gives the idea about, what is the percentage of the time, when particular kind of activity is there, or it is not being done.

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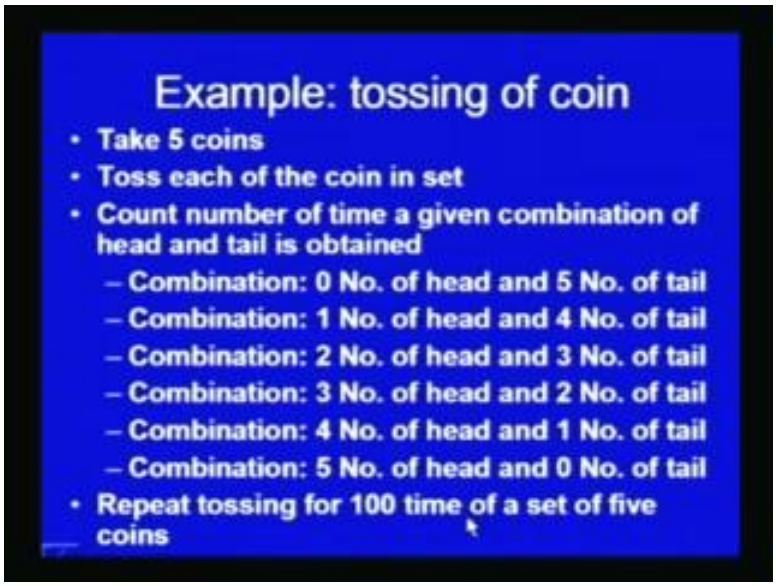

For example, if we take 5 coins and these coins are tossed, and each of these 5 coins is tossed, and then tossing will give us, either head or tail, so the possibility of having the

head or tail, combinations will be different for each of the 5 coins in1 set. So, this possibility and these possibilities can be as given below, like we may have 0 number of heads, or all 5 number of tails, there also possibility of having 1 head, and 2 number 4 number of tails or 2 heads 3 number of tails are likewise 5 number of heads and 0 number of tails.

So, these are the various possibilities, when a set of 5 coins is tossed, we may have either, all tails or 1 tail, and 4 heads, or 2 tails 3 number of heads, so what is the possibility of having either head or tail, it is we can say, that the 20 percent will be the possibility. Here in this case, it will be 1, 6 times, will be the possibility of having1 particular combination, so if this tossing is repeated 100 times, for 5 set of the 5 coins, then what kind of picture we can, have after summarizing the number of heads and the number of tails in all.

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Combination		No. of Combinations
Heads (p)	Tails (q)	
5	0	3
4	1	17
3	2	30
2	3	30
1	4	17
0	5	3
	Total	100

Then, that we can see here, the combinations that we can receive is, after the 100 number of times of tossing, that 5 heads and 0 tails are found to be there, for 3 times and the 4 number of heads and 1 tail combination was found to be there, for seventeen times, and 3 number of heads and 2 tails are found to be there in, for 30 times, and the 2 number of heads and 3 tails were found to be there for 30 time, and 1 head and 4 tails found to be there for 17 times, and a 0 head and 0 number of head and 5 tails, can be found for 3 times.

So, if you see this distribution comes out to be, on the extreme sides it is minimum, that is 3 only for 0, 5 or for 5, 0, a combination of head and tail. While, the possibility is maximum of 3, 30 percent where either, 3 heads and 2 tails or 2 heads and 3 tail, combination, which can occur, so if this distribution is seen, in this diagram.

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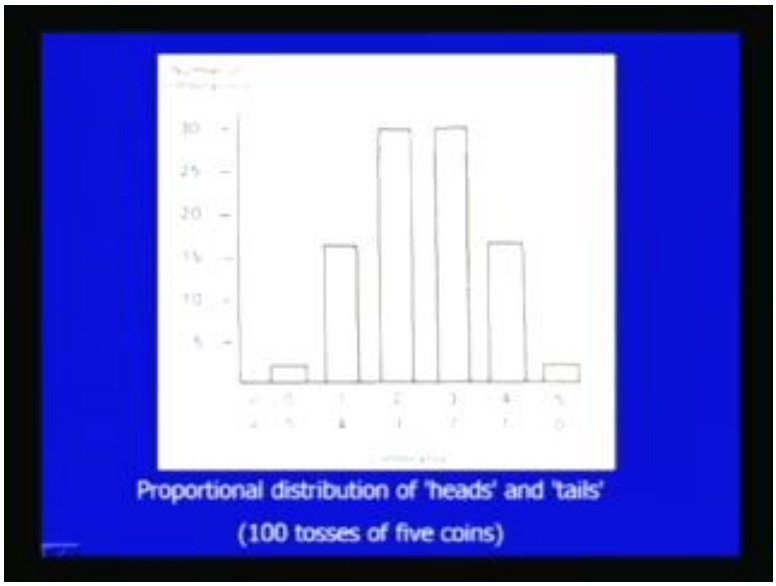

Indicating the different combinations in x axis, and the number of observations for a particular combination, if we see here, here 0 head say or 5 tails for 3 times, and the 0 tail and 5 heads for 3 times, and for 1 and 4 combination, 4 and 1 combination, we have the 17 number of observations for these 2 combinations, and for 2 head and 3 tails and 3 head 2 tail combination, have 30 number of observation.

So, this distribution, is such that the chances will be the maximum, for a combination of 3 and 2 or 2 and 3, while at the extreme end chances, will be will be minimum for having this particular kind of combination of the head and tail, if these observations are further, increased and to the large numbers.

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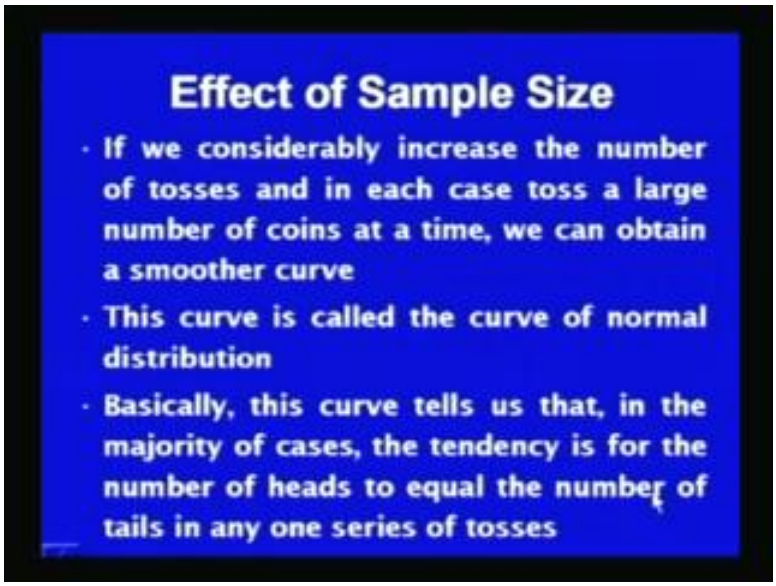

Then, it will help us to see, the more, clearer picture, the way by which distribution can occur, when a particular activity is carried out or when the number of observations are increased. If we considerably increase the number of tosses, and in each, in case of the task large number of the coins are used at a time, we can obtain a smoother curve, and this curve will show the normal distribution tendency. And basically this curve tells that, in the majority of the cases, tendency is for the number of heads, to be equal to the number of tails in anyone series of the tosses. Now, instead of the set of 5, number of coins, if we take set of large number of coins and they are tossed for, so many times for having large number of observations, and if the distribution of head and tail is seen.

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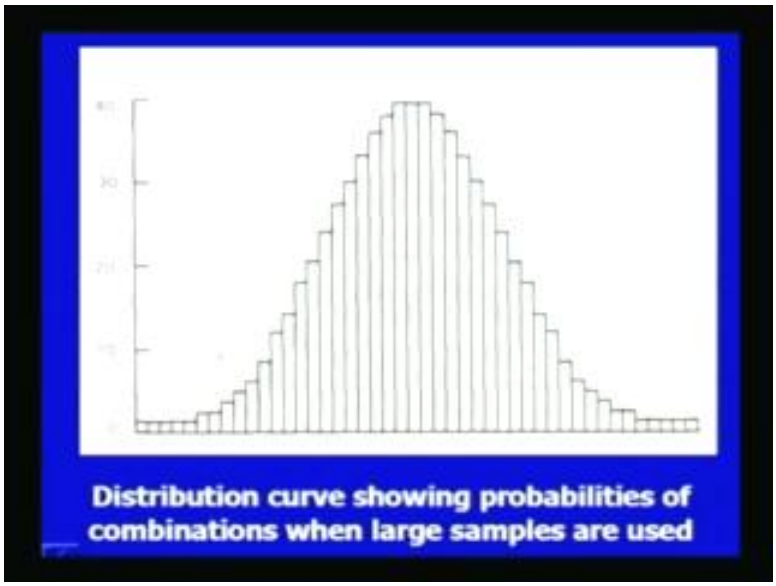

Then, we find that the chances are almost 50, 50 to have head or tail, while having the combination of, particular kind of combination like 0 5 or means the combination, which are of the extremeness are will be having minimum possibility. While the combinations corresponding to the, the 50 percent value, will be having the maximum chances of the tendency. So, if the large number of, observations are taken then we find a distribution, which is largely normal and that can be seen, in this diagram.

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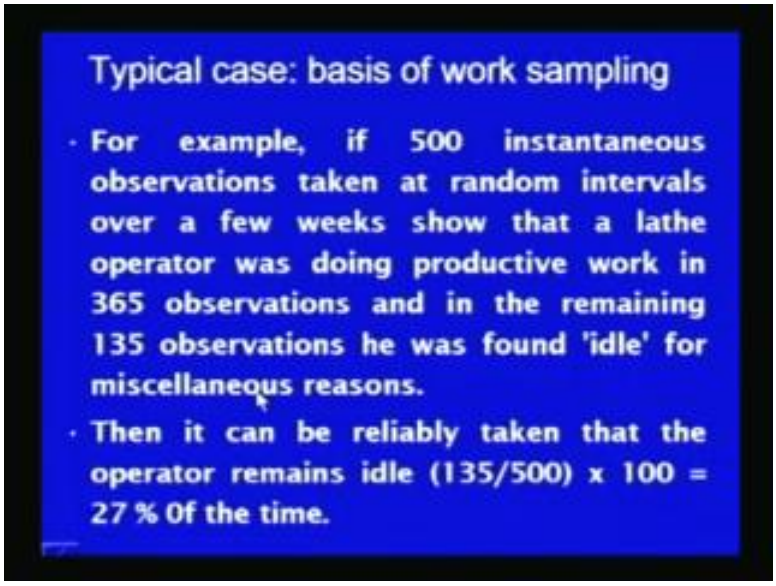

So, if we take say for example, if the, this kind of sampling of a shop floor is applied to investigate, that the term percentage of the time when, workers are engaging them self or the percentage of time when they are busy in other activities. Then, how we can apply the work sampling technique, say for example, if the 500 instantaneous observations are taken at random interval, over few weeks and these observations show that lathe operator was doing productive work for 365 number of observations, and in remaining 135 observations, he was found to be idle, for due to the miscellaneous reasons.

Then, it can be reliably taken, that the operator remains idle, for say 20 percent, which can be obtained from the number of observations for, which he was idle out of the total number of observations, that is135 divided by 500. So, that can be, used to see that, what is the percentage of the time when he remains idle.

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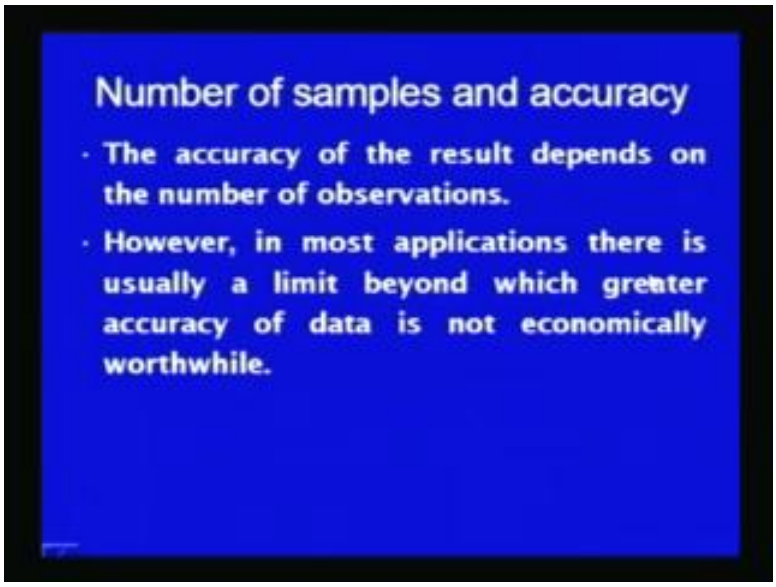

So, the accuracy of the, such kind of results, depends upon the number of observations, which are being taken, in most of the cases, there is a limit, beyond which greater accuracy in data, is not found economically justified. We can certainly increase the number of observations, but we have to see that, what is the accuracy desired in having the data. Many times even few observations also give, the approximate picture of the shop floor, regarding the activity of the machines and workers.

Unnecessarily having the large number of observations will simply increase the cost and the whatever, increase in accuracy is there, that may not be required also. So, depending

upon the accuracy desired the number of observations are taken and after all there is a limit, beyond which the greater accuracy, may not be of any use, from the economics point of view. So, further work sampling can be useful for, establishing the time standard on both and direct and indirect labor jobs.

So, if this kind of study is carried out on, on the workers over a long period of time, and to see, that what is the percentage of the time, when he is engaging himself, in carrying out the job. And, what is the percentage of, what is the amount of output, which is being delivered by engaging the job, for which he has been rated or for, by which he has been observed, that whether he has been engaging for 80 percent of the time or 60 percent of the time.

And, in the engagement of the 60 percent of or 80 percent of the time of the total time, in which he has produced certain output, that is used to find out, the observed time value for carrying out one particular job. And, that observed time value is added with the allowances, to find the standard time, so the work sampling, can also be use to set stand time standards, for both direct and indirect labor. For setting the time standard and the work sampling is carried out, using a particular procedure. And, in general also the work sampling, follows certain steps, in which the first of all it is required to define the problem.

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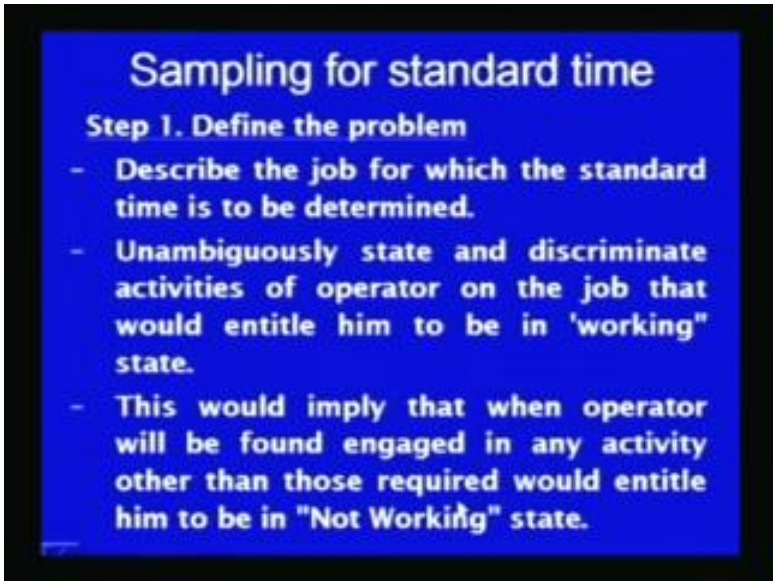

What is the purpose of carrying out the work sampling, and so what are the objectives behind, carrying out the work sampling. Whether time standard is to be set or it is just to be observed, that what is the percentage of ineffective time, in ineffective time related with the machines or with the workers, so describe the job, for which time standard is to be determined, if the work sampling is to be carried out for setting the time standard, that is defined first.

And, any unambiguously state or discriminate activities of the operator on the job that would entitle him, to be in working state. So, precisely, it is defined, at what are the kind of activities, if worker is found to be doing those activities, then the he will be considered as working or what are those activities, if he is found to be engaged those activities, then he will be considered as nonworking.

So, the set of the activities is identified first, to see if the worker is engaging himself, in carrying out those activities, then he is considered to be working, and all other activities in which he, is not suppose to be then the and he is engaging himself, during the work period or shift period, and he is considered to be idle. So, very clear cut statement is to be made, regarding the kind of activities, which will entitle him to be in working state, this would imply that when operator, will be found engaged in any activity, other than those required, would entitle him to be in not working state. So, this is very clearly defined in the beginning, the kind of the job for, which the time standard is to be set and, when he will be considered to be in working condition, and when he will be considered, in the nonworking state.

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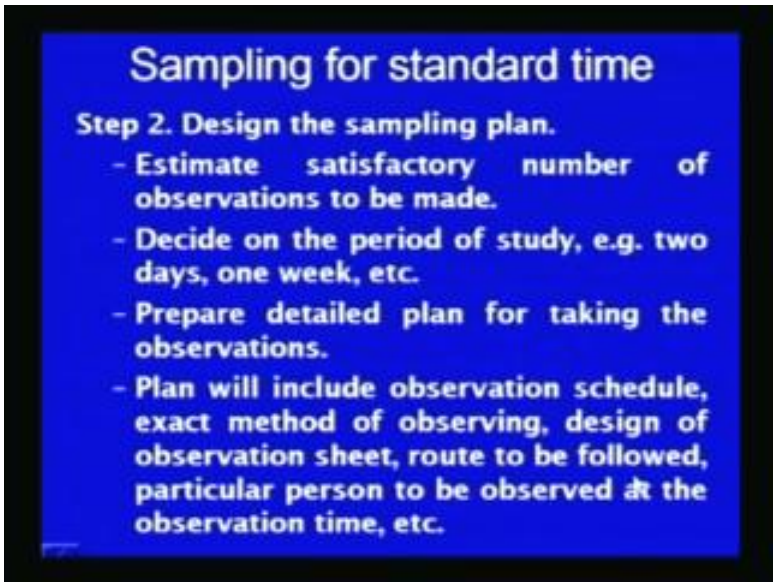

After that, the sample plan is designed and for designing the sample plan, we have to see that, the satisfactory number of observations are taken, so how many observations are to be taken, that is determined using the different methods, some of methods will be covered in this presentation. And, decide on the period when the study is to be conducted, this period may be spread, over few days to the few weeks, so depending upon the time period, the time when this study is to be conducted, decision regarding that is taken, and then detailed plan is carried out, for taking the observation.

Detailed plan will involve, that when work study man or the time work study man, will be visiting to the shop floor for having a glance, to see that what is going on at particular moment of the time. So, the detailed plan and the random randomized time plan is obtained, to have the observations of the shop floor and then plan, will include the observation schedule, exact method of observing, design of observation sheet and the route which is to be followed during the observation, and the particular shop the person need to be observed, at the observation time.

So, what are the things to be observed related with the worker, who is to be checked and, who will be the part of the study and the observation sheet is to be there in a proper format. So, that the information being collected is can be analyzed, properly later on, and through which route, the work study man will be going for the study, and the method, in which way observer, will be observing this shop floor and in which way, the

observations will be carried out, what will be the schedule of and the study. So, the plan of the study and the detailed plan of the study is prepared first, which includes the number of things ranging from schedule, to the method of observation, designing the observation sheet, and to see that, where visits will be conducted to carry out the observations.

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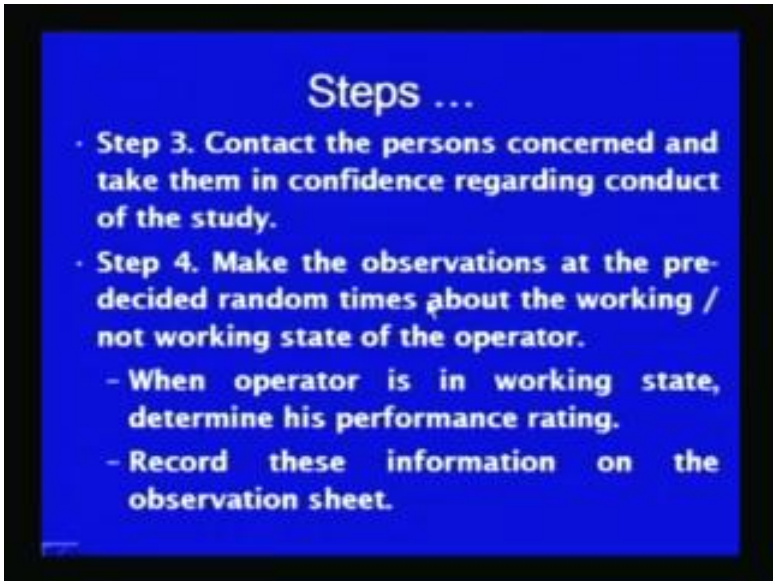

And, the third step, in the work sampling, will be to the contact to contact the persons concern, with the, the shop floor, where study is to be conducted and take their permissions, and the required approvals, after taking them into confidence, regarding the conducting, conduct of the study. So whether, the supervisor or the manager of the shop floor is there, he is to be contacted first, and it to be taken into the confidence.

So, that he can be informed about, the kind of his study, which is to be conducted in the shop floor, to see the kind of percentage of the people or the machines are working and quantify, the way by which people are engaging themselves. In the shop floor and to have the clear picture about or to set the time standard or to compare the performance of the different departments or to compare the effectiveness of the different methods, there may be different applications of the work sampling, for which it can be applied.

But, wherever study is to be conducted, the person responsible for that shop floor is to be taken into confidence, and after taking him into the confidence, random observations are made according to the plan, which has been prepared earlier, about the working or

nonworking state of the operator. The randomized time table is obtained with the help of the random tables and those will be the part of the plan, which is, which will be developed for carrying out.

The work sampling, study through the observations, random observations of the shop floor and when operator is in working state, the operators working performance is assessed, determine his the performance rating, if the worker is being observed and though then the same thing is recorded, in the in the observation sheet. For carrying out the work sampling as the preparation of the plan of the work sampling is very important, in that plan in addition to, the shop floor and the route, and the time when observations are to be carried out, it is important to see that how many observations should be carried out.

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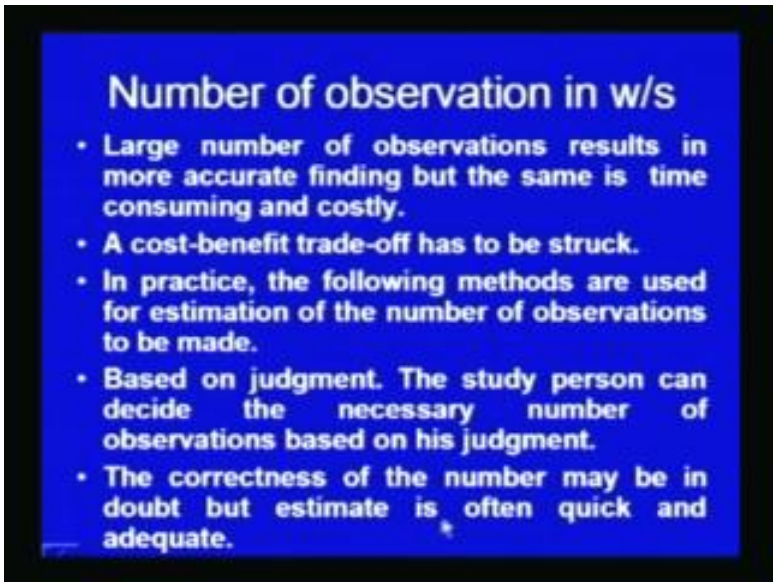

So, that whatever, results are obtained, they are accurate and they will serve the purpose generally increase in number of observations, increases the accuracy of the finding, but at the same, increase in number of observations, also increases the time required for carrying out the study, and the cost also. Therefore, cost benefit trade off has to be struck, so that what is the accuracy actually desired for the given purpose for, which study is being conducted and what is the cost, which can be bond with means.

So, the cost, which can be taken up for a given accuracy, so accuracy is to be decided very carefully, depending upon the purpose for, which study is to be conducted, and

depending upon the accuracy desired in the data of the sampling study, number of observations are carried out. And, generally these are based on the tradeoff between, the required accuracy and the cost, in practice the following methods are used, for estimation of the number of observations to be made.

Based on the judgment, one way, one simple way is that the work sampling person, who has carried out, who has performed over number of work sampling studied earlier, will be having idea, about the number of observations, which will be required, for carrying out a particular kind of activity, for a given degree of accuracy in the data. So, the study person, can decide himself, the required number of observations based on his judgment, but many times it may not be correct also, the correctness of the number, may be in doubt, but estimates often are found to be, quick and adequate. Another, method for to find out the number of observations for carrying out the work sampling study is the use of cumulative plot of the results.

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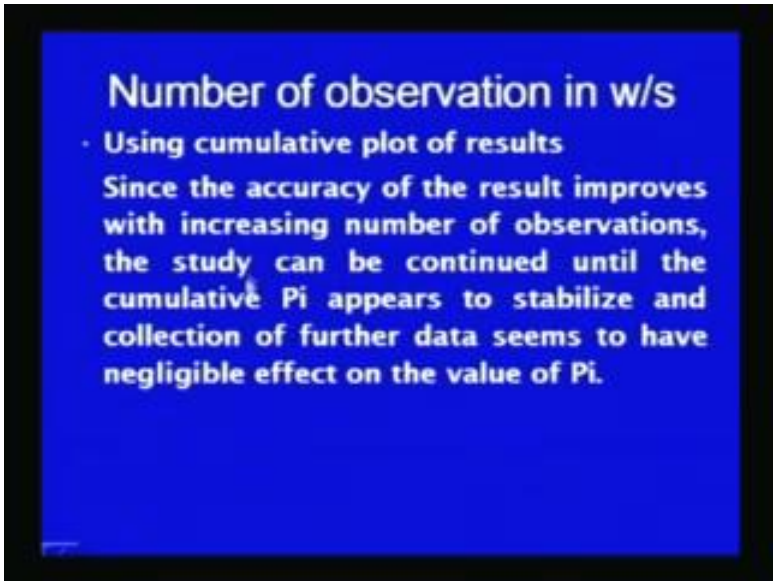

Since, the accuracy of the results improves with the increase in number of observations, a study can be continued, until the cumulative value of the, percentage of occurrence of activity, appears to be stabilized, and the collection of the further data seems to have, negligible effect on the value of P i.

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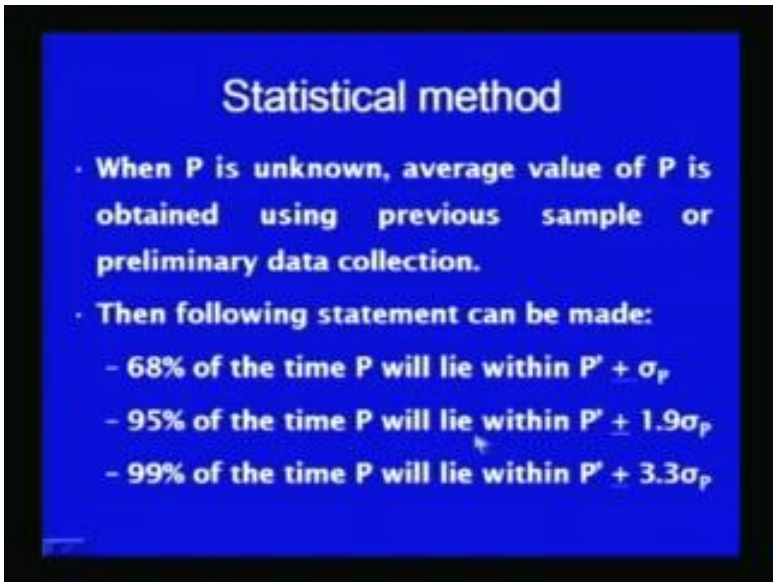

And, to have the rough estimates of the percentage of occurrence of particular activity, we may go either, for the preliminary study as we have discussed in the last slide, alternatively we can also see, the data from the previous samples or from the records itself. So, if the rough data of the average value of P is available, no need to go for the preliminary study, and then the following statements can be made for 68 percent of the time, P will lie within the P average plus minus sigma P, and 90 percentage of the time P will lie within the P dash plus minus1 point 9 times of the sigma P, and 99 percentage of the time, P will lie within plus minus 3.3 sigma P.

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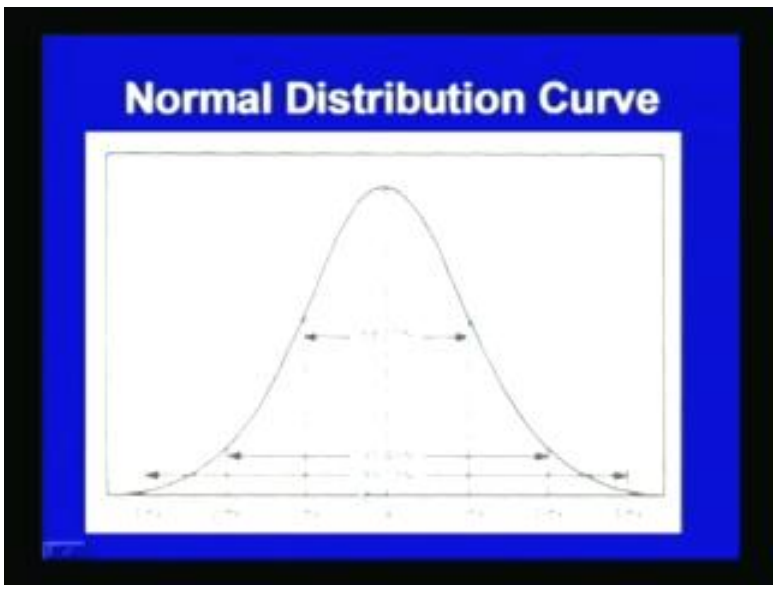

Here, the same thing we can see here, with the help of the normal distribution curve, that for the 68 percentage of the time, here it is the spread, on both the sides of the1 sigma P and the 2 sigma P is spread of 99.45 percent, and 99.73 percent for 3 sigma P is spread over the size of the average.

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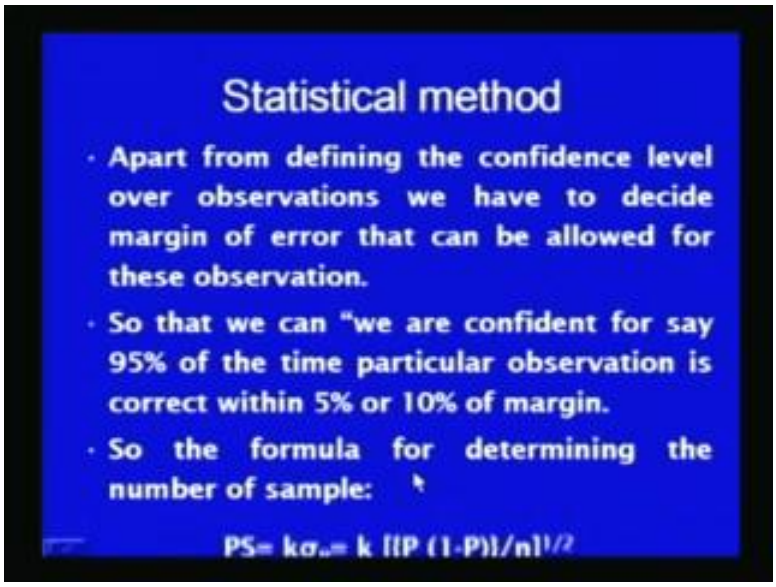

Apart from defining the confidence level, over the observation we have to decide, the margin of error also, that can be allowed for these observations. So, that we can say that, we are confident for saying, of the 95 percent of the time, particular observation is correct within 5 or 10 percent of the margin. So, the formula for determining the number of samples can be seen, from this equation PS is equal to k sigma P, here all these things indicate this entire portion indicates, the sigma P formula for the sigma P, when the number of samples are more than 30, and here it is k, so P S is equal to k sigma P is the equation, which is used to calculate, the number of observations.

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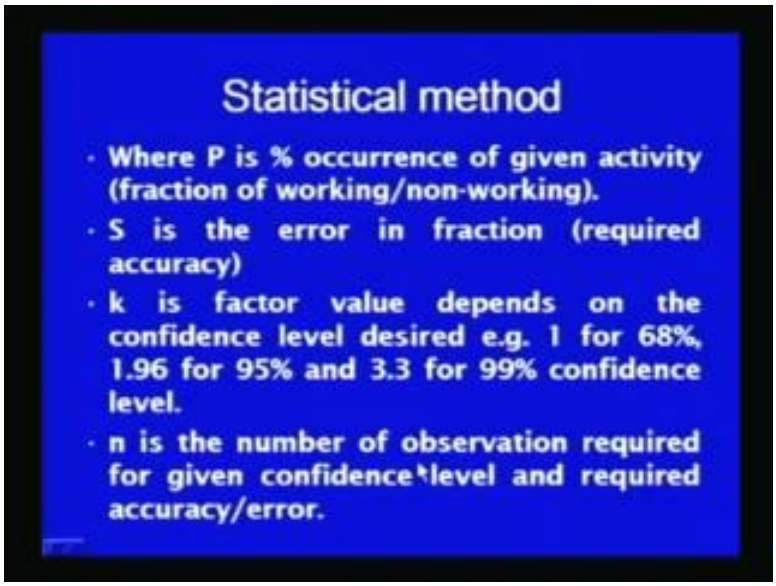

Where P is the occurrence of a given activity that is obtained from, the fraction of working or nonworking out of the total observations, S is the accuracy in fraction S is the error in fraction, that is the required accuracy. k is the factor, the whose value depends on, the confidence level desired, it is value is taken as1, for 68 percent confidence level 1.96 for 95 percent confidence level, and 3.3 for 99 percent confidence level in the data. And n is the number of observations required, for a given confidence level and the accuracy the above equation.

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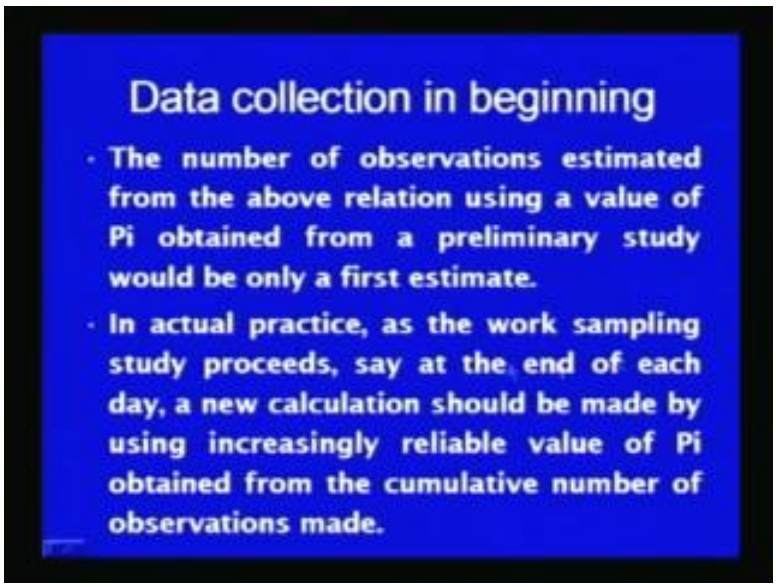

The number of observations estimated from the above relationship using value of P i, obtained from a preliminary study, would be like would be only the first estimate. In actual practice, as work sampling study proceeds, say at the end of each day new calculations should be made by using the increasingly reliable value of P i obtained from the cumulative number of observations made.

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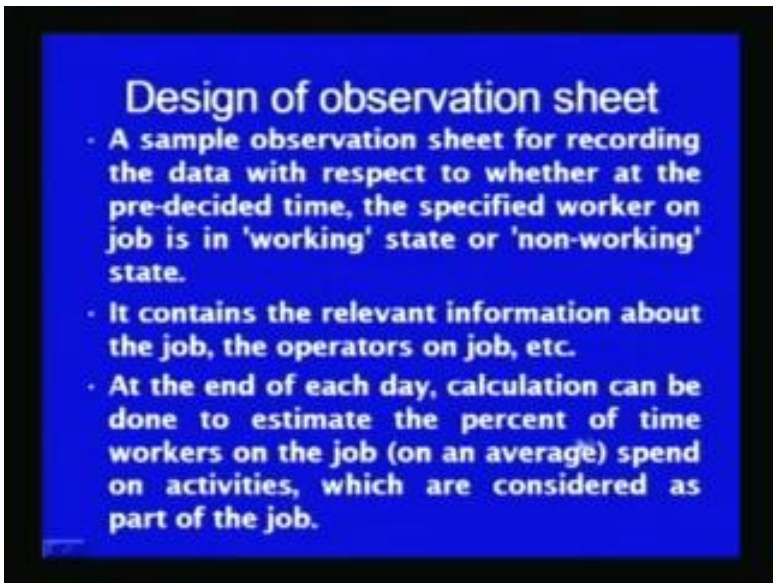

And likewise, the process whose is continued, until we get that for a given accuracy desired and the given confidence level desired, the number of observations are number of observations required, are less than the number of observations, which have been actually carried out. So, that when that situation, arise study further work sampling study is stopped, and we say that the required number of observations have been achieved, for a desired accuracy and the confidence level in data.

For collection of the data, during the study it is important that the observation sheet is properly prepared, so that the information desired can be accurately entered, and later on tabulated easily. So, as to find out the working state or nonworking state, of the particular item, whether he is a worker or it is the machine, which is to be investigated, so a sample observation sheet for recording the data with respect to, whether with respect, whether at pre-decided time, a specified worker on the job is working state or in nonworking state.

It contains the relevant information about the job operator and the place and the date and the sampling study person, who will be can carrying the study etcetera. All other information are also entered in the observation sheet, at the end of each day calculations can be done to estimate the percentage of the time worker on the job, on an average, it spends on the activity, which are considered to be the part of the job, so the percentage of occurrence of the activity, at the end of the each day of study is obtained.

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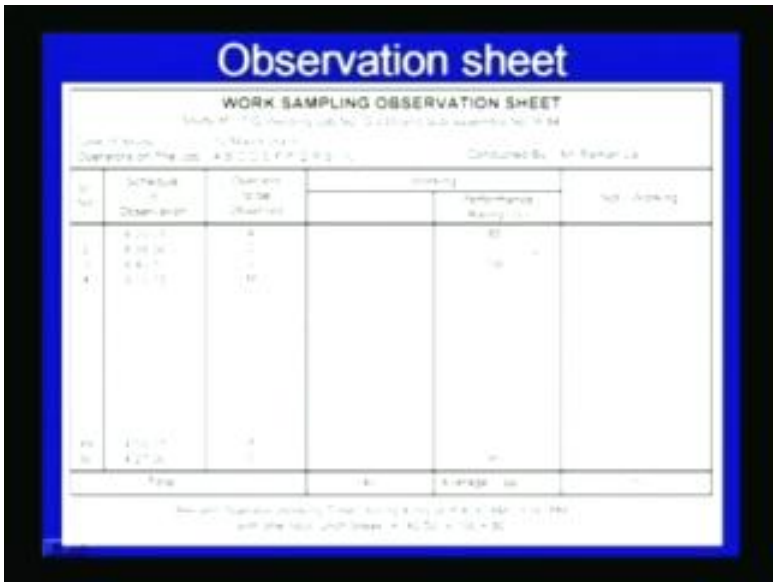

This form shows the typical observation sheet for work sampling study, it can have, the number of many information like the schedule of the observation and the operator to be observed and whether the operator is working or whether he is not working. If the operator is working, then simply tick marks are used, and if it is found that, he is working his performance rating is also entered here, and if he is found he is not working, then that those tick marks are made, in this region corresponding to the different times, when study was suppose to be conducted.

And, this information can be seen here, after entering the general information like, when a study data of the study, and the operators who are to be investigated and the person, who is conducting the study, the schedule is mentioned the operator, who is to be investigated is mentioned. And, the working or nonworking status is also ticked for the different observations, and their performance rating is also entered and at the end of the

day, average is obtained for the percentage of the time people are found to be, in inactive state or in active state in working or nonworking state.

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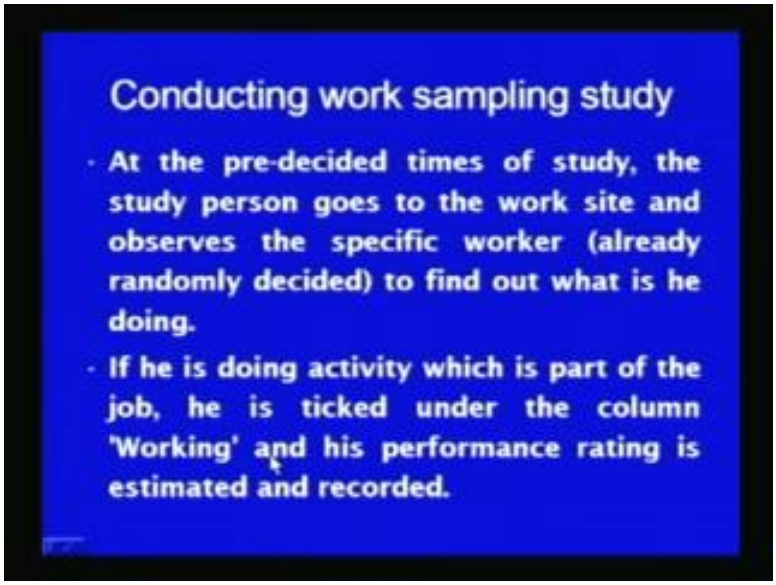

For conducting, the work sampling is study and obtaining the, and having observation, at pre-decided time of the study, the person goes to the work site and observes the specific worker to find out, what he is doing. If he is doing activity, which is a part of the job, he is ticked under the column working and his performance is estimated, and the recorded.

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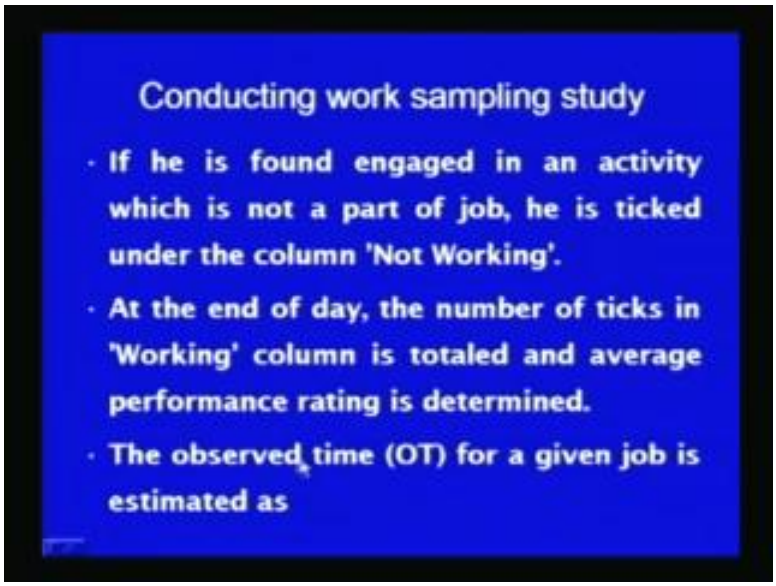

And, if he is found to be engaged in activity, which is not part of the job, then he is ticked under the column of not working and at the end of each day, number of ticks in working column is totaled, and average performance rating is determined, the observed time O T, for a given job is estimated as given in the following equation.

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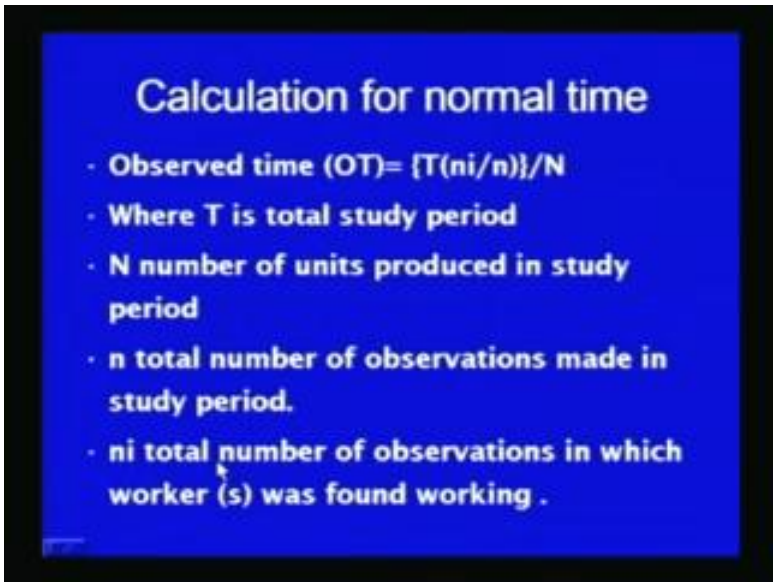

Where, observation time O T is found, using the T into n i divide by n, divide by capital N, where T is the total study period, N is the number of units produced in the study period, and small n is the total number of observations made in study period. Then, n i is the total number of observations, in which worker was found to be in working condition, so if he is producing the capital N number of units, over a period of the time. T of the study, in which n i is the percentage, n i is the number of observations, in which he is found to be in working, and the remaining he was the idle, out of the total number of the observations a small n.

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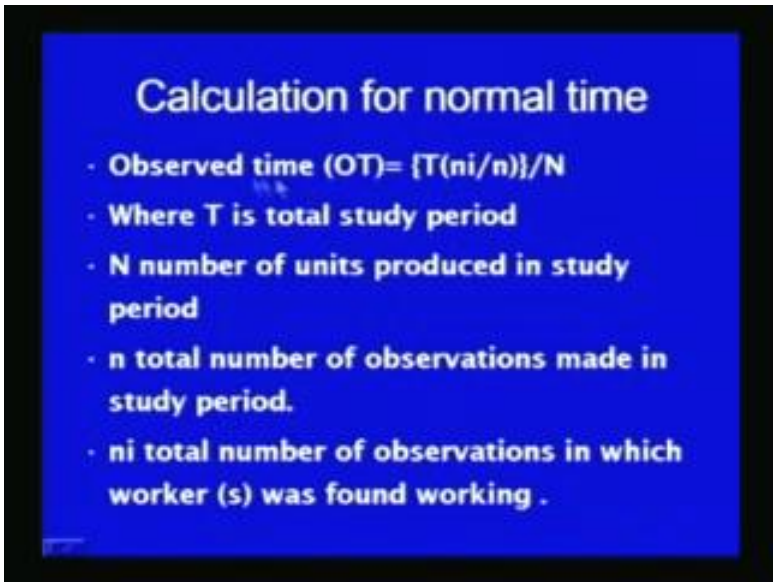

So, this is how, observed time or average observed time for producing an, unit item, can be obtained for a particular worker. So, T multiplied by the number of times, he is found to be working out of the total number of observations, divide by total number of the product he has produced, this equation is used to calculate the observed time for producing a particular job.

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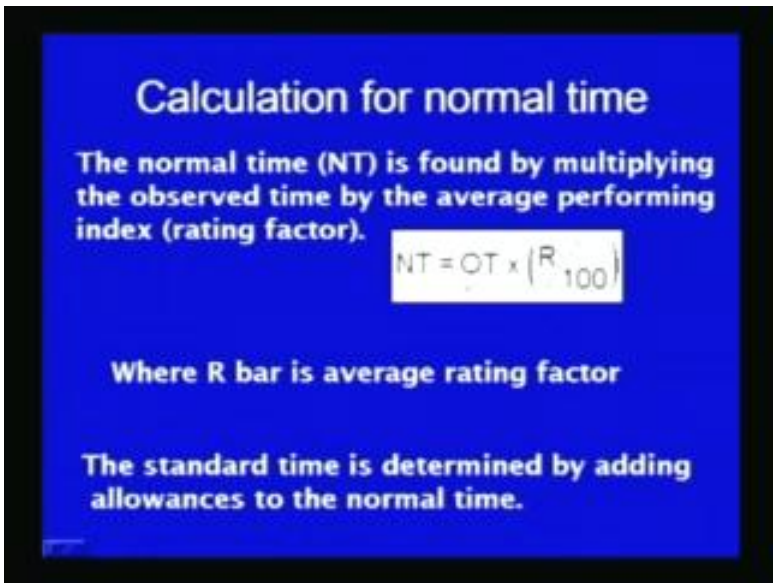

And to find out then normal time, the observed time is multiplied by the average performance rating of the worker. And, so here normal time N T is calculated using

observed time, multiplied by the average rating performance of the worker, R bar indicates the average rating factor of the worker during the study. So, the standard time, with the help, standard time is further calculated by using the normal time and adding the suitable allowances, allowed too.

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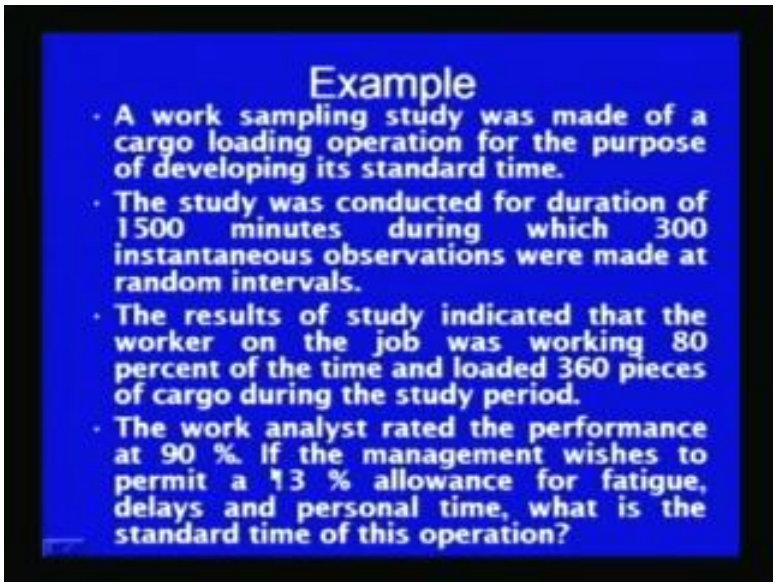

And, this can be made further clear using this example, that a work sampling study was conducted, on cargo loading operation, for the purpose of developing it is time standard. And, study was conducted for a period of 1500 minutes, during which 300 or instantaneous observations were made, at random intervals, and the result of the study indicated, that worker on the job, was working 80 percent of the time and he loaded 360 pieces of the cargo during the study period.

And, work analyst rated the performance of the worker 90 percent and if the management wishes to permit a 13 percent allowance, for fatigue delay and the personal time and what will be the standard time for this observation. So, here we have the important data about, the total period of the study is 1500 minutes, and in total 300 of observations is were carried out, spread over 1500 minutes and study showed, that he all he loaded 360 pieces, over the entire period of the 1500 minutes. And, he is, he was found to be working for eighty percent of the time, and his performance was rated ninety percent and the management allowed him, thirteen percent of the allowance.

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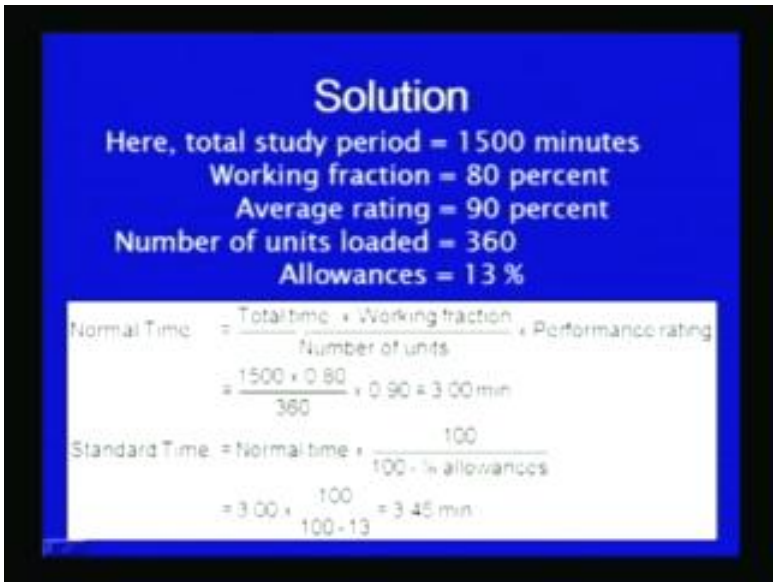

So, if we see here, the total study period is 1500 minutes, working fraction is 80 percent, average rating is 90 percent and number of units he loaded 360, and the time the allowances allowed 13 percent. And, the normal time can be calculated from the total time of study, working fraction divided by the number of units, into the performance rating of the worker. So, this gives the, that the total value of 3 minute for loading an, unit item.

And, if the standard time is to be calculated, the normal time into 100 divide by 100 minus percentage allowance, which is allowed by the management. So, if by putting the values in the equation, we can see that, the standard time comes out to be 3.45 minutes. So, this is how, if we have idea about the total time during which, worker is working and if we know the, what is the percentage of the time he is found to be in working condition, and the number of units, he has produced over the total entire study period.

And, what is his rating performance rating then we can establish the standard time, for carrying out a particular job, by the work sampling study. And, because of it is unique nature of the work sampling, that it does not require continuous observation of the, worker or of the shop floor, for carrying out to for quantify the work content, and to establish the time required for carrying out given job. This method can be effectively utilized, in number of situations like to compare the efficiency of the two departments.

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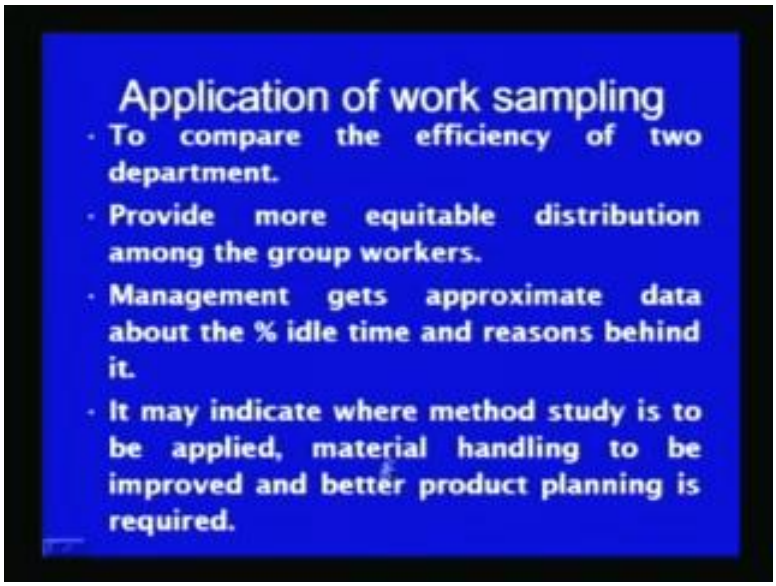

Random sampling of the two different departments can be carried out to see, the relative efficiency of the, two department, and to have the more equitable, to have more equitable distribution, among the group of the workers. So, from the work sampling study we can see, for how long time a particular worker or group of workers is, workers are more engaged in work compared to the other group of the workers or an individual worker.

So, that more equal distribution of the work can be obtained, between the group of workers, management gets the approximate data about, the idle time and the reason for it, the reason behind the idle time. So, this helps the management, to take the necessary corrective actions, in order to cut down the ineffective time, after going through it is reasons. It may indicate, where method study is to be applied, material handling to be improved and better product planning is required.

Percentage of occurrence of the idle time and it is reasons, will also indicate the areas, where there is a scope of the method study, and where better planning of the work is required, to provide the job to the workers, when it is required. And, in view of the uniqueness of the work sampling study, it offers various advantages over the other time work measurement techniques.

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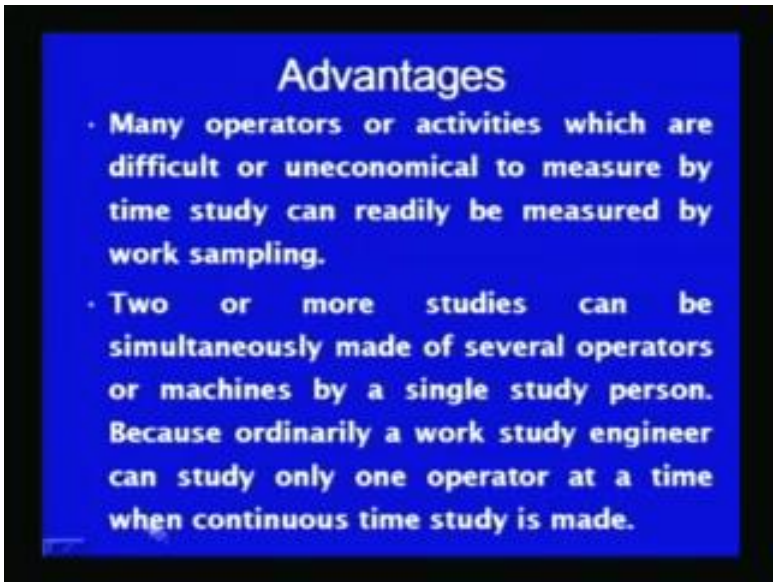

Like, many operators or the activities, which are difficult or uneconomical to measure by the time study can readily measured by the work sampling technique. Two or more studies can be simultaneously conducted on the several operators or the machines by a single study person, because ordinarily work study engineer, can study only one operator at a time, when continuous time study is made. So, this is the big difference for carrying out the time study, dedicated time study person is required for, study of one worker, or of machine while one study man, can carry out the study of the several workers or the operators and the machines using the work sampling.

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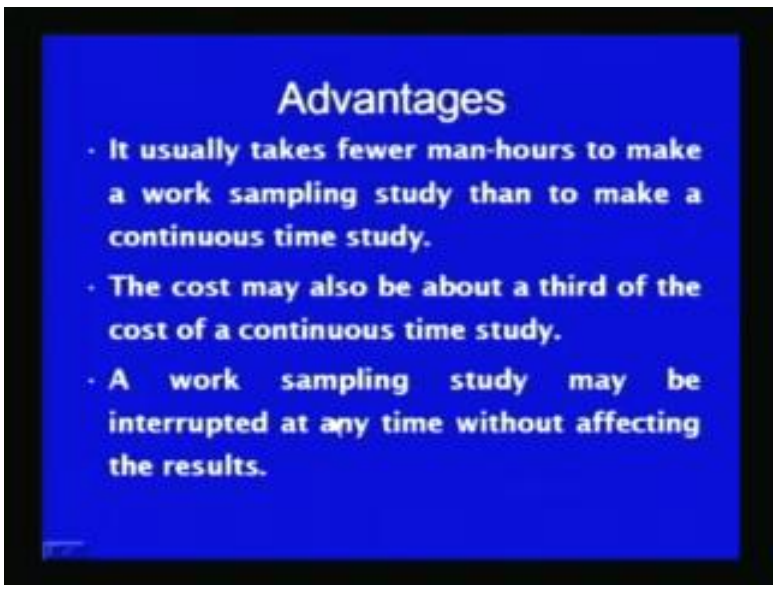

It usually, takes few man hours to make work sampling study, then to make continuous time study. So, this is another advantage related work sampling, that actual engagement of the work study man, is very limited for very less time, compared to that of the continuous time study method. And, the cost may also be, approximately one third of the cost of the continuous time study, so this method is economical also, in carrying out, work study sample work sampling study, may be interrupted at anytime, without affecting it is results.

But, in case of time study, it has to be continuous to note down, what is being done and for how long being done by the operator or the machine during the study. So, that needs continuous attention, while the work sampling can be discontinued without affecting the un results accuracy significantly.

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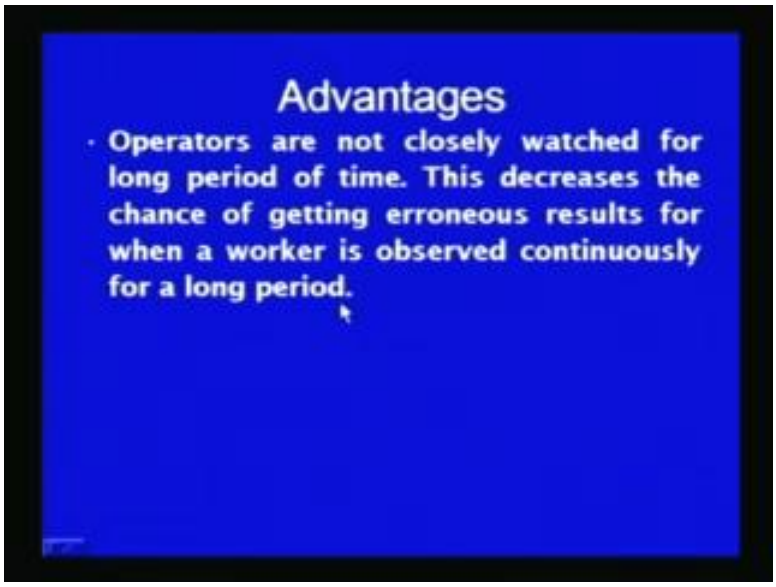

Operators are not closely watched for long period for time, which in turn may decrease, the chances of getting erroneous results, when worker is observed continuously for long period. Some of the workers may be very sensitive on the work, when they find, that some other person is observing them, during the work, so they may not be able to work at a normal pace, and which in turn may give the erroneous results, after the study.

So, but in the work sampling, the work study person will only be, going the shop floor and having, will be having a glance at the shop floor to see, what is being done by the, worker at a particular moment, instead of having the continuous observation on the

worker or on the machine. The observation may be taken over the days or the weeks this decreases the chance of day to day or week to week variation that may affect the results. So, this is another advantage of having the study, over a long period of time, at all the, such kind of variations of day to day or week to week variations in the results, will not affect the accuracy of this method.

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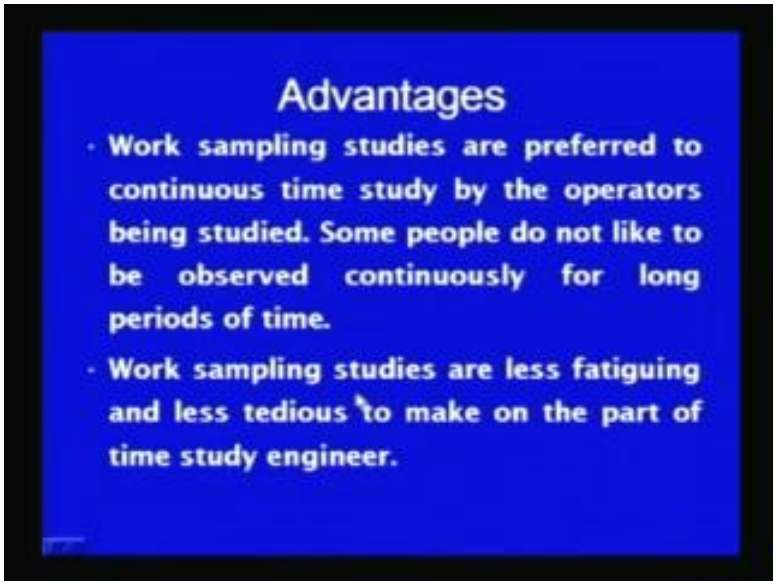

Work sampling studies are prepared or preferred over the continuous time study by the operators being studied, some people do not like to be observed continuously for long time, while the work sampling studies are less fatiguing and less tedious to make on the part of the time study engineer.

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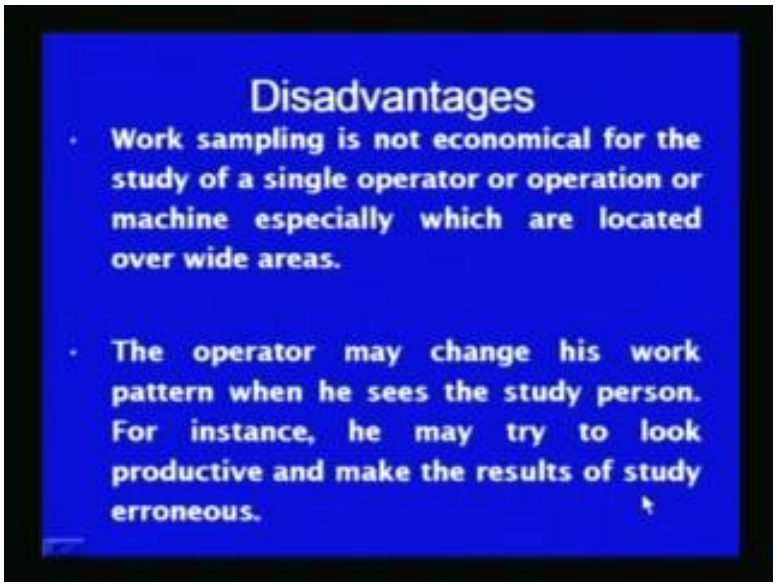

Well, they are certain limitations also, this method is found to be uneconomical, if only a single person or single machine is to be studied, and especially if the machines, which are to be, which are located over a wide areas. The operators may change his working pattern, when he sees that a study person is coming for instance he may try to look productive and make the results of the study erroneous.

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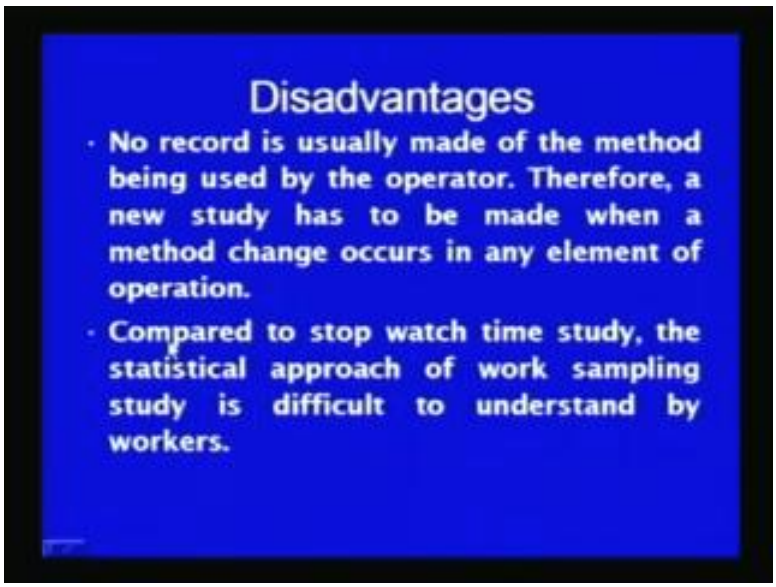

So, no record is usually made of the method study being used of the method being used by the operator, therefore new study is required, when there is any change in method or

any change in particular element or the operation. So, this is another important aspect of the work sampling study, that record is not there, that is why if there is any change, the fresh study is to be conducted, for setting the time standard.

Compared to the stop watch time study, a statistical approach is found to be difficult to under is to be to understand by the worker, workers find it difficult to understand, in which way, the time standards are being said. So here, in this lecture, I shall conclude, the remarks that, the work sampling study is useful technique, and it has a various advantages over the time study method, because only the random observations of the shop floor are carried out to arrive at the percentage of occurrence of particular activity. And to see whether the operators are working or the machines are idle or not or if they are idle, and what is the reason behind them, and it easily helps to identify the presence of ineffective time in the machines or related with the workers.

Thank you for kind attention please.