Work System Design
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Lecture – 41
Performance Rating: Examples

Namaskar friends, welcome to session 41st of our course on work system design and today we are going to start our discussion for the ninth week as all of you are well aware that this is a 12 week course and already we have finished the discussion for the first 8 weeks and if you remember in the eighth week, we switched gears from method study to work measurement and now we are trying to find out techniques which are used for setting the standard time for the method, which has been developed using the method study.

So, in method study, we try to find out one best method, one efficient method, one effective method, one productive method for doing the work and now, using that method using that technique using the sequence that has been developed, using the tools that have been developed for performing the task during method study, we are going to do the work and the time required for doing the work using that standard method we are trying to find out.

So, basically in order to improve the productivity, both things are important, we must do the work in a right way and in the right time, so that 2 things are important, the right method also is equally important and the right time also is equally important. So, if we do the work in the correct manner, if we do the work in the most efficient and effective manner, if we do the work in a productive manner automatically, we will be productive.

As well as, if we are able to do it in the standard time at a normal pace, then also we will be productive, so both are equally important, doing the work in the right manner in the right way in the right method and doing it in the right time. So, basically how to develop a better method, a best method of doing the work, we have seen so many techniques, if you remember we have seen outline process chart, we have seen flow process chart, string diagrams, SIMO chart, multi activity chart, 2 handed process chart.

So, there are number of graphical tools which have been used which we have already discussed which help us to develop a better method of doing the job. Now, we are trying to study how to find out the standard time for doing the task and in that we have seen that we can use stopwatch type of time study, we can use synthetic data, we can use predetermined motion time system, then we can do work sampling.

So, all these techniques are used for setting up a standard time for performing the job in one specified manner. Now, what is the specified manner? This specified manner is the one best method which has been developed as an outcome as an output of the method study and if we just revise what we have discussed in the previous week, we have seen what is work measurement, why do we need to do work measurement, what are the objectives of work measurement, what are the various tools and techniques employed during work measurement.

We have seen what are the different equipment that is used for work measurement, what are the various steps or the sequence of steps that we need to follow for setting up the standard time and if you remember in the last class, we have seen the performance rating that how do we rate or why do we need to rate a worker and I have given an example of 3 persons working sorry; walking for a distance of 15 metres.

And then we try to rate the performance of individual, so today we will try to see what is the importance of performance rating with the help of examples, so different examples we will take and try to understand the concept of performance rating. Before going to the performance rating we have seen that we do the direct measurement of the various elements of the work and for that we multiply it with the rating factor to get the normal time.

So, already 3 things are known to us, the observed time that we may be do that we may calculate using the direct measurement using stop watch, so that is the observed time, we have a rating factor that we have understood in the previous class, so we multiply the observed time with the rating factor and what do we get? We get a normal time. So, today we will emphasise more on the rating factor.

And later on we will focus on calculation of standard time which will be found out by adding the allowances to the normal time but today the focus is on the rating factor, so we will try to understand the concept with the help of few examples.

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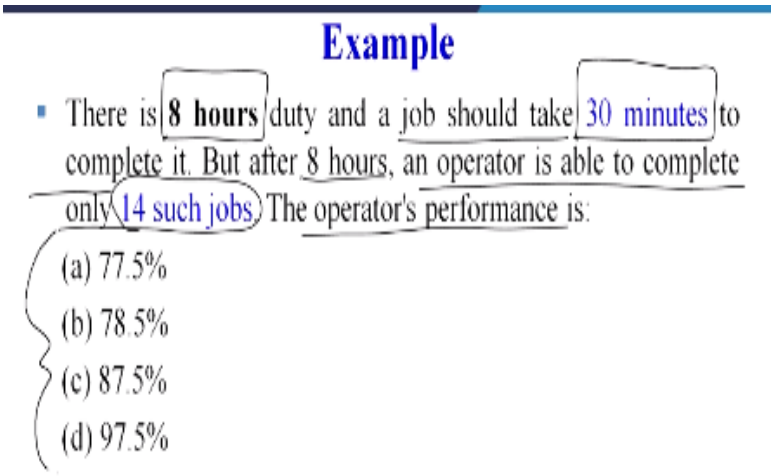

So, this is example number 1 on your screen, let us study the statement first, there is a 8 hours duty and a job should take 30 minutes to complete, so 2 data points are given, first one is 8 hours duty total time, then a job should take how much; 30 minutes, so from here we can see that how many jobs are expected in a day that is a 8 hour duty to complete it. There are; there is 8 hours' duty and a job should take 30 minutes to complete.

So, each job will take 30 minutes but after 8 hours an operator is able to complete only 14 jobs, so this is the performance of the operator, so 14 jobs he has been able to make, the operator's performance is; so we have to calculate the operator's performance and 4 choices are given, so we need to calculate what is the operator's performance.

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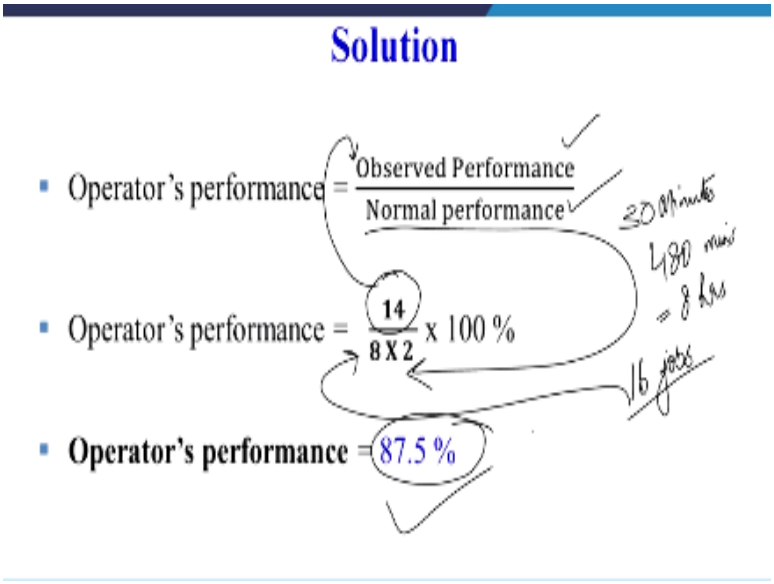

Now, operator's performance is given by the observed performance divided by the normal performance, now what is the observed performance? Observed performance is he has been able to complete 14 jobs in 8 hours, what is the normal performance expected that is because it takes 30 minutes, if you remember it takes 30 minutes per job, so in 8 hours, how many minutes we have? We have 480 minutes in 8 hours' duration.

So, how many jobs are expected? So, we can see that 16 jobs are expected, normal performance is 16 jobs, so that we are seeing here, how 8 * 2 is coming into picture because 8-hour duty 30 minutes per job, so every hour, we must be able to produce 2 jobs, so 8 hours * 2 jobs, 16 jobs. So, this is the operator's performance, the observed performance he has been able to produce 14 jobs, how much was expected that is 16 multiplied by 100, so of the answer comes out to be 87.5%.

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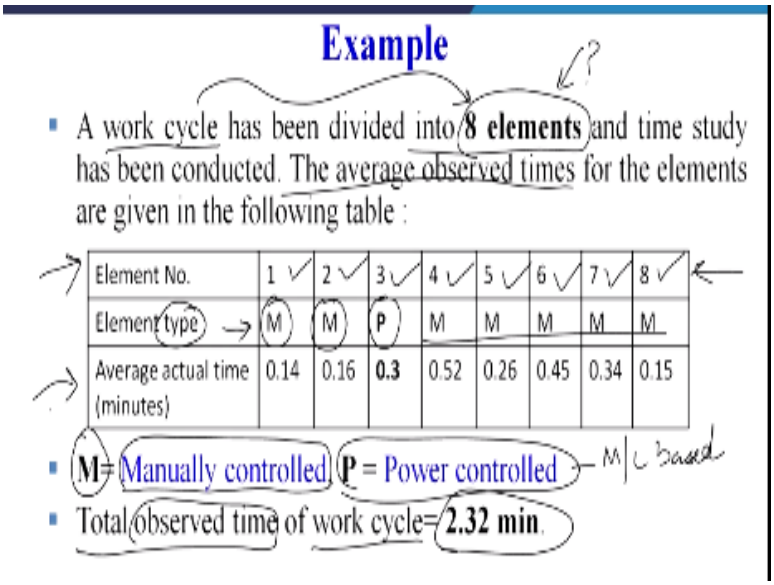

So, this is maybe the most simplest example of performance rating, Now, let us take an example number 2, slightly busy slide for all of you but we will try to understand the problem, so let us see, a work cycle has been divided into 8 elements, so what do we mean by element has already been explained in the previous session and if you remember, we have taken an example of stitching a shirt, so there our different work elements may be fixing up the zip or the zipper in the shirt or maybe fixing up of the arms with the main body of the shirt.

So, maybe there are so many different elements which were making up the whole work cycle of stitching a shirt, so the work element is maybe the building block of the complete job, so this total work cycle is divided into 8 elements and the time study has been conducted, so we have directly measure the time for all these 8 elements. The average observed times, so these are the average values of a number of readings for the elements are given in the following table.

So, what is; the elements are named as 1, 2, 3, 4, 5, 6, 7 and 8, so these are the 8 elements which comprise of the work cycle, this is the type of element, so M, M and then this one is P shown in the bold, rest are all M, so what do we mean by this? M means that these elements are manually controlled and P means it is power controlled or it is machine based. Why this classification has been done?

Because we will understand this from the rating factor point of view that when the work is being done manually, we can give some rating as I have highlighted in the previous session also that when the work is being done by machine, we know that machine has this capability this will be able to produce 100 components per hour for example, and if it is producing 100 components per hour, so the rating is 1 only.

Whereas for a worker, he may working at a faster pace, he may working at a slower pace we maybe; we may try to rate that worker, we may give some rating factor. If he is faster, we will multiply with the rating factor accordingly, if he is slower, we were multiply with the rating factor accordingly, so this is power controlled. Then the total observed time, please I will again request that you must keep these terms in mind, observed time, normal time, standard time.

So, these are different words as a learner of work study, we must be able to differentiate between these 3; the observed time, the normal time and the standard time, so the total observed time of the work cycle is 2.32 minutes, so this is a problem now. So, if I have to summarise the problem, the total work cycle consists of 8 elements, out of these 8 elements, 7 elements are manual elements or the work is being done manually or the element is being completed manually.

And only 1 work element is power controlled or machine operated, the actual average actual time the average value, we have done direct measurement of time for each and every element and average values are reported in the third row and the total observed time is given as 2.32 minutes. Now, what do we need to do in this problem?

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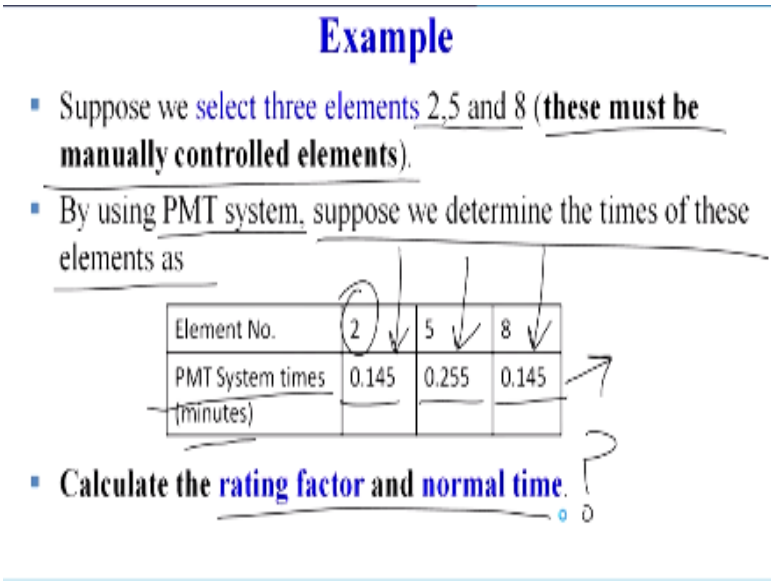

Suppose we select 3 elements, so let us go to the previous slide, which elements we are selecting; we are selecting element number 2, we select element number 5 and we select element number 8, so 3 elements are selected. So, suppose we select 3 elements; 2, 5 and 8, these must be manually controlled element, so we have already checked. By using the PMTS; predetermined motion time system, suppose we determine the times of these elements as, by PMT system we have calculated the time.

For second element the time is 0.145, for 5th element the time is 0.255 and for 8th element the time is 0.145, so from where we have taken; this has been taken from already available data. Now, we have to calculate the rating factor and the normal time, this is our question that is what is the rating factor and the normal time, so now you can very easily see that there is data available with us, we have understood the problem, we have seen that only for 3 elements.

We are able to find out the system times or PMT system times, for all the other elements we have done the direct recording, for these elements also we have done the direct recording but we have the PMT system times also available. So, now what we can do; we can do this problem by calculating the rating factor for these 3 elements and then we can take a average rating factor and multiply the observed time, which is given in the previous slide.

If I remember it is 2.32, so 2.32 minute is the total observed the time, so we can multiply this with the rating factor and calculate the normal time. One more thing that we need to keep in mind is that one of the elements is a power operated or a machine operated element that is element number 3 that I suppose, so this element number 3 is power operated, so power controlled, so this also we have to take into account when we multiply the observed time with the rating factor.

Because for power controlled elements usually the rating factor is taken as 1, so that has to be taken into account. Now, let us see how to calculate the normal time using this performance rating factor.

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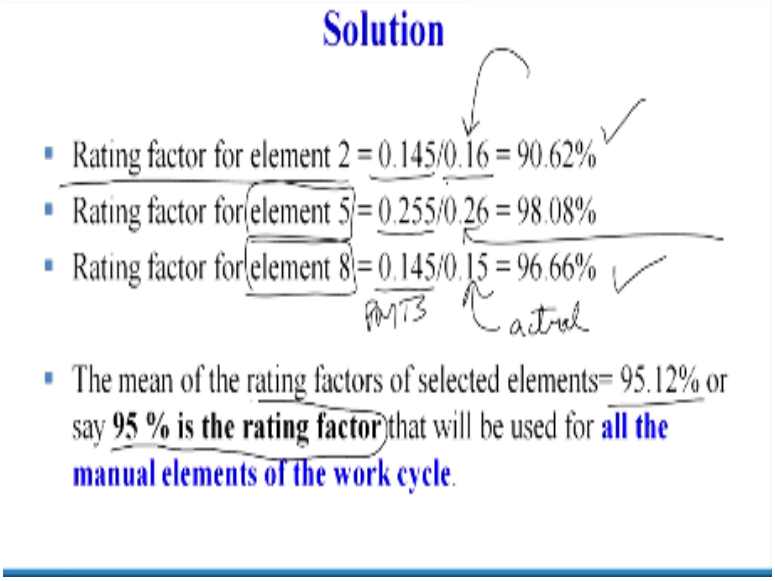

Now, rating factor for element 2 is calculated as we have now 2 data available with us, what is that data? One is the PMT system data which we have found out and the another one is the actual data which has been recorded or the average value of the actual data for element 2, so the actual data is given as in the denominator and the PMTS data is given in the numerator. So, you can see once again the PMTS data for element 2.

So, the PMTS data for element 2 is 0.145, so 0.145 if you remember is taken in the numerator and the actual data which was recorded, which is given in the problem is taken a 0.16, similarly the rating factor for element 5, the PMTS data is 0.255 and the actual data which has been taken

from the direct observation is 0.26 and similarly, for element 8 also in the numerator, we have the PMTS data and this is the actual data which is given to us in the problem.

So, this is we can say, the calculation of the rating factor, so rating factor if you remember that we have seen in the previous session that how we can calculate the rating factor, so here we are seeing the example, so we are calculating the rating factor based on the PMTS data but that data is available only for the 3 elements, so the rating factor for element 2 is 90.62, similarly for element 8, it is 96.66%.

So, the mean of the rating factors is 95.12% or say 95% is a rating factor, we rounded it off to 95% and this will be used for all the manual elements of the work cycle, so if we are able to find out the rating factor as we have been able to find out for the elements 2, 5 and 8, so for each and every element if we have the PMTS data, we can very easily calculate the rating factor for individual element and multiply it with the rating factor for that element, the observed time for that element.

So, we have the observed time data already available with us, if we can refer back to the data which is already this data; this data is already available with us, if you see, so we have average actual time for each element is already available with us, so if we have the PMTS data also available for each of the element, so we can calculate the individual rating factor for each element and then multiply this average actual time with the rating factor to calculate the normal time for each element.

And then add up the normal times for all the elements to calculate the total normal time but here the issue is that we have the PMTS data available only or the time data available only for 3 elements that is 2, 5 and 8, so what we are trying to do here is; we are trying to find out the rating factor for these 3 elements and we are assuming that the same rating factor we can apply for the other manual elements as well.

So, this rating factor of 95% which is average rating factor for these 3 elements for which we were able to find out the PMTS time data we are using as the average value, so then we have to

calculate the normal time and the normal time as all of you are well aware is calculated by multiplying the observed time with the rating factor, so this multiplication we have to do but there also one thing we have to keep in mind.

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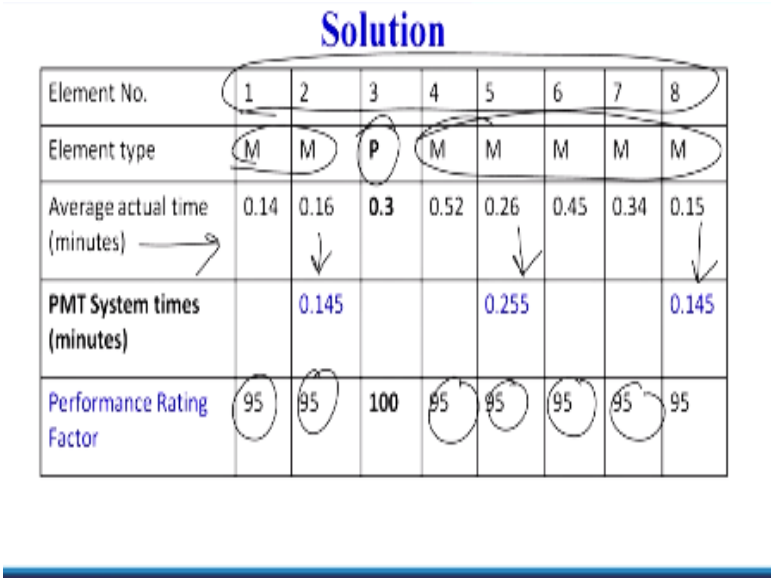

So, here this is some solution which is there, so element type, there are 8 elements as all of you are well aware, 7 elements are manually controlled element, only one element is the power controlled element, this data already was available with us, PMT system time data is only available for 2, 5 and 8 number element and the performance rating now we are assuming that rating factor as 95 for all the manual elements.

And for the machine controlled element, we are taking the rating factor as 100 which I have already explained, so now we have to calculate the normal time, so how it will be calculated, you can see.

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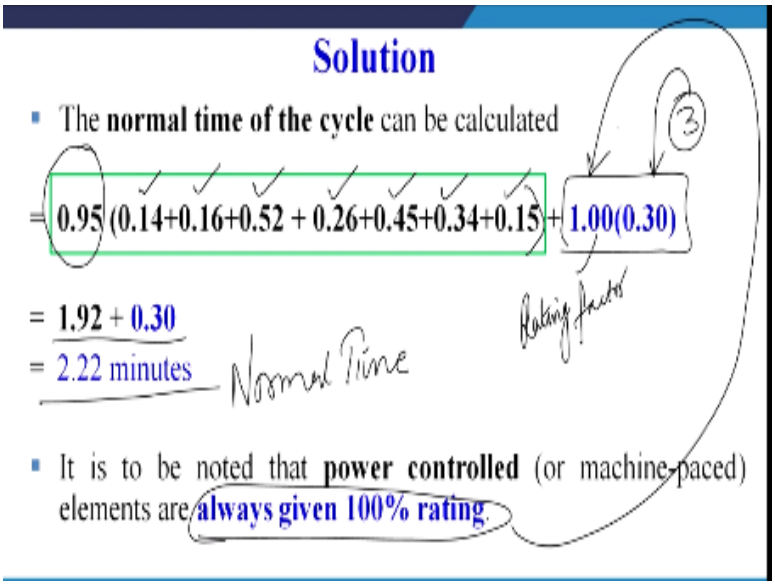

So, the normal time of the cycle can be calculated as, so this is the rating factor 0.95 which we have taken, we have assumed that this is rating factor for all the work elements, which are manual in nature, so we have 7 work elements which are manual, so let us see this 7 work elements; 1, 2,3, 4, 5, 6 and 7, so we are summing up the actual observed time for all these 7 elements and multiplying it with the rating factor which we have assumed as the average rating factor for all the manual elements + this is something, which is different.

We are giving this 1, basically is the rating factor for power controlled element and this is the observed time or the actual observed time for element number 3, which is a power controlled element, so this is the total time now, 1.92 + 0.3, 2.22 minutes. So, this is basically the normal time for the work cycle, so it is to be noted that power controlled or machine paced elements are always given a 100% rating.

So, where we have given a 100% rating, you can see this is the 100% rating which has been given to a power controlled element. So, in this way we can calculate the normal times based on the rating factor or the performance rating factor which we have calculated as a ratio of as a ratio of the 2 times, so we have taken the PMTS time which has been divided by the actual time, so again I will go back to that slide.

And emphasised this is the PMTS time divided by the actual time, so this is the way we have calculated the rating factor and then this rating factor, we have average rating factor, we have multiplied with the actual observed time to calculate the normal time. So, now we go to the last example for today that is example number 3. So, I think we have seen that the importance of performance rating is that we are able to set a normal pace of working.

Somebody is working fast, somebody is working slow, we calculate the rating factor and that rating factor will help us to adjust the time as per the normal pace expected by an experienced workers or trained worker or able bodied worker, so based on the worker we have a normal pace for which at which the work must be done. So, if the worker is working fast then the rating factor will help us to normalise it.

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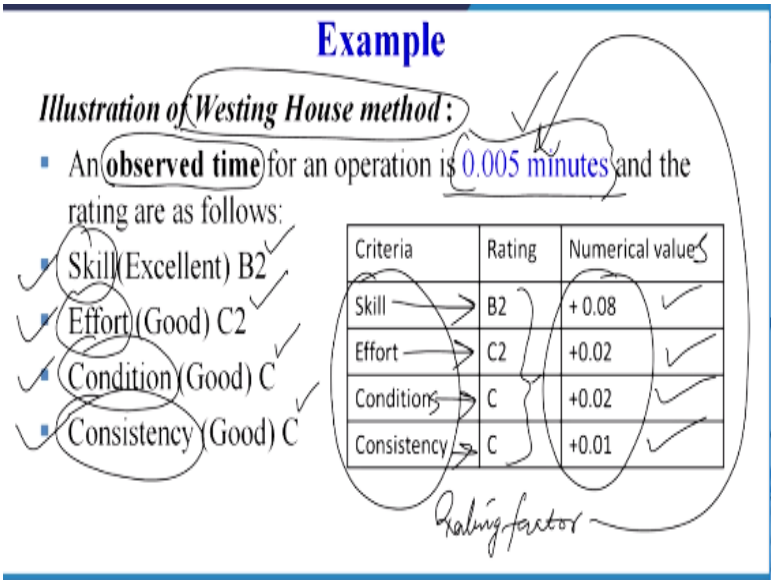

If the worker is working slower than the normal pace again the rating factor will help us to normalise it as per the normal pace of working, let us see now the last example for today, this is based on the Westinghouse method and this method as we have already seen in our previous session and if you remember in Westinghouse method, there are 4 important factors which are given the numerical values if you remember that.

All these 4 parameters are skill, effort, conditions and consistency, so these 4 parameters we have to take into account the numerical values are given to these 4 parameters and they help us to

establish a performance rating parameter which will be multiplied or performance rating factor which will be multiplied by the observed time to get the normal time. So, an observed time for an operation is given here.

So, the observed time I am again emphasising, we must be very, very clear with these terms, the observed time, the normal time, the standard time, so an observed time for an operation is already given, this is 0.005 minutes and the rating are also given, you can see skill is given a B2 rating, effort is given a C2 rating, condition is given C and consistency C, so we have B2, C2, C and C.

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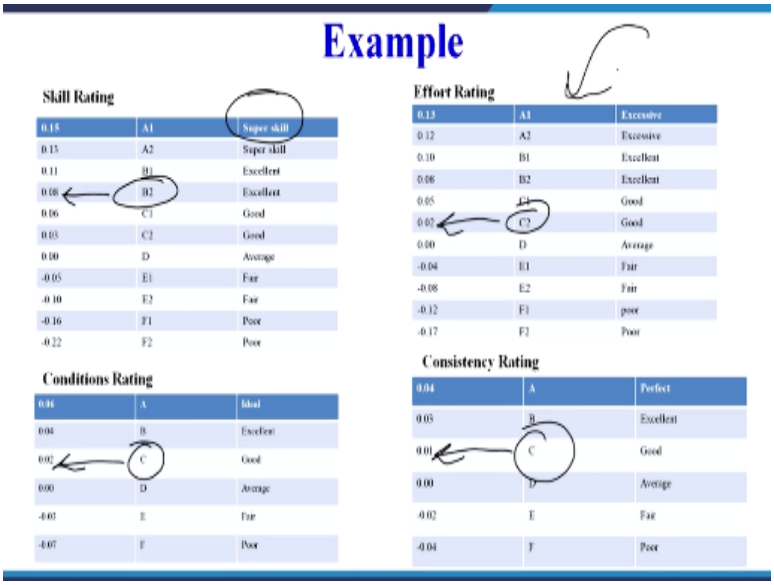

And from where these values are coming? We will just go to that so, B2, C2, C and C, so we can go to the next slide and see, I think you will be able to see in skill rating, this is a super skill, so we can say that what is the rating here let me and go back and see, it is B2, C2, C and C, so B2 you can see this is B2 and the value is 0.08, C2 is for effort, C2 and the value is 0.02 and then the other 2 are we can again go back and see whether we have 0.08 for skill and 0.02 for effort.

Let us go 0.08 and 0.02 for skill and effort, now let us see for condition and consistency, C and C conditions is value is C, it is 0.02 and for consistency also it is C, which is 0.0, so let us again verify this, so these tables are standard tables which we have already seen in our previous session, so here you can see, skill B2, effort C2, conditions C, conditions, consistency C and

these are the numerical values which have been given and taken from the table; +0.08, +0.02, +0.02, +0.01.

So, these are the numerical values that we have taken for all the 4 important factors which help us to calculate the rating factor, so we have a calculate the rating factor and then multiply it with the observed time, where is the observed time which is already known to us, it is given in the problem that is 0.005 minute, so this is the one thing that we need to solve now, this type of problem already we are solved in session number 40.

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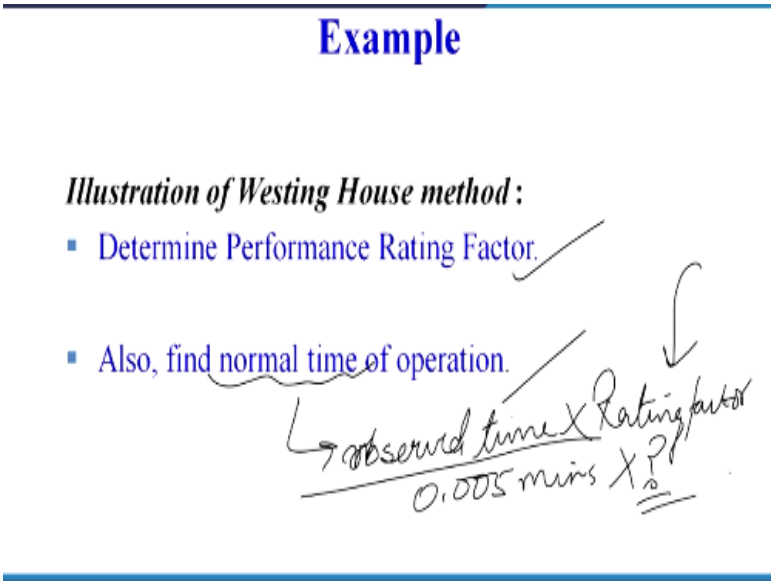

So, let us see now, how the solution will come out, now illustration of Westinghouse method, we have to determine the performance rating factor and find the normal times, so normal time will be found out by multiplying the observed time multiplied by the rating factor, so first we need to calculate observed time is already given to as 0.005 minutes is given, if I am correct I will again go and check, I think there is 0.005 minutes, it is correct 0.005 minutes.

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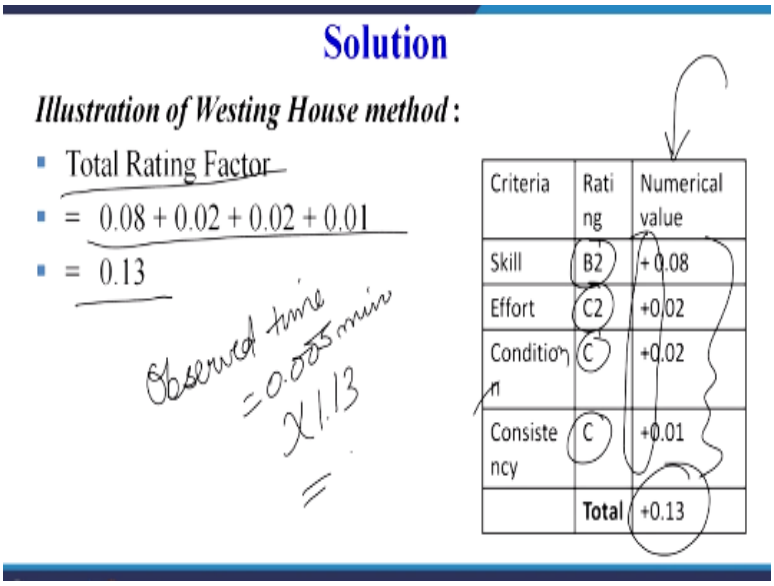

But what is the rating factor that rating factor we have to find out, so let us now see what is the rating factor, so this is already given, the numerical values are given already from the table, so skill the rating is B2, effort C2, condition, this is conditions C and consistency C, so the numerical values are given here, so the total is +0.13 and if you remember in the previous session that we have taken session number 40.

We have seen that there are negative values also and may I go back again and show some of the negative values also, you can see here -0.02, -0.05, -0.07, -0.02, so we have negative values also in the tables but here we see that all the values are positive with the + sign, so what we will do? We will find the total rating factor that rating factor numerical values are already know, so we add up all these, it comes out to be 0.13 with a + sign.

So, it means that we need to do now is; we need to multiply the rating factor with the observed time and the observed time as all of you know, observed time is already given in the problem and the observed time is 0.005 minutes, so now the rating factor is also known to us, 1.13 and we will get from here the normal time.

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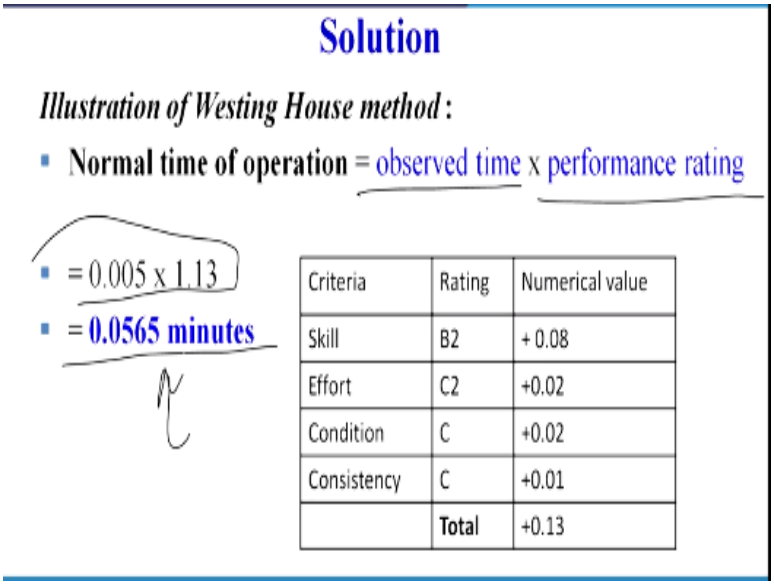

So, this is a normal time, this is the observed time multiplied by the performance rating 0.005, 1.13 and this is 0.056 minutes, so here we can see that we can calculate the normal time based on the observed time, which we can get from the direct measurement or sometimes from the PMT system also, so that time we multiplied the rating factor, how to get the rating factor using the Westinghouse method is given here based on the 4 parameters of skill, effort, conditions and consistency.

The numerical values can be seen from the table and then they can be added and multiplied by the observed time to calculate the normal time, so this is a simple method for solving the problem using the Westinghouse method. Now, in totality we have tried to solve 3 different problems related to the rating factor and calculation of the normal time, now how to calculate the standard time from the normal time that we will see in our subsequent sessions, thank you.