**Work System Design**
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**Lecture - 21**
**Flow Process Charts**

Namaskar friends today we are going to start the discussion for week #5 in our course on Work System Design and if you remember in the last 4 weeks we have tried to understand that why are we studying this course. In the very first week we had the introduction to our course on work system design. We have seen the basic aspects; we have seen what are the techniques employed.

And finally we have seen in the second and third week that why productivity is important, because productivity is directly related to the way we are doing our work, the sequence in which we are doing our work, the people who are involved in doing the work, the place which is required for completing our work or the work place where we are doing our work, so productivity depends on so many parameters.

And most of the cases we see that productivity is poor because of n number of reasons. We have seen that there is additional work content that is added which can be easily eliminated if we do our work in a very, very systematic logical scientific way and if we do the work in a haphazard way, in a random manner, most of the time our productivity will be low. So from the theoretical point of view we have seen that what are the causes of low productivity.

What are the productivity improvement techniques, how we can measure the productivity? What are the productivity measurement measures, then we have taken few examples and try to understand that how productivity is usually or actually calculated in practice? Once we understood that what are the productivity improvement techniques, how we can improve the productivity we went for the week third.

We discussed about productivity and in week 4, finally we went to understand that what are the various maybe techniques that are used and in that we have seen operation process chart. We have seen the various definitions of method study. What are the various graphical tools

that can be used to understand method study? So in first 4 weeks we have just launched ourselves into the course by trying to emphasize the need importance of studying this course.

And in the last week if you remember in week 4 we have seen operation process chart, we have taken few examples in the last session on operation process chart and I think it is absolutely clear to all the learners by now that currently our focus is on method study. One week of discussion already over, today we are going to start the second week, so this is the summary.

First week on introductory part, then 2 weeks on productivity, the fourth week on basics of we can say method study and one of the techniques that is the operation process chart. Fifth week our discussion primarily will be on all the techniques or all the tools or graphical tools which we use for improving the way we are doing our work that is related to method study. Why I emphasize for the initial 5 minutes or maybe 6 minutes on what we have covered.

Because we have to relate it is not a stand-alone lecture or a discussion or a session. It is related to what we have already covered. We have already covered method study what is the basic definition of method and we have seen one of the graphical tools of depicting or having a bird's eye view of what is happening inside the organization or in the factory and if you remember in operation process chart mostly we have drawn the charts with 2 symbols.

What are these 2 symbols you can just remember, these 2 symbols are symbols of operation and inspection and the other thing that we can talk about the operation process chart is that the major component or the main assembly is towards the righthand side of the chart and the other sub symbol is that we are manufacturing or fabricating are depicted by parallel vertical lines moving far away towards the left.

And when these operations are completed and their inspections are done these are then assembled to the main component or the principal component of the product so usually we have not depicted storage, delay, transportation usually if you see in the operation process chart. Today we will see the flow process charts and we will see that in this it is more detailed as compared to the operation process chart.

So let us start our discussion, so 5 minutes are over and the introductory part how this is related to this is one of the techniques that is covered under method study and in the last week our focus was on method study. This week we will learn other tools and techniques, other graphical tools for depicting our process or comparing our processes or comparing our sequence of operations and the next week also our target will be method study only.

So the 4 weeks are dedicated to method study. One week is already over and this week our target is to learn the various aspects of method study. Let us now see what is the flow process chart.

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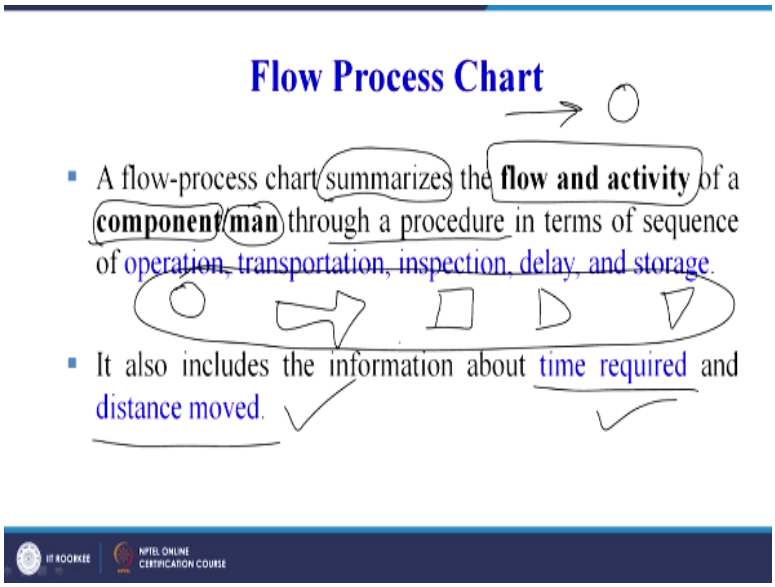


On your screen you can see that the flow process chart basically is the flow and activity of a component or men through a procedure in terms of sequence of operation, transportation, inspection, delay and storage. Once again, I will read it for you, you can see, flow-process chart summarizes, so the complete process is taking place, we will try to summarize that whole sequence of operations on a chart.

So a flow process chart summarizes, what it will summarize? the flow and activity. The flow can be depicted by arrows and activities can be depicted by maybe a circle that is the operation taking place of a component or a man so you can see either it can be a component type flow process chart or it can be a man type flow process chart which we will cover today. We will see what are the different types of flow process charts through a procedure.

Now there will be a procedure, the sequence in which we are doing in terms of sequence of operation. So is this we can see operation, transportation, inspection, delay and storage. So we will be using these symbols which we have already covered in our topics earlier in order to depict the whole process. Now some of you may be wondering that how it is different from the operation process chart.

So I have already highlight that in operation process chart our target is to have a bird's eye view of what is happening inside the organization and majorly our focus is on the operations and the inspections taking place, but here our target will be to even focus on the delay, the unnecessary intermittent or maybe the stoppages, unavoidable stoppages in the process.

Our target will be to focus on the inspection also. Moreover, our target will be to focus on the sequence that we are following with the distance that we are travelling, the flow the material is taking or the man is taking inside the shop floor so this is much more detailed as compared to operation process chart. It also includes the information about the time required and the distance moved.

Today we have selected one case study that we will try to see today's end of today's session where we will see that once we are able to draw the flow process chart we can easily optimize the distance travelled by the material in a shop floor. Now flow process chart definition is already known, let us try to further make the concept even crystal clear by another definition.

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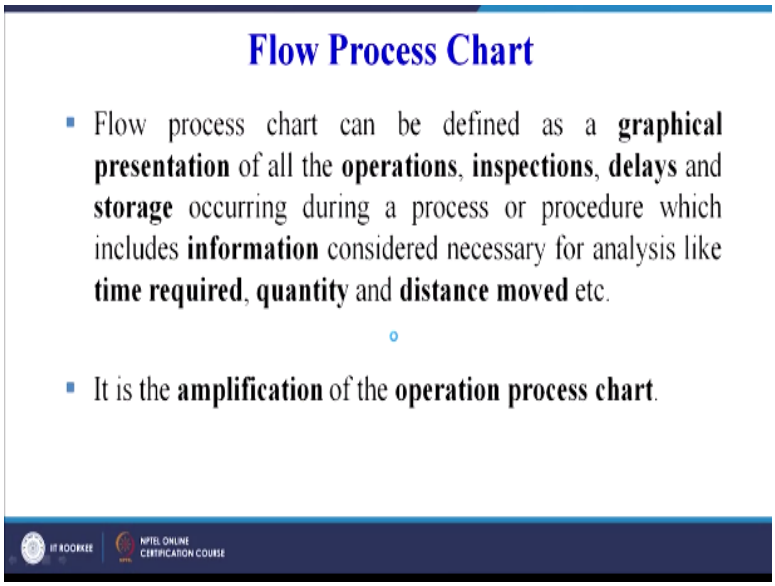

Flow process chart can be defined as a graphical presentation. It is a graphical presentation of all the operations, inspections, delays and storages. I must add here transportation also occurring during a process or procedure, which includes information, considered necessary for analysis like time required, this is first information, quantity that we are handling and distance moved.

So basically we are going to use the symbols, process chart symbols, so we are going to use the process chart symbols to depict the overall process that is happening or overall sequence of operations that is happening inside the organization with the target. Now what is our target. We want to reduce the time required. We want to reduce or we want to handle the quantity with minimum effort.

We want to minimize the distance the operator or the material is traveling inside the shop floor. So that all is our target, so we will depict the process using the standard process chart symbols and then we will calculate how many operations are taking place, how many inspections are taking place, how many times the material has to wait before being processed that is unnecessary delay is there.

Then we will see how much transportation the material has to undergo from entering into the shop floor to be dispatched as the final product what is the sequence being followed, what will be the objective of analyzing all these things or calculating all these things or maybe tabulating all these things.

So our target will be to see, use creativity and use common sense to find out that can there be a better method which can reduce the number of operations we are doing, can there be a better method or better inspection policy which can reduce our effort on inspection but still is relevant and does not allow any defective item to pass through. So can we change our inspection policy.

Can we reduce the distance travelled by men and material? Can we reduce the time that is taking place or time that is taken up for manufacturing or fabrication activity or by the sequence of operations? So basically as we know, as all of you know in method study our target is to first study the current method then uses our creativity, common sense, intelligence, brilliance, genius-ness in order to develop a better method with these objectives in mind.

So we will try to see one example today. It is an amplification of operation process chart, so it gives you more details as compared to the operation process chart and more number of symbols maybe or more we can say detailed depiction or detailed analysis can be carried out in case of flow process chart. Now what are the objectives, I think this will be repetition only in the discussion I have already highlighted that what is the objectives of the flow process chart.

Why do we draw, it is not the objective of flow process chart only, it is a common objective of any graphical tool that we use under method study that we want to combine the operations, eliminate the operations, frame our inspection policy in such a way that we required less effort, we are able to do it in less time, the money spent is less, so with these objectives we do method study and here also you will see that they are listed in a more systematic manner than what I am speaking?

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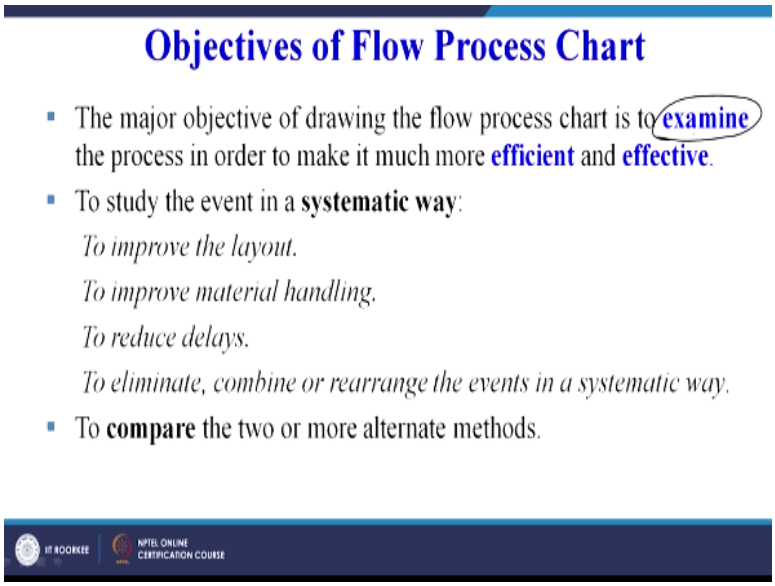


So the major objective of drawing the flow process chart is to examine, very important, if you remember we already had one session you can go back and refer the steps involved in method study, so examine is one of the important steps that is listed there. To examine the process in order to make it much more efficient and effective. So what we need to do. We need to first understand that what is the current method of doing the job.

And what is our target? Our target is to make that method much more efficient and effective. Now maybe if you want to do or if you want to apply method study what we are discussing in

the class, you may go to a bank and any bank, any branch, any company you can go and see that what are the operations being done. For example, a customer is coming, there will be customers coming with different types of requirements.

So maybe you can focus on one specific type of requirement. For example, you say that if a person has to get the draft issued by the bank in favour of any competitive exam, what the person has to do? he has to come to the bank, you just list down that what the various sequence of activities that he has to take.

Maybe in some bank he has to just go, fill a form, hand it over to the bank executive and the person may tell him to collect the draft after one hour that can be the procedure. Other bank can be he has to first go, he has to stand in a queue to deposit the money then get the receipt attach it with the application form and then give it to the another bank official who will tell him to come back and collect the draft.

So you can just focus on one particular activity that is happening or one particular function that is happening in the bank and list down what are the various operations or various activities involved in that operation. Then you can try to optimize it. The objectives can be that it must take less time. So what can be, it can be a single window operation as compared to the 2 windows.

Then suppose for a draft the frequency is more for example if there is a competitive season and there are so many tests that the person has to fill for example most of the competitive exams are done after you pass out or maybe in the month of March, April, May, June, so this is a season when lot of competitive exams are there, so during that period the draft issuing bank official can be closed to the entrance point.

So that these people who are coming need not travel to different places inside the bank to get their draft issued. So these type of practical problems can be solved using the concepts of method study. So we need not maybe think that when we will go to the shop floor we have to analyze the material how it is moving then there only we can find the application of method study.

Method study can be applied and today we will see the example which is a very easy common sense type of example where it can be applied in shop floor, it can be applied in any place where we are doing the work, where operator is involved, officials are involved, where there is one to one interaction between the workers and the machines. So method study is the universal, we say technique, it can be applied in service sector also.

It can be applied in the engineering sector also. So we can see, but what we need to understand is that what are the main advantages or may be objectives of applying. Advantages we will cover towards the end of today's session, but let us first focus on objectives. Now as we have seen our main target is to graphically represent the combination of operations, inspections, transportations delays.

So that is what we want to actually represent graphically. So once we want to represent them graphically why do we need to do it. We need to do it to study the event in the more systematic manner. Therefore, we required a graphical representation to improve the layout. Now what is layout, maybe layout is the location of the various facilities within the premises.

Now suppose you go to any workshop there is a carpentry shop, there is a foundry shop, there is a welding shop, there is a machining shop, so all these shops are located at their respective places and if we are told to draw the layout you can easily draw the layout that where which facility is available.

So when you enter a big campus like you enter IIT, Roorkee at the very beginning only you will see the layout of IIT, Roorkee that where do you have the academic area, where is the residential area, where is the swimming pool or the sports facility is located, where are the grounds, so all that basically is the broad layout of the organization. So flow process chart will help us to optimize to improve our layout.

And if we are able to improve our layout we will be able to reduce or minimize the travel of man, material, machine between the 2 facilities or between the 2 location. So improved layout means less movement of man, material and machine. To improve the material handling that can be one of the off shoots of improving the layout so we can also improve the material handling and it will further reduce the delays.

So that is our target, that we need to minimize or completely eliminate the unnecessary delays that take place in the shop floor. To eliminate combine or rearrange the events in a systematic way. So you can see there are 3 things, eliminate it may help us to find out that there can be operation which is happening which can be clubbed with any other operation so one operation can be eliminated.

So now we have a combined operation which is happening at one place only. Combine is already given so once you eliminate you are combining it with any other operation or if it is a redundant operation you find out using the flow process chart you can completely eliminate it without combining it with any other operation. So you can eliminate the redundant or unnecessary operations. You can identify them. You can combine the operations wherever possible.

Even you can rearrange, you can re-sequence, you can change the sequence of operations that you are doing with the overall objective of improving the efficiency and effectiveness of your operations. Then the other important objective is to compare the 2 alternate methods. So as I have already highlighted in today's session only that we have to examine the process that is we have to find out that what is the current method of doing the work.

Then using our creativity, we have to find out the alternate ways by which the work can be done. Now we have 2 different methods or maybe we have one current way and 4 alternate ways to do the same work, now we have to compare that which one is giving us more benefit. Which one is more advantageous as compared to the current method of doing the work. So that is going to help us which is going to be one of the main objectives.

Where comparison you can say objective of drawing the flow process chart. So in nutshell we can say examining and comparing the 2 different or 3 different methods of doing the same work are the main objectives of drawing a flow process charts.

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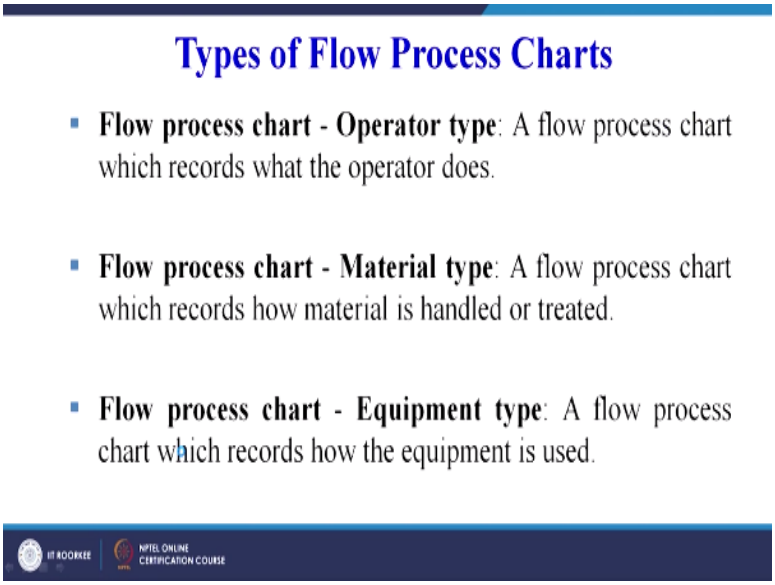


So types as I have already told that there are 3 types, one is the operator type, you can read for yourself, a flow process chart which records what the operator does. The second one is material type, a flow process chart which record how the material is handled and if you remember in the previous slide we have seen one of the major objectives of drawing the flow process chart is to improve the material handling system.

So here we can see it will help us to understand how material is handled or treated and the third type of chart is the equipment type. A flow process chart which records how the equipment is used. So we can have a man type of flow process chart or an operator type of flow process chart. We can have a material type of flow process chart. We can have equipment type of flow process chart. Now what are the features of a flow process chart, you can see.

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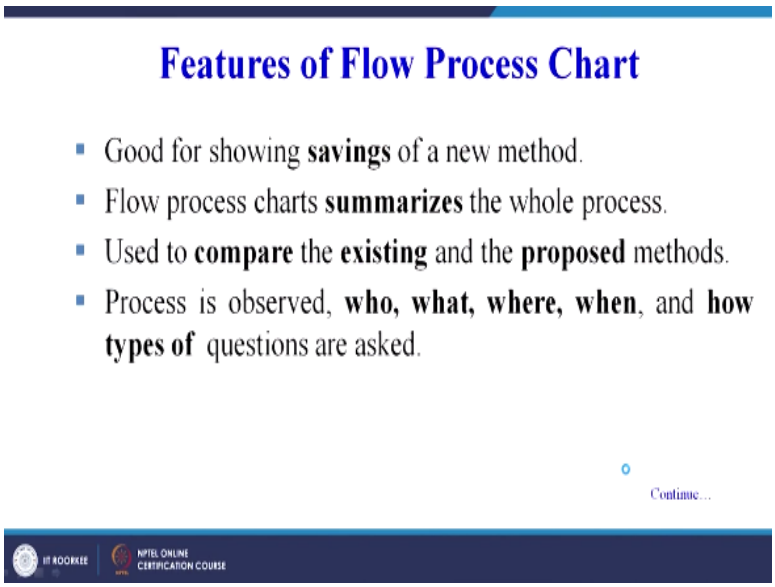


Good for showing savings of new method as we have already seen that it will help us to compare. So we can easily do the comparison by drawing that in a tabular form that how many operations were there in the current method. How many operations are there in the proposed or the new method. How many inspections, how much delay is in the current method, how much delay is there in the proposed method.

What is the total time required for doing the work using the proposed method, how many people are required to do the same work using the proposed method? So there can be number of criteria and flow process chart will help us to scientifically or to systematically compare the current method and the proposed method. It summarizes the whole process which we have already covered.

Used to compare the existing and the proposed method, it is given in a much more clear manner here. Process is observed who, what, where, when and how type of questions is asked. So this is what once we are able to draw the flow process chart our focus will be to find answers to all these questions. Who is doing the work, what is being done, where the work is being done, when it is done, how it is done?

All these questions will help us to find out new and new ideas of doing the work in a much better manner. Now information shown that is standard way of drawing a flow process chart when you construct a flow process chart all these information you must have, type of the flow process chart as we have already seen 3 types are there operator type, then there was an equipment type and then there was an operator type, equipment type and material type.

So you have 3 types again we can just go and check. These are the 3 types that we have seen, it is operator type, material type and equipment type.

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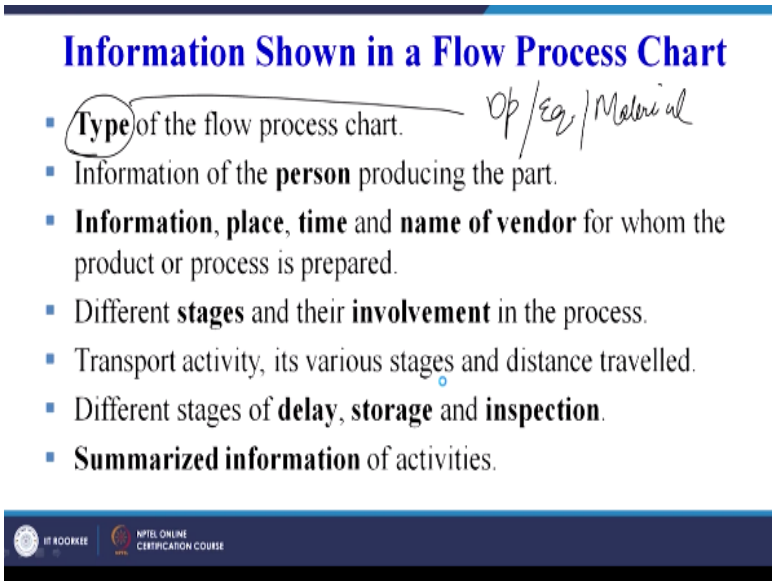


Same things I have mentioned there. Operator type, material type and equipment type. Information of the person producing the part details of the operator; information, place, time and name of the vendor for whom the product or process is prepared; different stages and their involvement in the process; transport activity, it is various stages and distance travelled; different stages of delayed storage and inspection, summarized information of the activity.

So to summarize what is there in this slide we will use all the 5 process chart symbols with whatever detailed information we can provide in order to draw the flow process chart. Also the information related to the person who is preparing as well as for the company for whom this flow process chart or the product is being produced will be mentioned on the flow process chart.

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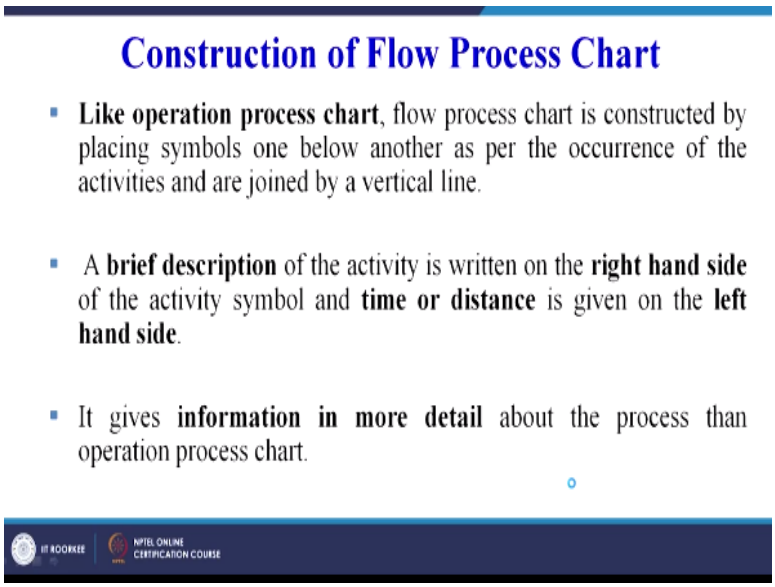


Now construction of process chart like operation process chart already we know we have seen in the previous week operation process chart and seen number of examples also. Flow process chart is constructed by placing symbols, which are the symbols, the operation, process chart symbols or the process chart symbol, same circle, square, then the transportation symbol arrow, then we can have a combined symbol also, inverted triangle.

So all these symbols are used. They are placed one below the another as per the occurrence of the activities and are joined by a vertical line. We will see one example. A brief description of the activity is written on the righthand side of the activity symbol and time or distance is written on the lefthand side, it is same as we have seen in operations process chart. It gives information in more detail about the process than the operation process chart which I have already clarified.

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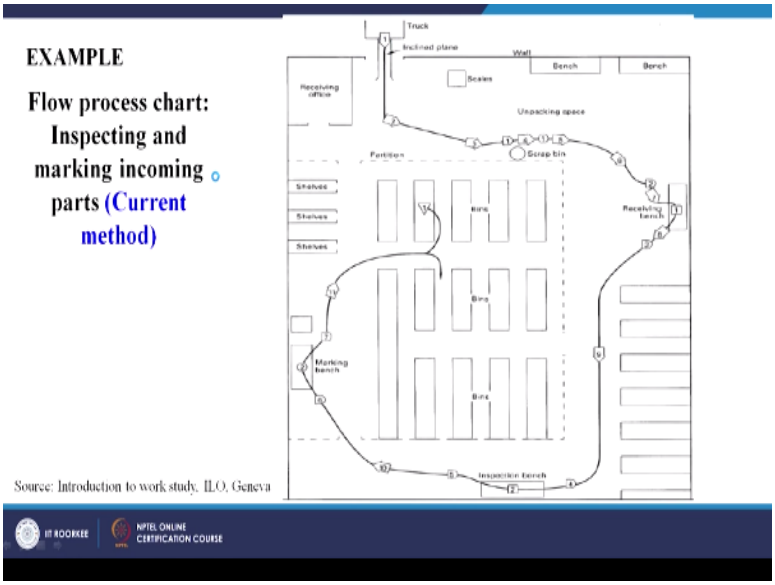


Now this is one example. You can see on your screen flow process chart inspecting and marking incoming parts. So what we are doing, we are inspecting and marking. So we have to do the inspection. So here you can see it is written very clearly truck. There is an inclined plane, all this information usually is missing in operation process chart, but in flow process chart it is given in a detailed manner.

And you can see the flow that how the material will flow inside the direction is given, inside the shop floor. So here we can see from the truck the material is entering all these are this is arrow, this is arrow, this is showing the direction, this is arrow. All these arrows we are using to depict the transportation.

This is arrow and here you can see this is one square which is representing the inspection as one of the targets is inspection and marking of the incoming parts and the sequence is shown the transportation there is a delay symbol here again there is an inspection bench and the symbol is again inspection symbol is there and then it goes to the marking bench, circular symbol is there which is showing you the operation or activity.

So we can see in a flow process chart, we use all different types of the process chart symbol so operation is there, inspection is there, transportation is there, delay is there, all symbols we are using and finally it goes to the storage which is the inverted triangle. So how this can be improved now. We can see that what we can improve. We can see it is travelling a lot of distance and finally it is getting stored here.

And we can try to improvise our method in by looking at the sequence of operations that are required and then we can redesign our layout in such a way that our effort is save, our time is saved, the transportation is minimized, the material handling is minimized, so with that we can see this is the current method. We have to now see that can it be simplified, can it be improvised, can it be optimized.

So with that target we can try to look at this thing. So if you go to the previous slide we can see there is a partition here. This is a partition it is written clearly here; this is the partition. So we can see that the material is coming from here and then the marking is happening here and it is going here. So we can try to improvise our layout. How we can improvise. We have changed now.

What is happening here, marking bench is there and our target is inspection, you can see inspection and marking. So these are the 2 major activities that have to be accomplished. So this is the receiving bench here, inspection is happening here and marking is happening here and all these material is moving through and finally being stored here.

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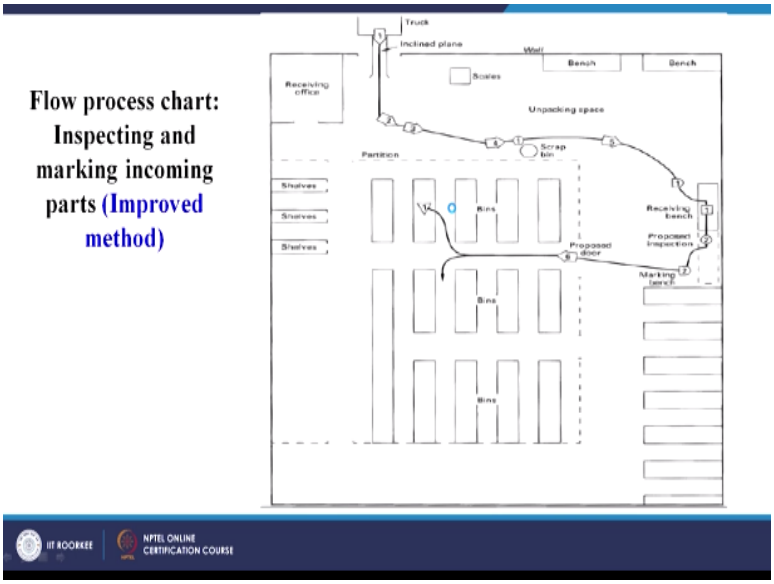


So we can improvise the method, it is coming from the truck, this method we cannot change but here you can see there is a receiving bench, inspection is happening, proposed inspection. So from our previous inspection which was happening somewhere here if we see in the previous slide. This is the inspection bench here. In the proposed one what we are doing. In the proposed one we are shifting it from here to here.

And then we were having our marking somewhere here if you go to the previous slide we can see. Here we are having the marking bench so we can change this we can bring the marking bench from here, we are changed it to marking benches coming here. So these 2 operations or one operation and one inspection what was happening here. We have changed the marking bench also; we have changed the inspection also.

And with this we can directly propose one door here that instead of the material traveling all the way in this direction and then being stored here we can very easily change our layout, these 2 things we can shift near to this receiving bench and directly move the material here. So it will certainly reduce the material handling. It will save time; it will reduce the distance travelled by the material on the shop floor.

So minor modification in the location of the facilities has helped us to optimize our layout. Then this is the flow process chart inspection and marking much more details are given here.

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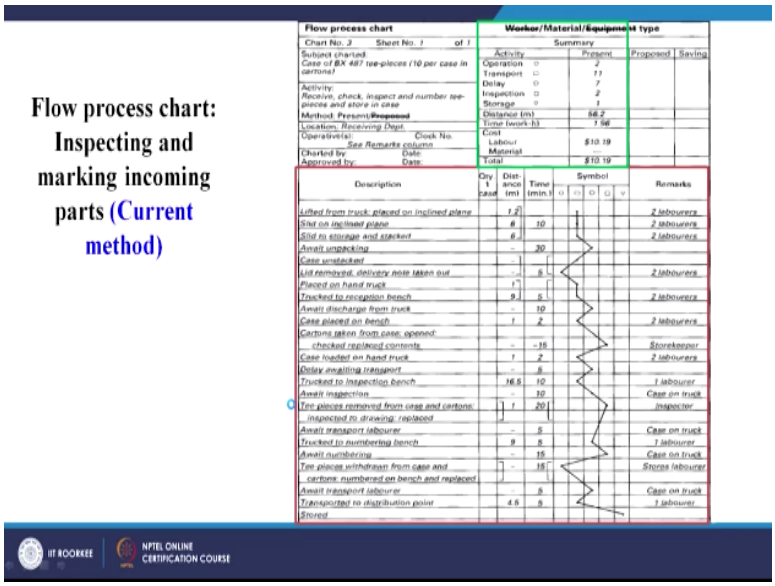


We can see quantity, distance and time are mentioned, these are the 5 symbols that we use circle, this represents operation all of you know this is transportation, delay, inspection and storage and what is happening and the remarks are also given, how many people are involved. So whatever details are given mentioned here.

And if you see flow process chart we have seen that we have to highlight what type of chart it is. So there are 3 types, operator type, material type and equipment type. So this type here we are depicting that how the material is coming from the truck, how it is traveling in the shop

floor, so it is a material type of flow process chart and this is the summary you can see the present method, how many operations are there 2, how many transportations are there 11, delay, inspection and storage.

Distance 56.2 meters, so again the cost of labour and material is also mentioned, distance basically is the main target here 56.2 is the distance travelled and time is also given in work hours.

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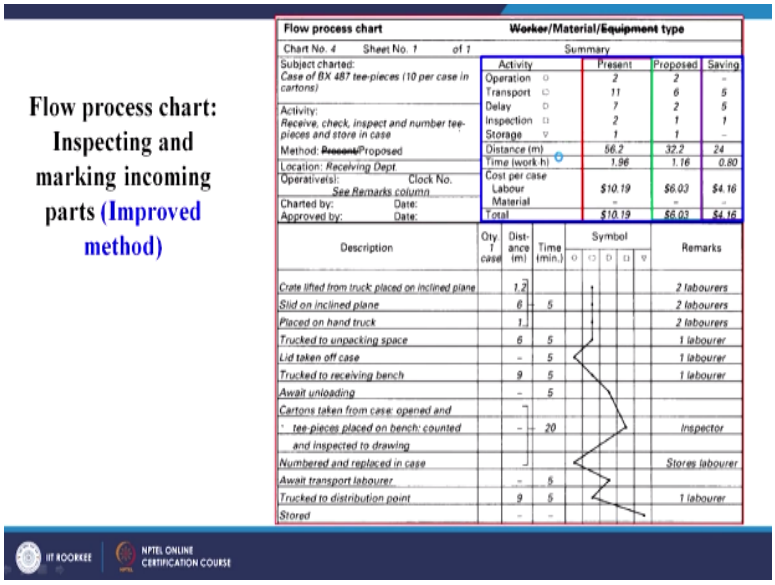


So if we see in the modified method the proposed method the distance travelled is 32.1 meter. Earlier in the present method it was 56.2 as we have seen here I have highlighted 56.2. So 56.2 has now been attacked and we have been able to reduce it to 32.2 by changing the layout of our shop floor. So all the other details you can look, but here we can see the number of transportations earlier in previous section were 11.

Here also the transportation is 6, so not much changes from 11 it has reduced to 6. Operations remains 2, delay earlier there was lot of delay 7 it has reduced to 2. So transportation reduced from 11 to 6. So in the proposed method we are doing less transportation. We can say less delays are there. The distance travelled is less, so overall our savings are more.

So the cost per case of travel labour you can see $10 earlier now it has reduced significantly to $6 per case. So this is a material type so our material that we are moving is it is given here subject charted that is the case of B 487 tee-pieces 10 per case in carton. So this is the material type so the details of the material are also highlighted. So we can see that by

changing the layout slightly we are able to save money in terms of the effort that we are putting the number of labourers that we are employing.

So we can see the overall advantages are there of applying the systematic technique of recording using the graphical tool such as operation process chart and specifically today the flow process chart and then optimizing our layout and these are the advantages.

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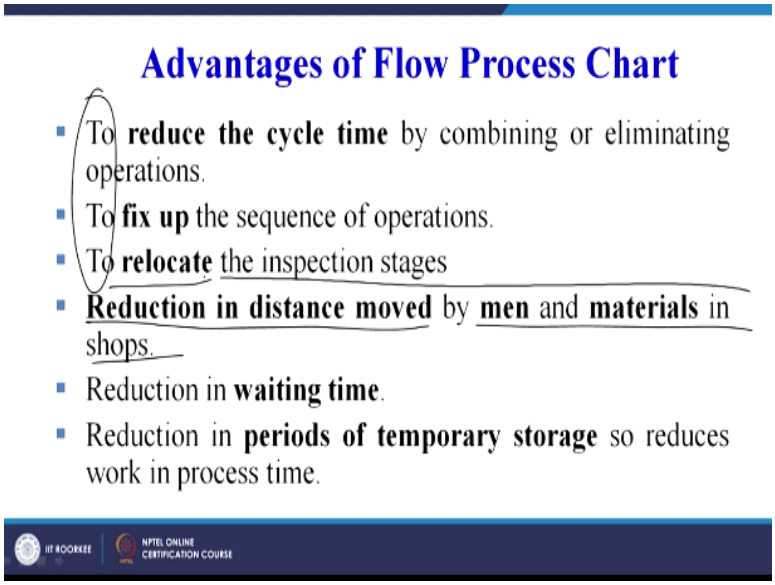


I think whatever I have discussed today it is the summary of all that. It is to reduce the cycle time by combining or eliminating operations to fix up the sequence of operations, to relocate the inspection stages so these are the advantages, it is the flow process chart will help us in achieving all these 3 things, it will reduce the cycle time, fix up the sequence of operations, relocate the inspection stages as we have seen in an example reduction in the distance moved by men and material in the shop.

This is the summary of our case study, reduction in the distance moved by men and material specifically in our case it was the case study of the material type of flow process chart, reduction in the waiting time, delays have come down in our case study. Reduction in periods of temporary storage so reduces the work in process time.

So with this we conclude today's session by understanding that flow process chart can certainly help us to improve the work or improve the method by which we are doing our work and the criteria is already outline that how we can compare 2 or 3 different methods of

doing the same work. Maybe in next session our target will be on other techniques that are employed for doing the method study.

We will try to take examples wherever possible to make the things even more clear and seems practical for understanding point of view. Thank you.