Principles of Industrial Engineering
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Lecture- 26
Material Handling

Hello, I welcome you all in this presentation related with the subject Principles of Industrial Engineering and in this presentation basically will be talking about the material handling related aspects. We know that during the manufacturing it is required that, the material from its raw condition to the semi-finished condition to the finished condition. These are the different stages through which material will be passing through in course of the production process. So, since the material is processed at the different stages, so it is required that it is moved from one stage to another.

So, this movement of the material from one stage to another, basically comes under the material handling. And it requires a lot of efforts to realize these kinds of movements; so that it goes through the different stages efficiently, effectively and with the minimum cost. Because the material handling means the movement of the material course of the production involves lot of time, resources and cost.

Sometimes this the cost related with the material handling can be as high as sixty to eighty percent of the total product cost. So, if the material handling related aspect is not designed and executed effectively, then the material handling cost may be very high and the production system maybe inefficient.

Because it not only effects the cost related thing but also effects production cycle. So, the productivity of a plant which is involved in manufacturing of something can be affected significantly due to the inefficient material handling. So, under the material handling, what are the different features that will be talking about.

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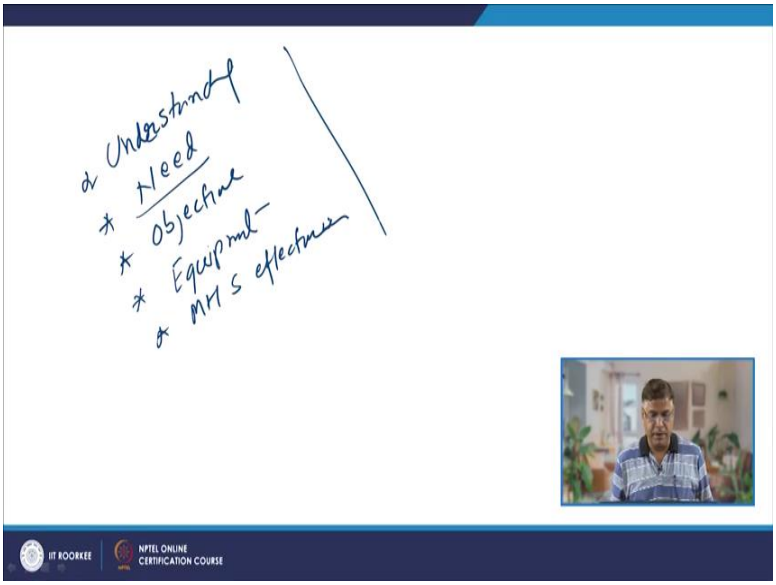

First, will try to understand the material handling understanding of the material handling. Then what are the requirements and needs fulfilled by the material handling, what are its objectives. So that the material handling system is designed in such a way that; the production system is able to give the output desired in a minimum production cycle time at the low cost in the required quantity and the required quality. Then what are the different equipments which are used for material handling? And how to assist the effectiveness of material handling system as a whole. So, material handling system effectiveness, how it is checked. So, these are the different things about which we will try to talk about in this presentation.

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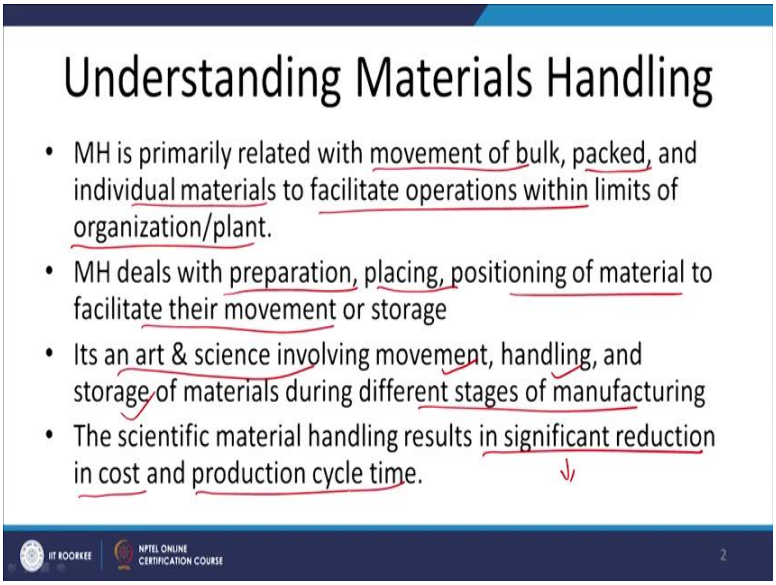

So, as I said the material handling primarily involves the movement of the material and this material maybe in the form of the raw condition like solid, liquid or the gases. This maybe in form of semi-processed condition or in finished condition. So, material handling primarily involves the movement of the bulk material or the packed material or the individual components depending upon the size and shape or the form in which the material is to be moved in course of the production.

So, it helps to facilitate, so this kind of movement primarily helps in facilitating the operation in course of the production; primarily within the limits of organization and or the plant. So, in realizing this, the different things which are done under the material handling include the preparation, placing and positioning of the material so that it can be moved from one stage to another or it can be located or stored suitably wherever it is to be used.

It is an art and science involving the movement, handling and the storage of the materials in during the different stages of the manufacturing. And then if the material handling system is designed efficiently, then it can result in significant reduction in the cost and production cycle time. So, reducing the cost, reducing the production time will help in increasing the productivity and will help in providing the products to the customers at very competitive price which will consolidate the position of the company in the market.

So, these are the different aspects related with the material handling. What is the kind of purpose related with the material handling?

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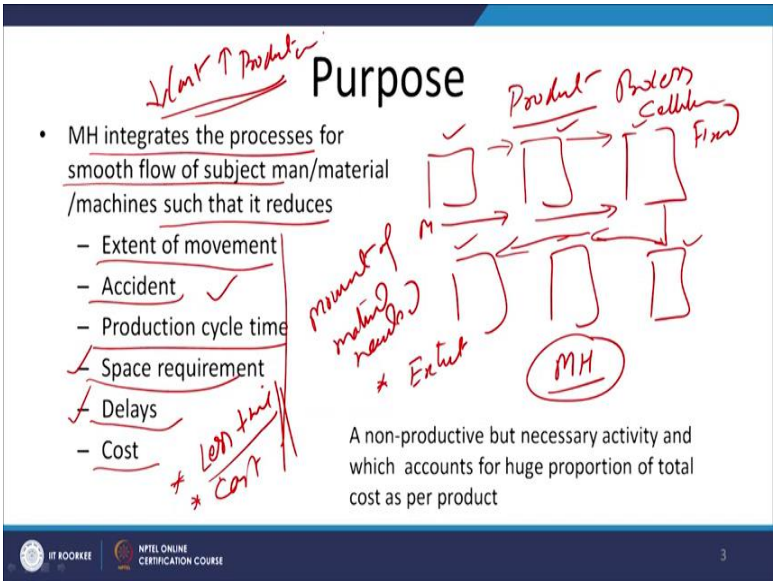

Basically, let us say there are different kind of the production systems or the way by which the material facilities are arranged, like we have seen the facilities maybe arranged in form of like the we can follow the product layout or the process layout or the cellular layout or there can be fixed layout or combination layout. So, as per the kind of layout which is being followed in all these layouts there will be some kind of the pattern or the movement of the material.

So, whatever kind of the layout is being used in a production system, the material or the raw material has to be moved material has to be moved from one stage to another, like say this is the kind of the movement which can be there for the product layout or it can be zig-zag in case of the process layout. But, in all these cases the movement of the material is needed, efforts are always made in such a way that, the extent of the movement, the system is a material handling system is designed in such a way that the extent of the movement is reduced.

So, that the efforts required to move the material from one stage to another can be reduced. So, basically between these machines all these machines, all these machines which are arranged in different ways as per the kind of the layout which is being followed. These will be integrated through the some kind of the material handling system because material will be moved from one machine to another and these will be integrated or these can be connected with each other through some kind of the material systems.

So, material handling therefore, integrates the processes and the production system for facilitating the smooth flow of the resources which are needed for realising the target production. So, this material handling system should be designed in such a way that, it reduces the kind of the movement which is needed or extent of movement which is needed. It reduces the accidents occurring due to the harmful hazard movement or the placement of the material and the shop floor.

It also should reduce the production cycle time and more effective utilization of the space available in the shop floor is facilitated through the material handling. So, the space requirement is also reduced. It also should reduce the delays and the cost. So, if these things are realised, then will be investing the less time, material will be investing, material will be there for the less time in course of the production. So, less time means higher productivity in less time we will be able to produce more or in the same time will be able to produce more, so that it turned will help in increasing the productivity.

At the same time, it will also help in reducing the cost at which it because the time is reduced, accidents are reduced, space requirement is reduced, delays are reduced. So, these scenes will help in actually in reducing the cost and making the increased production or increasing the production. And both these aspects will help in providing the products and services to the customers at the competitive price which will help in consolidating the position of the company in the market in much better way.

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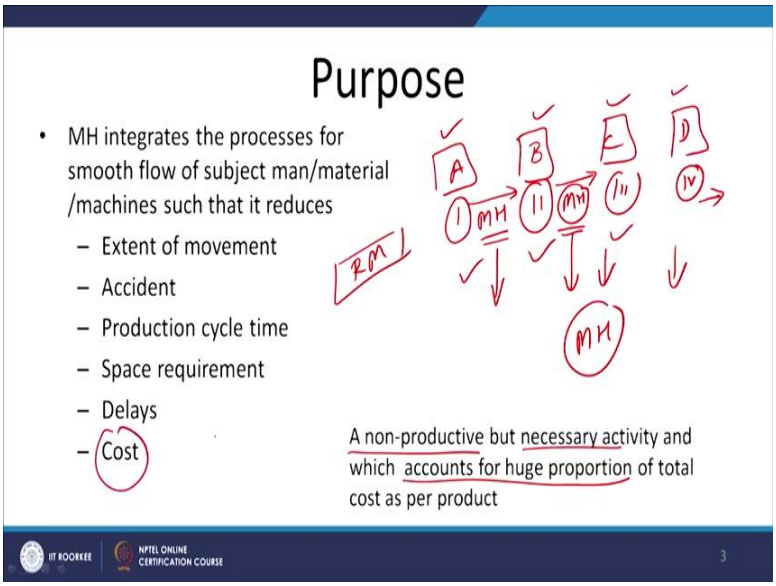

If we see the actual work is done by the different machines in which will help in completing the product towards the final stage.

Like a product is processed from it's the raw material stage to the through the different machines, like A, B, C, D so some of the operations are done at machine 1, then some of the operations are done at machine second machine, then third machine and then fourth machines. So, the product is completed at the fourth machine. So at each stage material will be moving from one stage to another and approaching towards the completion. So, actual the work is done on the raw material at these stations by these machines.

But, all these machines will be able to do the work only if the material is able to reach to them. And for that we need the material handling system, we need that material is moved from one station to another. So, actually the material handling component here is not contributing in sizing and shaping towards the completion but, it is simply facilitating the availability of the material for further processing. So, considering these aspects this is not helping in completion but this is necessary activity which will help to initiate the process at the next station.

And that is why, material handling activity is considered to be a non-productive activity. Although it is necessary to do the work at a particular station, so that it can be completed or the job can be completed. So, it is a non-productive activity but it is necessary activity and it accounts for huge proportion of the total cost. So, because of this sufficient efforts and trust should be given so that efficient and effective material handling system can be designed. So that it requires the minimum movement, minimum efforts, minimum time to move the material from one stage to another.

And so that it can be completed in the earliest possible time with the minimum investment of the resources so that the cost can be reduced and the production time can be reduced.

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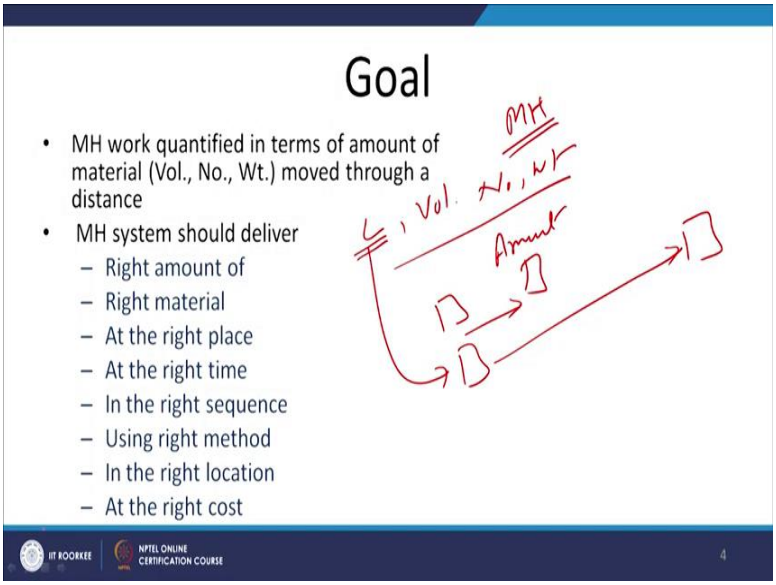

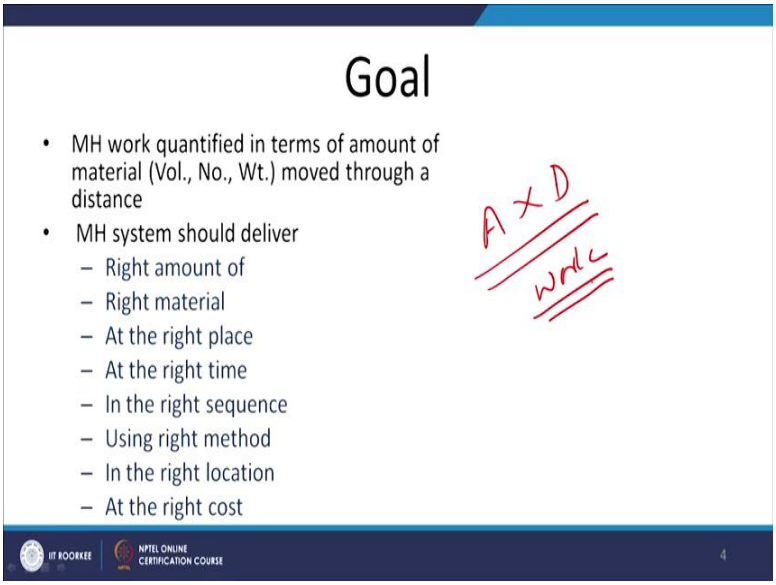

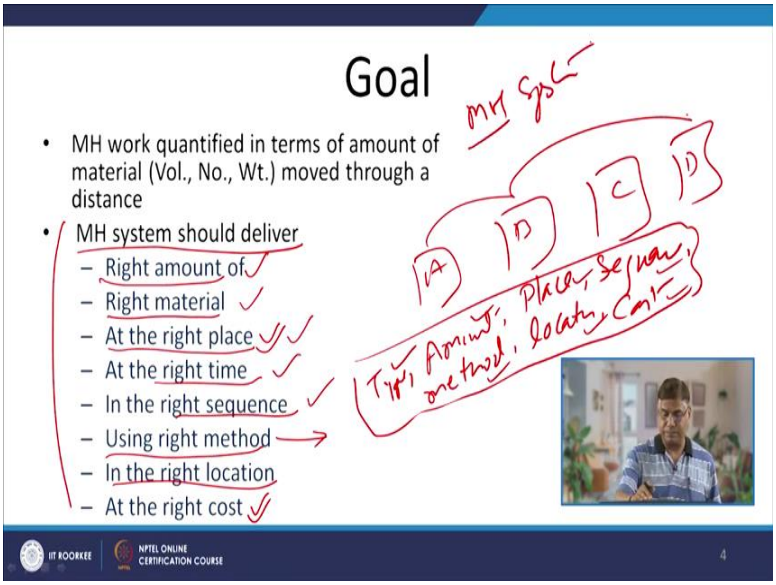

So, these are the purposes, then so in which way we should design a material handling systems so that we are able to achieve the target of the reduced cost and increased productivity or the reduced production cycle time. For that, of course we have to move the material from the one stage to another so we need to quantify the kind of the movement of the resources which is needed through the material handling.

So, if we see material handling work if we have to quantify, this can be quantified in terms of the kind of litres of the liquid which is to be handled the kind of volume, the number of units, the kind of the weight of the material to be moved from one stage to another in course of the production. So, apart from this amount of the material like the two stations very closely placed the extent of the work to be done for this movement will be limited as compared to the case when the two stations are widely spaced.

They are located far away, so for the same load same amount of the material handling will have to do lot of work. So, the distance through which the material is be moved and the amount of the material which is to be moved will be determining the extent of efforts to be made for.

So, amount into the distance, this will be determining the kind of the work to be done for material handling and whatever kind of the machinery and the procedures are used for material handling it should make available, it should deliver basically a material handling system should deliver the right amount of the material which should be there at a particular station so that the further work can be done.

It should provide the right amount of the material and that material should be made available, right material in the right amount should be made available at the right place, means at the right station. And it should be available at the right time at the right sequence because sometimes there may be different products, so the material will be moved from A to B, then B to D like A, B, C, D.

So, if there may be skipping of some of the machines as per the kind of the product which is to be manufactured. So, product to be used, so suitable amount of the material, the suitable type of the material at the right time at right place and at right sequence using the right method. This is important so that the material does not get damaged in course of the material handling and it is made available in the right form in which it is required using the suitable method.

And while keeping in mind that, the efforts required suitable methods means it should be such that, we have to invest less as less as possible. So, that the material handling activity can be realised at minimum cost, and the material should be made available at the right location, at the right cost means at the minimum cost. So, these are the kind of the factors like the right amount of the material, right type of the material in right amount at right place at right sequence using the suitable most appropriate method and it should be made available at the right location and then cost.

So, these should be the correct one, means the required material, the required type of material in required amount at right place, at right sequence using right method at right location and at minimum possible cost, it should be made available. So, these things should be kept in mind when a material handling system is designed.

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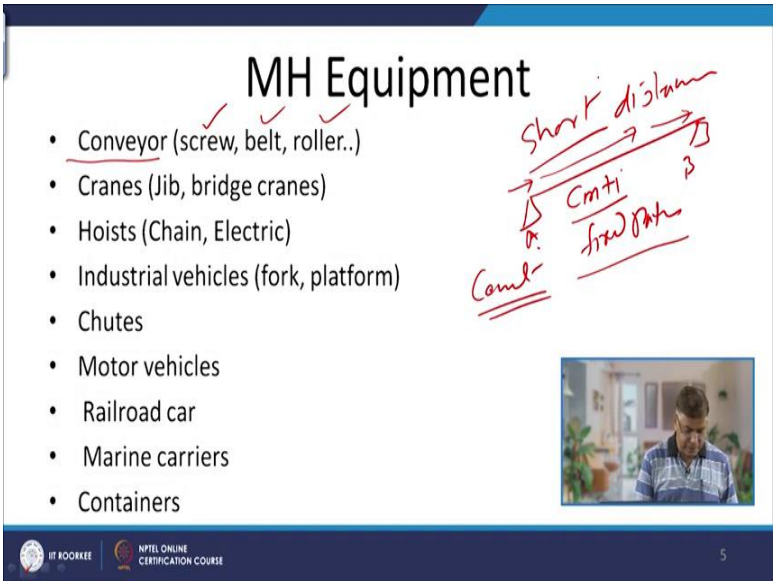

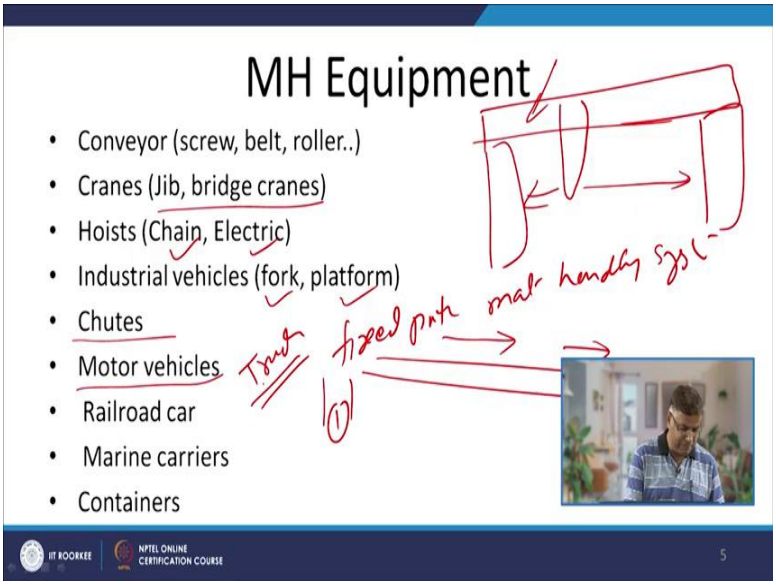

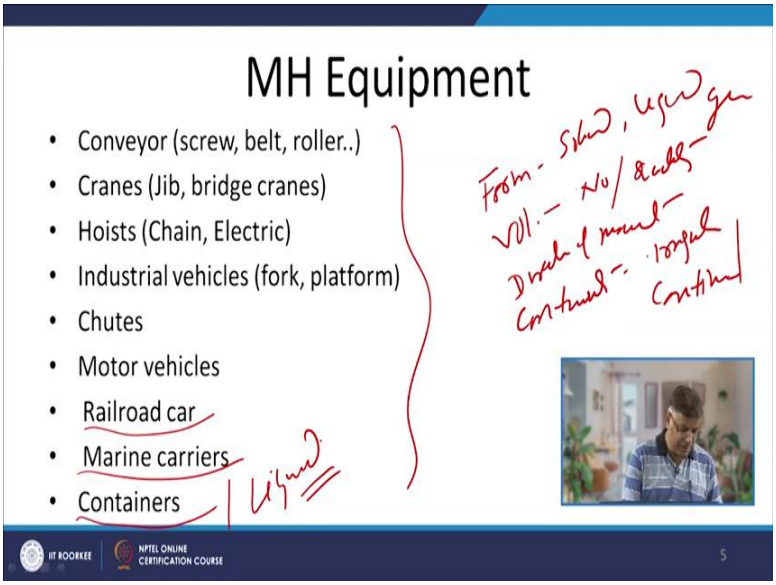

So, there are different types of the machines and the equipments which are used for movement of the material depending on the type of the material and the kind of the operation which is the scale of production, the kind of material, the form of material which is to be handled.

So, this is just the list of equipments which are used, say conveyors which can be of the screw type conveyor, belt conveyor, roller conveyors these are primarily used for comparatively short distance movement, like say ten meter, fifty meter like that and when the path is fixed between the two stations. So, if there is continuous movement from station A to B is needed, fixed distance, short distance and there is no change of the direction of the movement.

Always the material is moved in this fashion only and that is continuous, continuous movement fixed path, fixed direction, short distance then these conveyors are used. So, as per the kind of the material to be handled, suitable type of the conveyor can be used, roller conveyor belt conveyor, screws. And these are like in a cement industry these are used and likewise in the number of manufacturing processes these conveyors are commonly used. Then we have the cranes which are like say, jib crane or the bridge cranes.

These are also called overhead cranes like bridge crane. So, when like say there are two supports and between these two there is overhead crane, which will be moving in the different directions, longitudinal and transverse direction to move the material within a particular area. So, the different types of the cranes are there, then the hoists of the chain type and the electric hoists, then electric vehicle these are basically powered vehicles of the fork

type and the platform type which are very commonly used in industries to move the material from one section or one department to the another.

The chutes are like these are the fixed path the material handling systems. So, these can work like under they use the gravity, effect of the gravity to move the material from the one point to the second point. So, fixed path movement in fixed direction, short distance kind of, if the movement of the material over short distance in a fixed path, fixed direction is needed from like say difference in elevation is needed to utilize the gravity effect while using the chutes.

And then the motor vehicles like the, trucks in the cement industry these are very commonly used because of lot of material is to be handled. Then the railroad cars material handling of the coal to the thermal power plants from the mining area. Then marine carriers and the containers for the liquid handling or the liquid movement of the liquid, and the gaseous items like LPG, petroleum et cetera are used.

So, for those purposes containers are used. So, these are the different varieties of the equipments which are used for the material handling. So, depending upon the from like the solid, liquid, gases depending upon the volume like in number of units or the quantity to be handled. The direction of the movement or the continuity of operation, so it is like a regular or the continuous. So, depending upon the kind of the nature of the movement which is needed the suitable type of the material handling equipment is used.

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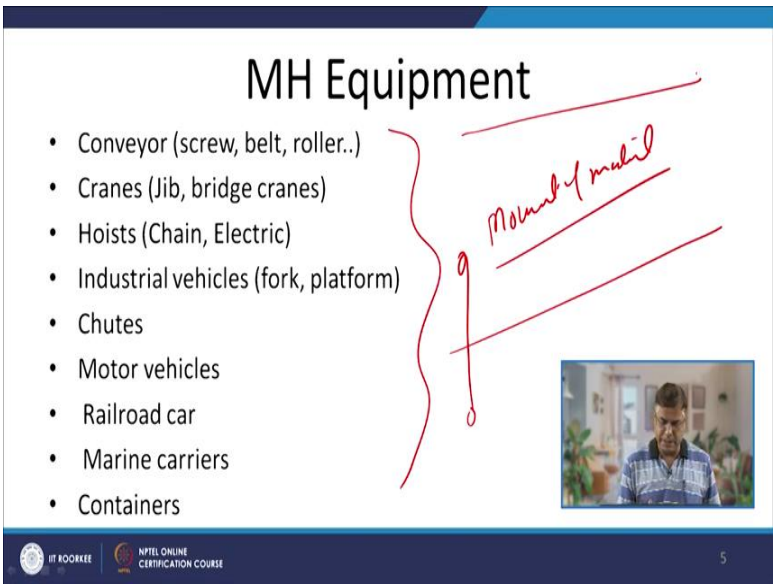

So, now will see these material handling equipments will be facilitating the movement of material in different ways, like say simply the movement of the material in the same plane or movement of the material from lower plane to the higher lower level to the higher level or the movement in a fixed path at a particular level. So, depending upon the kind of the constraints or the conditions under which the material is to be moved, a suitable type of the material handling equipment is installed to facilitate the material handling.

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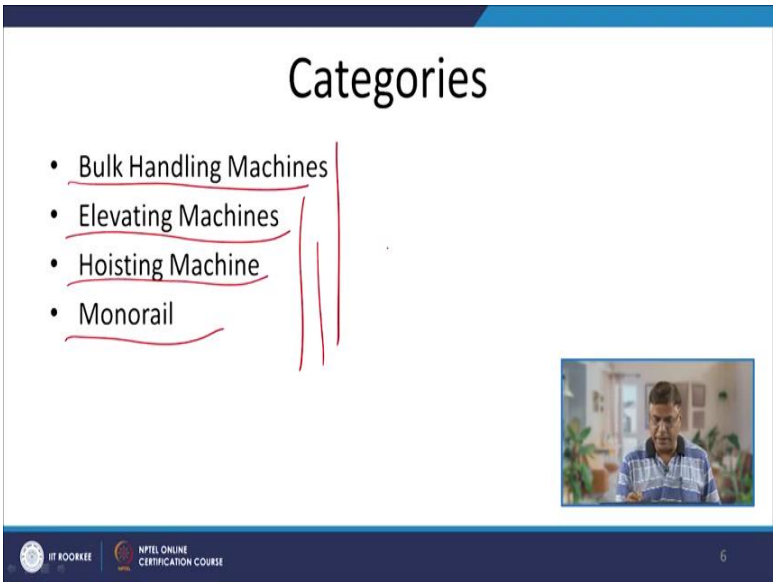

And these material handling equipments will performing the different kind of the functions. So, based on the kind of the role that these material handling equipments play like a bulk material handling machines, which are used for moving the large quantity of the material changing the level of the machines like elevating machines where the raw material is moved from one level to another. Hoisting machines and the Monorails, so these are the four categories of the machines depending upon there role and the purpose which can be facilitated through these machines.

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So if we see the material handling equipments of the Bulk Handling Machine type. So, the material is handled here and then it is moved, so material is moved from one this is also kind of the crane. This is the industrial tractor, so these will be used to move the lot material from one section to another department to another for further processing in course of the production. Then in Elevating Machines like in cement industry or the crushing stones, these kind of the equipment are used, where the change in the level of the raw material is facilitated through these elevating machines.

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Then we have the hoisting machines, hoisting machines are like this is typically used in say in the dams for opening for facilitating the opening and closing of the gates, for release or a control of water. So, these one typical applications. Likewise in the industries these hoisting machines, these electrical hoist or the chain hoist which are used. So, on these will be working on a fixed path, fixed distance because there is a limit on the maximum distance which can be covered through so whatever is the span between which the material can be moved very efficiently using this.

But, the problem is there is no change in the direction. Other than the path which these have been developed, it will be difficult to use these in the other directions.

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And then monorails, monorails operates over the fixed path rather than over the limited areas.

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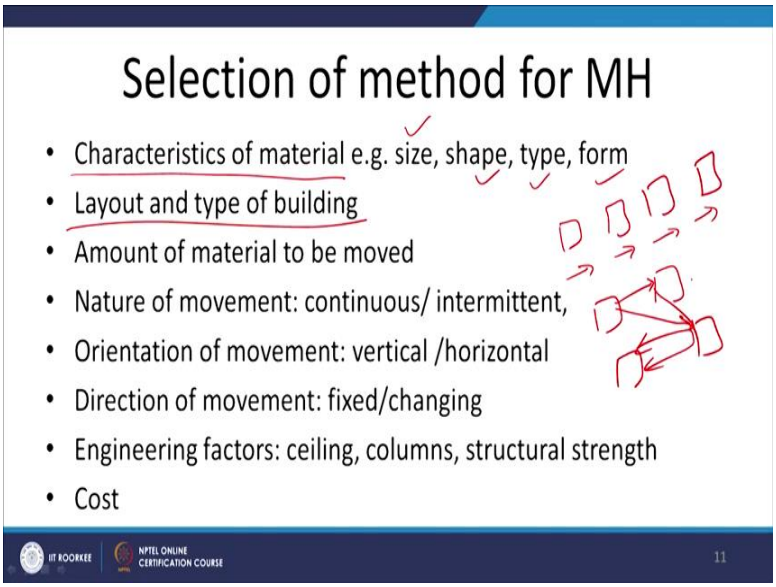

So, these are some of the material handling equipments, so since there are variety of the material handling equipments. So, there choice should be made in such a way that, it is able to provide the required amount of the material in required time so, that the production cycle time can be reduced and the cost of production can be reduced.

So, the choice of the suitable material equipment is critical. So, that choice is made based on the certain factors, so the points that we should consider for selection of the suitable material handling system, includes like the characteristic of the material to be moved or handled

depending upon its size like small size component chutes can be used, if their shape does not create problems in the movement of the material through the chutes.

So, the size, shape, the type means the solid, liquid, gas or the form in which the material which is to be moved. Then another is the type of the layout and the type of the building. We know that in certain kind of the layouts like product layout the path is the most of the time fixed. So, material in any case will be moving from one stage to another in a particular sequence only. While in case of the process layout, the material can follow any path as per the kind of the it can go through these root or then it can go directly through these roots, so there is no fixed path.

So, in process layout there is zig-zag movement, there is no fixed path. So, that point is to be kept in mind when selecting the suitable material handling equipment for handling the material.

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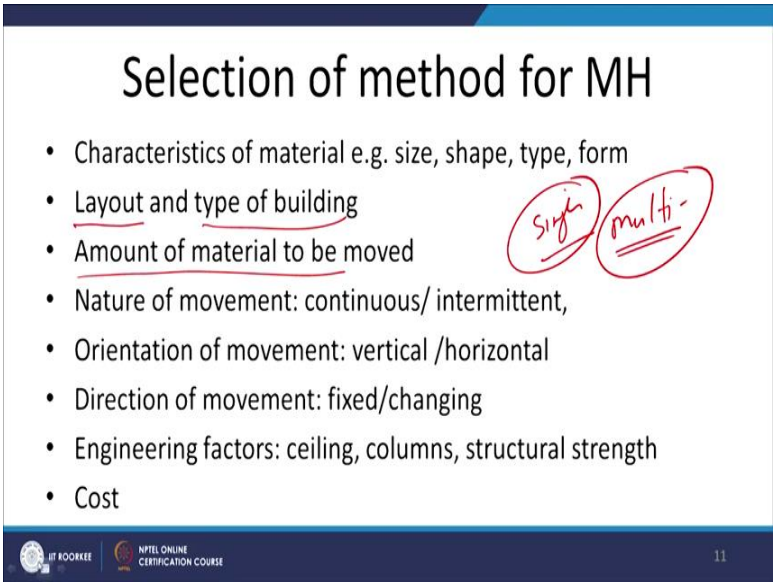

So, depending upon the type of the layout and the type of building is another important because if it is the single story or if it is a multi-story kind of thing. All these devices will not be working effectively equally in equally effective way, for the different types of the buildings.

Maybe for a single story these maybe good but for multi-story story there will be specialised kind of the material handling devices, which will maybe effective many devices may not be many material handling equipments may not be effective for the multi-story kind of the

buildings. Then amount of the material to be moved like say, the material to be moved once in a while or it is like so once or twice in a day or the continuous movement is needed. So, accordingly the suitable kind of the material handling equipments should be used.

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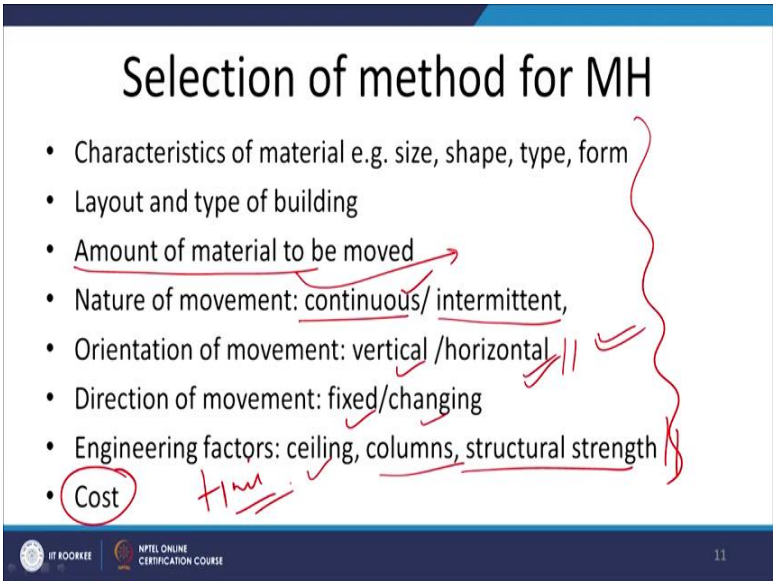

Then there is a like nature of the movement whether it is continuous or the intermittent. There was an amount of the material to be moved, amount means whether it is like the few units or the thousands of the units few litres or the thousands of the liters. So, the depending upon the volume suitable material handling device should be used. The nature of the movement is about whether it is continuous or the intermittent kind of the movement. Like fixed roller conveyors and the conveyors can be used for continuous movements likewise the monorails can be used for the continuous movements.

Industrial trucks and the hoist can be used for the intermittent movements. Then the nature of the orientation of the movement, whether it is vertical movement is needed or the horizontal movement. So, the cranes and hoists can be used for moving the material up and down. Then there are various machines like machines which can be used. Means machines or material handling equipments, which can be used primarily for the movement of the material in the horizontal plane.

And then the direction of the movement whether it is fixed or it is changing. So, if it is changing, then the cranes or the industrial trucks will be more useful. If it is changing and if it is fixed, then the like say equipment monorails can be used for the fixed direction of the movement. Then the various engineering factors like height of the ceiling is very huge height

of the ceiling. In case of the hoists and the monorails because there should not be any interruption, then the restrictions can be offered by the structural strength of the building and the columns because the lot of load will be taken by the columns.

So, these can also restrict on the use of the type of the material handling equipment should be used. Now, whatever type of the material handling methodology we are using, it should help in reducing the cost as well as time. So that we can actually produce the things economically at higher productivity.

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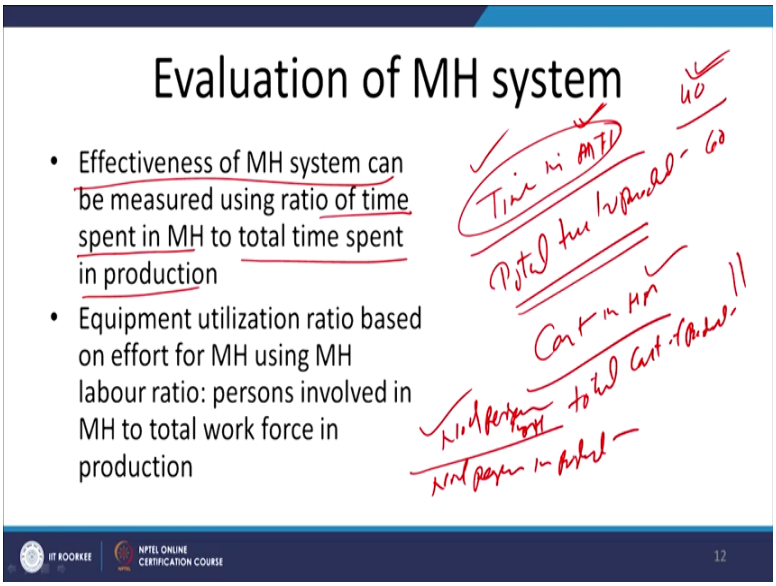

Then to evaluate the effectiveness of the material handling system, there basically two approaches or two parameters are used. This is called like say effectiveness of the material handling system can be measured using the kind of the time spent in material handling.

Time applied in the material handling, time required to move the material divided by total time to produce. So, if the total time is say sixty minutes and the time required to move the material is forty minutes. So, this means we are investing really a lot of time in the. So how much percentage of the time efforts are made in moving the material out of the total production time.

So, this is one parameter like the time required to in process of the material handling or for the process of the material handling divided by the total time required for the production. So, ratio of the time spent in material handling to the total time spent in the production. Another that parameter is the cost that is involved in the material handling divided by the total cost to

produce the things, total cost of production of unit item or the given volume. And there is another way that, the number of persons involved number of persons involved in material handling in material handling divide by the number of persons in the entire production process.

So, these are the some of the parameters which can be used, the time in material handling divided by the total production time. The cost of the material handling divided by the total production cost or the total number of workers being used for the material handling divided by the total number of workers involved in the production process. So, these are some of the parameters which will indicate that, what is the kind of the efforts being made in the process of the material handling and how effective it is.

Now, will summarize this presentation. In this presentation basically I talked about the importance about the material handling, the different objectives of the material handling, the equipments which can be used for material handling and what are the factors should be considered, while choosing the suitable type of the material handling system. Thank you for your attention.