Principles of Industrial Engineering

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Organization of Facility
Lecture No. 24

Hello, I welcome you all in this presentation, related with the subject Principles of Industrial Engineering. And you know, we had talked about the various ways by which the facilities are arranged in the plant which is manufacturing variety of products, and that is what we have learnt under the plant layouts. Like the plant layout of the product type, where facilities or manufacturing processes and the machines are arranged in the order of, in the sequence in which the jobs are to be done to produce the, to produce the product from the raw material to the finished product stage.

On the other hand, the process layout where we have seen that the facilities performing the similar type of the function are arranged at one place. And then there were the combination types of the layouts, like cellular layout and the product, and process layout where facilities are grouped according to the functions as well as the sequence in which the jobs are to be done.

We have also seen one more type of the layout, which was the fixed layout. In this fixed layout, we have seen that the whatever facilities, manpower need to be used for manufacturing the big item like ship or any big equipment so there the minor equipments, facilities and the manpower are brought to that location and the work is done to get the desired product. So, but that was about the arrangement of the production facilities.

In this presentation, we will be talking about the way by which the different facilities and the things need to be arranged in a plant. So, that is what we will be seeing under the organization of the facilities. So apart from, like the arrangement of the manufacturing processes and the machines, we need to see various other aspects to accommodate the various facilities which are needed in a plant.

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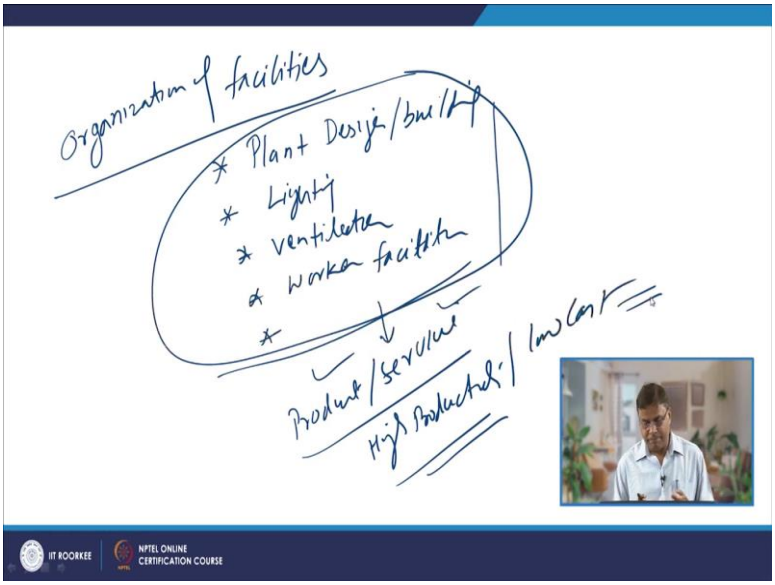

So, organization or arrangement of the facilities, organization of facilities in a plant to a great extent influenced by the kind of the plant building design or the plant design or design of building, which is there. Then, there is other factors like the kind of the lighting requirements, the kind of the ventilation requirement, and the kind of the facilities, worker facilities which are, facilities which are to be arranged.

So, these are the, these are the things that we have to accommodate in organization to come out with the products and services which can be realized with the high productivity at low cost. So, main idea here is to have various facilities in a plant in such way, that our products and services are produced with the maximum productivity and at minimum cost.

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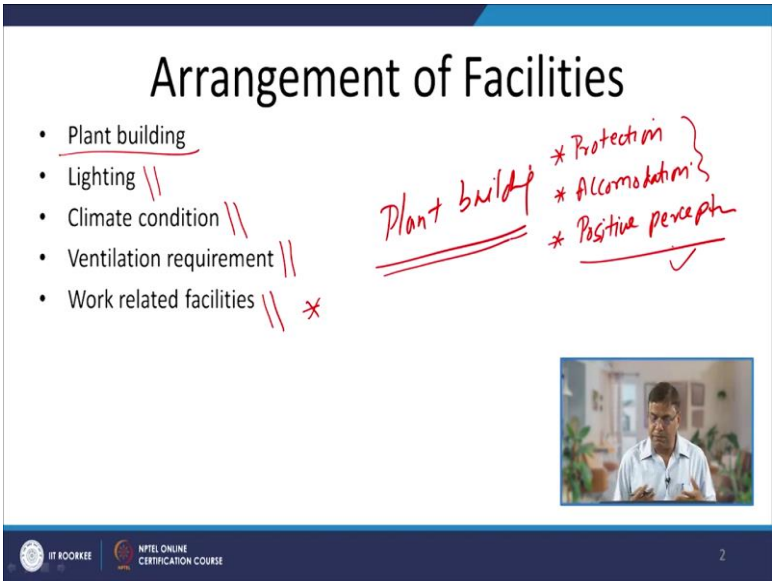

So, what are the various things that we need to see in setting the various facilities in organization of facilities in a plant. So, the plant building is one of the big factors because it affects how the different machines which are being used to produce the goods and services will be located and what kind of the plant building or plant design should be, so that it can really accommodate the changes as per the requirement in future, due to the change of the product or due to the change of the technology related with the manufacturing.

It also considers the kind of the lighting which will be needed for the smooth production, free from accidents, without fatigue to the operators. Climate conditions must be comfortable to the operators, so that they can work efficiently and can give the maximum productivity. And likewise, for healthy conditions of, for healthy, for good health of the workers, proper ventilation in the working environment at the workplace should be maintained.

So, what are the requirements related with the ventilation, about which we will be talking about. And the various worker related facilities, also need to be accommodated in the plant. So, among these factors the plant building is one of the biggest factors and it is very important, because it affects the way by which different facilities will be accommodated in the plant.

So, the main purpose is that it provides the protection to the various resources; in form of the man, material, machines, workers and other resources, and it also accommodates all these resources. So, protection as well as accommodation to various resources is made possible through these, the plant building.

At the same time, it also creates like the very grand, very good looking building helps to create very positive perception among the users about the, about the kind of the company it is, or the manufacturing unit. So, the perception is also influenced by the kind of the plant building which is there. Sometimes the plant building in very poor shape, despite of doing good job may not be perceived to be very good.

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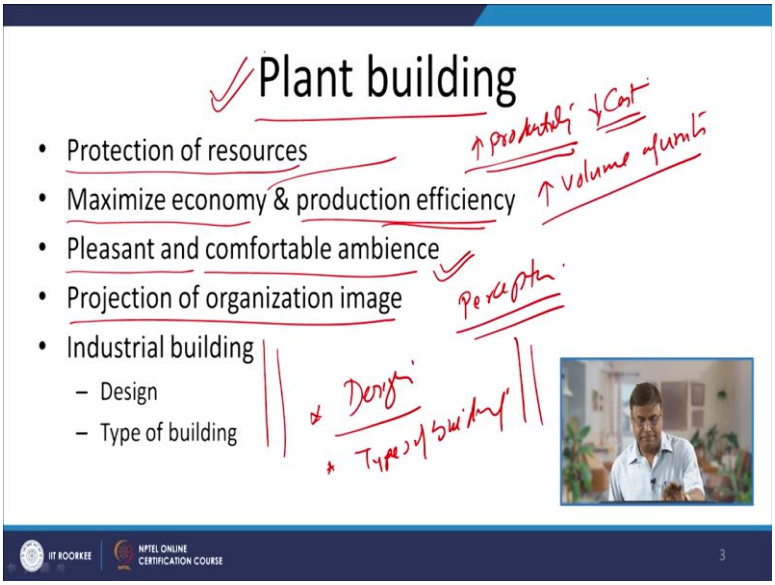

So, as far as the plant building related points are concerned it provides the accommodation, as well as protection to the resources in form of man, machine, material and other worker welfare related facilities. And these, the plant building should be such that it helps to arrange the machines in such a way that, it increases the productivity and helps in producing the things at the minimum possible cost, so that we get the advantage of maximizing the economy.

And the production efficiency in, is enhanced in terms of the increased volume of the, increase in volume or the number of units which are produced by the company using the given set of the resources. So, it should be such that it accommodates the facilities and all resources in such a way that the economy is maximized. Then, it should also provide the pleasant and comfortable working environment, so that the workers can continue to work for longer time with the minimum fatigue; for realizing the high productivity, minimum wastage, minimum accidents, minimum defective products.

So, if the workers are happy and they work, they get the pleasant environment to work then they will be able to produce the things with the minimum defect and maximum productivity. As I have said, it also affects the plant building, affects the projection of the organization's image. So, perception about the organization is influenced by the plant building. As far as the plant building is concerned, there are 2 big aspects. One is the what kind of the design or plant building should be and what are the different types of buildings. So, these are 2 important factors, as far as the plant building is concerned.

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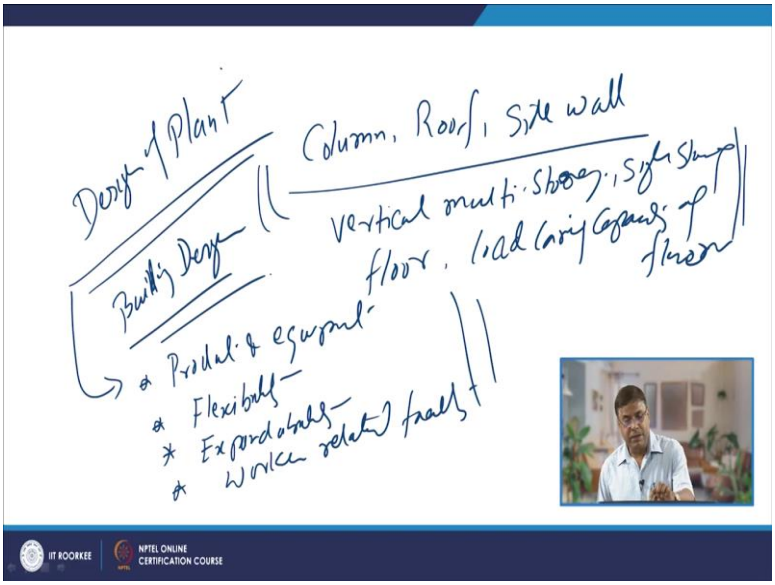

So, if we see among the factors related with the design of plant. Design of the plant like, where will be the columns, where will be the roof, where will be the side walls, whether it will be the vertical arrangement like the multi storey structure, or it will be the single storey structure. So, the kind of the building design will depend upon, and the kind of the floor, and the load carrying capacity of the floor, of floor, all these things will be influenced by the plant design related factors.

So, what are the factors that should be considered when we are looking after the design of the plant or the design of the building, so that is about the kind of the product and equipment to be used for manufacturing, the kind of the flexibility that will be offered by the plant building, the kind of expandability, the kind of expandability or expansion related aspects, and then worker related facilities. So, these are the 4 factors that need to be considered when we are looking after the building design; choice of the building or construction of the suitable building design.

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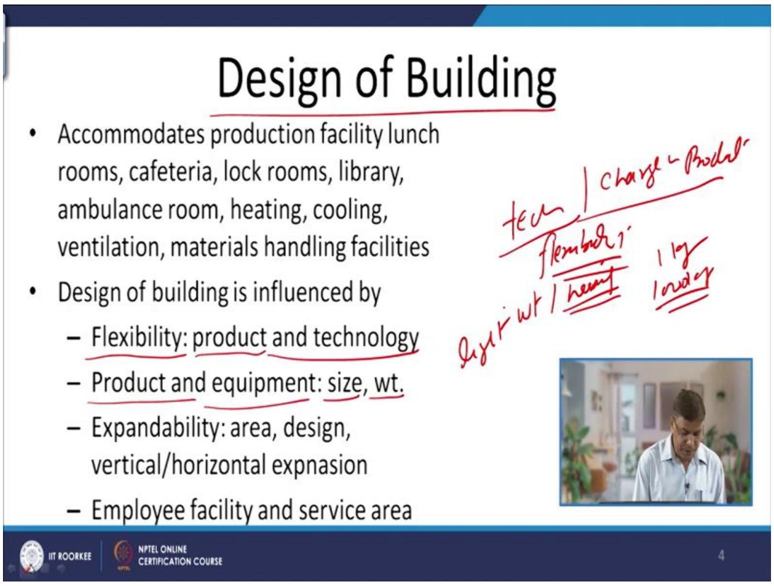

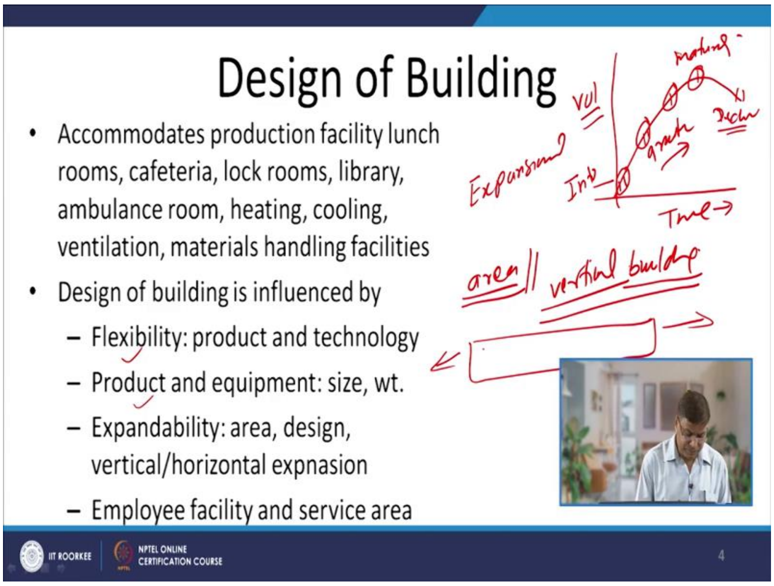

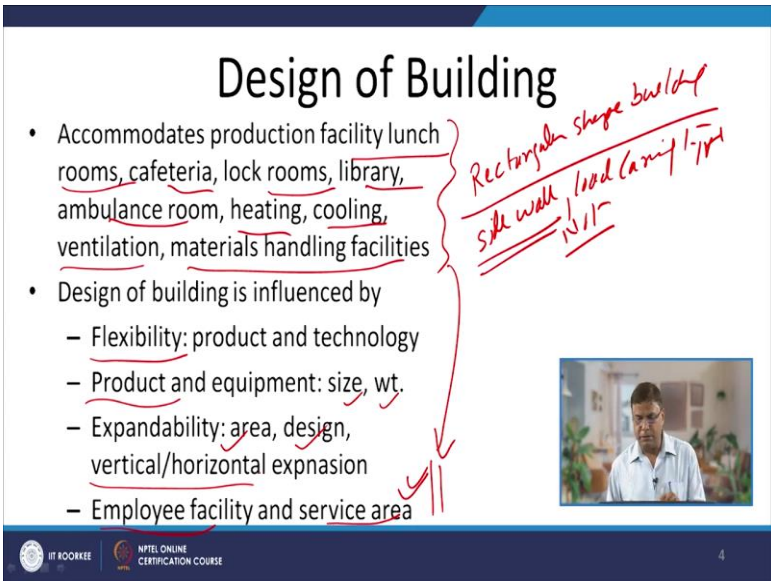

So, the design of the building as I said, design of the building is influenced by the flexibility. Because currently, considering the existing product the building may be designed but in a long run after 5 years, 10 years the products may change and accordingly we may have to use the facilities, different types of the production facilities. So, the building design should provide enough flexibility to accommodate the different products and the different technologies which may come up subsequently in future.

So, not just the existing products should be kept in mind with regard to the efficient manufacturing, but also the kind of technologies which are being used or the kind of the change or alteration in products which will happen to remain in the market. So, whatever design is there of the building, that should allow enough flexibility for accommodating those changes. So, the building design must allow the change in product and the technology related with the manufacturing efficiently in future.

The kind of the product and equipment also affects the suitable building design like the, if the product is lightweight or the product is heavy. So accordingly, we may go for the single storey or the multi storey or the kind of the weight which is to be handled, it is just like 1 kg or 1000 kg products are to be handled during the manufacturing.

So accordingly, the floor space, columns, and the walls, which will be accommodating the material handling devices should be in position to deal with the size of the product and the kind of the weight which associated with the product to be manufactured in a particular plant. In addition to this flexibility, and the product, and equipment related factors, expandability is the another important aspect.

Like, we have seen in the product lifecycle the product goes through various stages as a function of time. So, if here we have volume in y axis and time in x axis, then starting from small batches to the large size batches, then continuous production, and then maturity and then decline. So, these are the various stages as per the volume of the product which is to be produced to deal with the demand. Product grows in terms of the volume as a function of time during its growth. So, from the introduction stage to the growth stage, followed by maturity, and then decline.

Since the volumes of the units to be produced will keep on changing, so we need the different strategies. We need the different amount of the resources. So to produce, to deal with such kind of the growth requirements whatever area is there, it should be kept in mind like the

sufficient area or the land is available for the future expansion. And the design of the building should allow the accommodation of the more resources so that the growth, increased demand and increased growth of the product can be dealt with efficiently and effectively.

Like, so the expansion possibilities are affected by the kind of the design of the building is like, if it is about the vertical building, then the building cannot be extended vertically beyond a certain limit unless the foundation and the columns are strong enough. So, right from the beginning we have to keep in mind, like how much expansion is possible vertically in case of the, in case of vertical buildings.

Likewise, in case of the horizontal expansion, horizontal expansion is considered to be easier. Like, if the building is rectangular in section, then it can be extended easily sidewise to increase the area to be used for the purpose of expansion. So normally, rectangular shape buildings are preferred for the future expansion.

Particularly, and one more thing, whatever buildings are there, the side walls should not be the load carrying type. So, because if these are the load carrying type, then they cannot be shifted. If these are not of the load carrying, side walls are not of load carrying type, then they can be easily shifted sidewise for satisfying the expansion requirement.

Similarly, the plant building should also allow the accommodation of the facilities in form of, like employee facilities and the surface areas required. So, these areas are there in form of like, say the facilities for lunch room, cafeteria, lock room, library, ambulance room, the facilities for heating and cooling, ventilation, and the material handling equipments.

So, it is required that all these facilities should find enough space to get accommodated in a plant building. So, the plant building should not just accommodate these facilities, but also allow enough flexibility to accommodate the change in production, technologies related with the manufacturing.

It also, it should also, it should be designed considering the kind of the product size and its weight and its, the kind of the material handling equipments, which will be needed in course of the manufacturing and considering the possibility of the future growth of the product how it will be expanded in terms of the area or in terms of the building design whether, and how can we go vertically or horizontally for expansion purpose.

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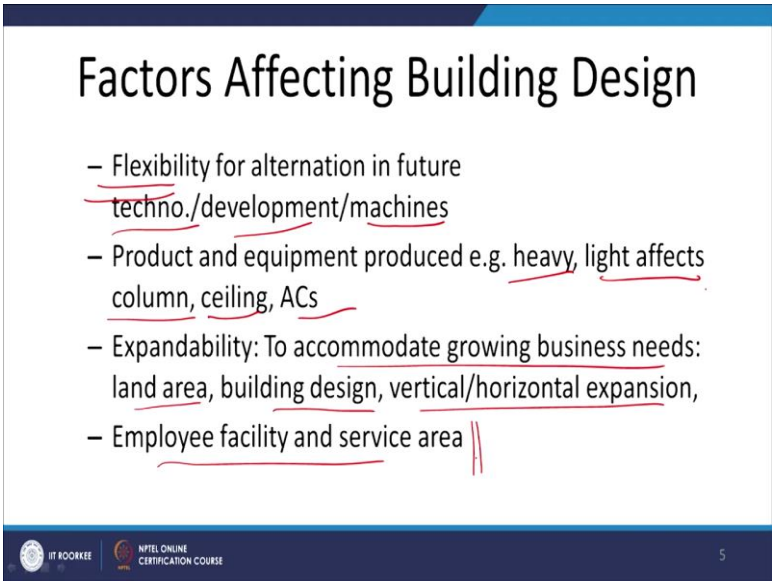

So now, this is what has been elaborated as far as those 4 factors are concerned. Plant building should allow enough flexibility, so that the production facilities, equipments can be accommodated to deal with the changing technologies, changing machines, changing product designs etc.

Then the product equipment, and product and the equipment to be used in course of the manufacturing should be accommodated, should be considered in designing of the plant building. Whether the product is heavy or light, it will require which kind of the material handling equipment it will require like the overhead cranes, monorails, or the conveyors. So, it should find enough space for those facilities. Then the columns whether these will be closely spaced or widely spaced as per the kind of the working area needed for dealing with the material handling of the small or the large size components, the ceiling height, ACs, etc.

Then the expandability to accommodate the growing business needs, the land area, the plant design whether it will be vertical and horizontal, I have already talked about this. And the various employee facilities, and the service areas which will be needed to satisfy for the comfort, and satisfaction of the basic needs of the workers, during the working hours.

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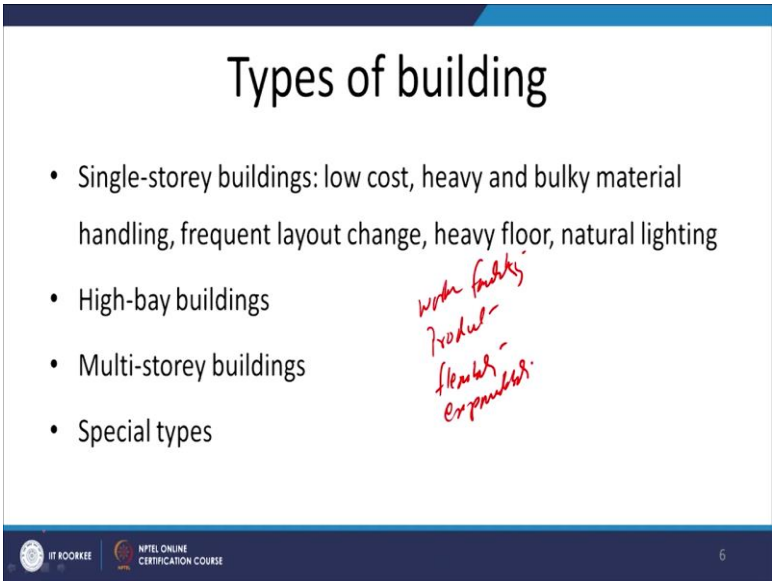

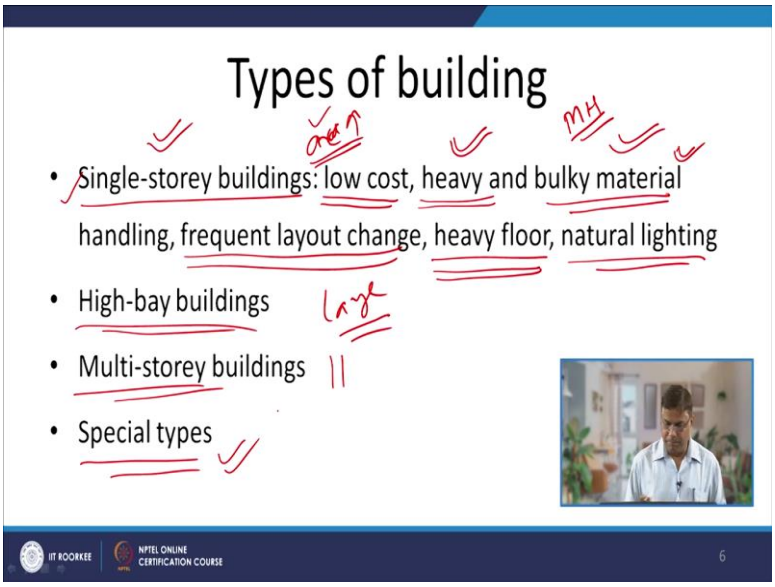

Now, as I have said the plant building should be designed considering the various factors like, product, flexibility, expandability, and the kind of the worker related facilities, worker related facilities. So, what are the various options we have as far as the plant building design is concerned, there are, there are 4 types of the buildings. Like the single storey building, in case of the single storey building we require lot of area. Very large area is needed to satisfy the plant requirement.

So, since the area requirement is very high in case of the single storey buildings to accommodate all those facilities, material handling equipment, conditioning, air conditioning, ventilation, material storage, and the facilities for the workers. So, due to the high, large area

requirement this kind of the plant building can be good, in case of the rural areas where land cost is low. If the land cost is high, then probably single-storey building may not be justified.

Then, the single storey buildings are found very effective for the situations where the component to be manufactured is very heavy and very bulky. So, there is enough space for effective and efficient material handling. So, in those situations where material handling is difficult, single storey building found to be easier and better and more efficient, from the material handling point of view. So, heavy and bulky material handling requirements are easily satisfied by the single storey buildings.

Then, if it is required to change the layout frequently because of the very dynamic market conditions, frequent change in the technology, frequent change in the kind of product designs, so the single storey building design is considered to be more favorable, if the frequent layout changes are needed. And if the requirement is such that, this single storey building concept is also found to be good, when the very heavy and strong rigid foundation, as well as the flooring is needed so that the vibrations being developed by the heavy machines during the operations are minimized. Machine life is increased and also when we need the natural lighting.

High-bay buildings are used when we need a lot of large open space, open space in the ceiling. And the multi storey building is used for certain kind of the purposes like the schools, the hotels, and the shopping malls. And it is used for the manufacturing purposes only, when the land cost is very high and the type of the equipment to be manufactured, type of product to be manufactured is very light in weight.

Then the special type of structures like, where we want that only the machine is housed under the roof and the rest of the space is open, or very huge structure, huge enclosed structure is needed to accommodate the, like the aircrafts or so. So, these are the special type of the buildings.

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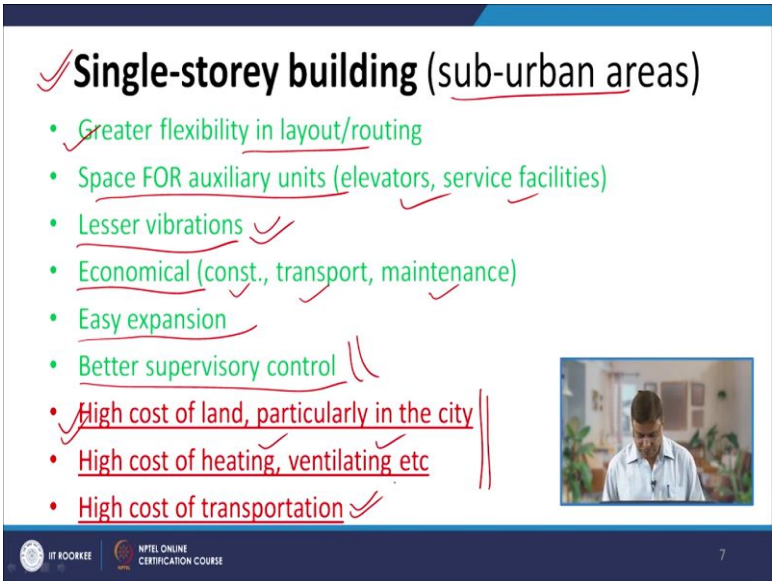

So, we will see the more details related with these. When we have the single storey building, good for the urban and the rural and the suburban areas, where lot of land is (())(26:21), land is available at the low cost. It allows the greater flexibility in the lay outing and the routing and because of the easy availability of the space, the space for the auxiliary units and service facility easily available.

Since, the heavy machines are founded or based at the ground floor which can be made very heavy and robust so the vibrations being generated by the machines will be less. And in this case, it will be economical, this kind of the building construction will be economical, maintenance is easier and transport is also easier. Because all the things are happening at the same floor, at the ground floor.

Expansion is easy and the supervisor control is also easy. Because like say, as I said, rectangular building structures can be expanded easily, through the extension of the, extension sidewise. And all the workers, machines are housed at single floor, in a single building so the supervisory control over the situation is very effective.

But this kind of the building is not justified, especially in the cities when the land cost is high. Or in case the cost of, in case of single storey building because of the greater surface area, large openings the cost of the heating, ventilation and air conditioning, is also high as compared to the multi storey. And the cost of the transportation is also high, because long distances need to be covered, the machines are scattered over a long distance, over a large area. So, the cost of transportation in this case is also high.

Now, I will summarize this presentation here. In this presentation basically, I have talked about the way by which the factors that we need to consider while organizing the facilities and among these factors the plant building is one of the important factors. Thank you for your attention.