Construction Methods and Equipment Management

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Lecture – 22
Summary

Let me try to summarize and conclude it with some important concluding remarks related to this course. I hope the course was useful for you to learn the construction equipment management and the construction methods. So, as I told you earlier equipment management is a very broad area which includes so many parameters like right from the selection of the equipment and planning the equipment utilization and planning for the equipment replacement.

So, there are so many aspects to be covered under the equipment management. I hope we have discussed about most of these important parameters related to equipment management. And as I told you in the introductory lecture about the significance of this course, the knowledge of estimation of productivity of the machines and the estimation of the cost of the machine is very important for the project planner.

Because, right from the selection of the machine, we need the information on the productivity of the machines and the cost of the machine then only we can select the machine. Say, for example, what is your job required productivity? You can know it from the contract specifications. And, what is the project budget? You can know from the contract specifications.

So, based upon that, you have to match the equipment of the required productivity and the cost. So, for that you need to have the information. You need to have the knowledge on how to estimate the productivity and the cost. Then only you will be able to make the selection of the machine. Also, as I told you even when you go for the bid preparation itself, then knowledge on cost estimation of equipment is very important.

Because the equipment cost forms the part of the project cost. See if you either overestimate or underestimate the cost of the equipment. Finally, you will not be able to go for a proper bidding. So, that is why the knowledge of this productivity and cost estimation is very much important for the project planners. So, I hope this course will be very much useful for the students who are studying the core of civil engineering or construction management.

Or even for the faculties working in the area of civil engineering and also for the people who are working in the construction industries as project planners. For all these people, this course will be beneficial. So, the entire syllabus of this course was split into 8 modules. So, let me just summarize what we are learned so far.

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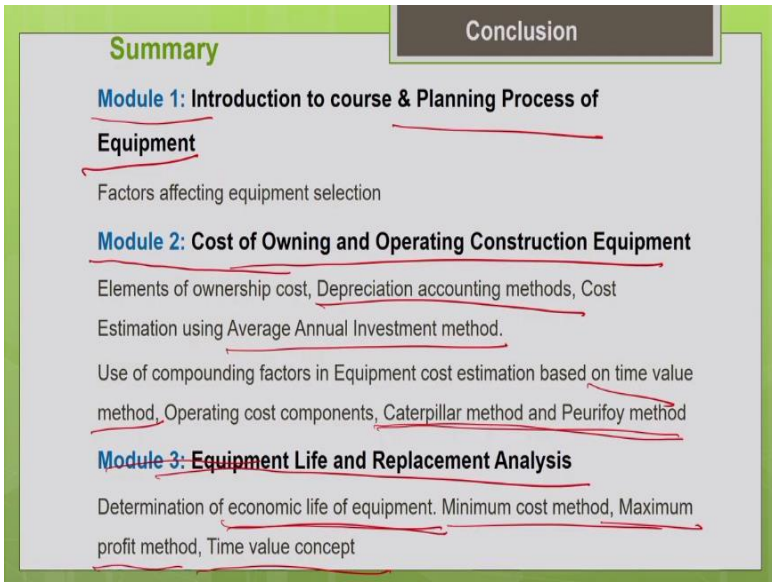

In the first module, we discussed about the planning process of the equipment. Say, what are all the important factors right from the selection? So, what are all the important factors which governs the selection of the machine? So, as I told you, your contract specifications will be the main guideline while you make the selection of the equipment because that will tell you what is your required job productivity and what is the actual project budget.

So, accordingly if you have the information on the equipment productivity and the equipment cost, you can choose the matching equipment corresponding to the required job productivity. So, similarly, there are also many factors like job site location, your altitude, temperature, everything have an influence on the equipment selection. So, we have discussed that in detail. So, then we moved on to Module 2, where we discussed about the estimation of the cost associated with the equipment.

So, what are the major components of the cost of the equipment like owning cost and operating cost? So, what are all the components under the owning cost and operating cost, and how to estimate those components? We have discussed in detail. So, we have spent enough time about

the how to estimate the depreciation of the machines. Like, I have introduced to you different depreciation accounting methods.

Like straight line method, sum of the years' digit method and double declining balance depreciation method. So, we have compared the merits and limitations of all those methods. And we also discussed 2 important approaches in the equipment ownership cost estimation. So, one is average annual investment method. Other one is time value method. So, the first one the average annual investment method is an approximate method.

Like here we just consider the average cost of the machine over the entire useful life of the machine. But, in time value method, what you do is you consider the timing of the cash flows and convert the cash flows which are occurring at different time period using compounding factors. You convert it into equivalent cash flows and then make the estimation which is more accurate when compared to average annual investment method.

So, both the approaches we have discussed. And also I have introduced to you what are all the Caterpillar methods and Peurifoy methods which are commonly adopted. And you can see in most of the literatures they commonly use this Caterpillar method and Peurifoy method for the equipment estimation. So, we have discussed about those methods also. Then, coming to the Module 3 about the equipment life and replacement analysis, we have dedicated nearly 3 lectures for the equipment replacement analysis.

So, the main thing in replacement analysis is we have to determine the economic life of the machine. So, hope you remember economic life is nothing but the life at least the cost associated with the machine will be minimum the total cost associated with the machine is minimum. At the end of the economic life you have to definitely replace your machine. So, before the cost associated with the machine increases significantly you have to replace the machine.

That is why we need to find, what is the economic life? So, there are different approaches. Either, you can go by minimum cost approach or you can go by maximum profit approach. So, from cost minimization perspective, you have to look for the period till at which the cost associated with the machine is minimum. From the profit perspective, if you see, you have to look for the period at which the profit associated with the machine is maximum.

So, before the profit reduces you should replace the machine. So, different approaches were there we have discussed all those approaches and limitations of all the approaches also we have discussed earlier. And one thing you need to keep in mind is that when you estimate equipment replacement time, you have to consider all the cost components including the inflation cost, downtime cost, obsolescence cost.

Everything should be considered into account so that you can get an accurate picture of equipment replacement time. And also another important thing here also you should consider the timing of the cash flows. So, we have worked out the illustrations how to consider the timing of cash flows in the replacement analysis.

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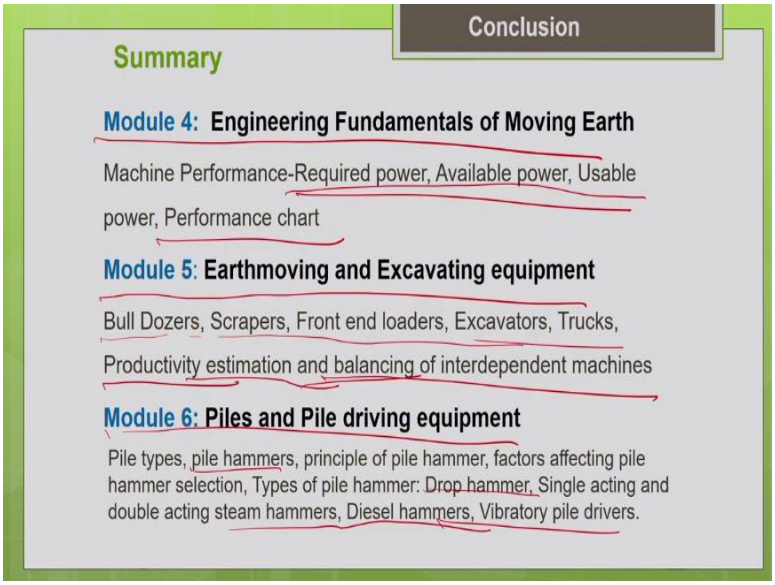

So, then we moved on to Module 4 where we discussed about the engineering fundamentals related to the earthmoving operation. So, I have introduced many terminologies related to earthmoving operations. And also we discussed how to define the machine performance? Like, what is its required power? What is available power? What is usable power? So, out of the available power, how much power becomes usable?

So, what are all the factors which influence the usable power? So, those things we have discussed here. And also I introduced to you, how to make use of the machine performance chart? The machine performance chart which are always supplied by the equipment manufacturer. How to use that chart? So, using the machine performance chart, how to estimate the machine performance for the given project conditions?

So, how to estimate? That we have discussed already. So, in the Module 5, I have introduced to you the different earthmoving and earth excavating machines. So, we discussed about the bull dozers, scrapers, front end loaders, excavators and the trucks. So, the merits and the limitations of all these machines also we have seen clearly. And we have worked out many illustrations on how to estimate the productivity of this machines?

And also we have worked out, how to balance interdependent machines? That is very important, because as you know in project site, may all the machines work in a team. So, we need to balance them in number as well as based on size. How to do the balancing? Also, we have discussed. In Module 6, we have discussed about the piles and the pile driving equipment.

So, how the piles are classified based upon their function based upon the material type? We have seen the classification. And the merits and limitations of all the pile types, we have discussed. And then we moved on to the pile driving equipment. Particularly, we have discussed a lot about the pile hammers. So, I have introduced you different types of pile hammers like the olden drop hammer and diesel hammers and steam hammers and the modern vibrator hammers.

All these hammers, their merits and limitations, mode of operation, everything we have discussed. So, and how to select the pile hammer for a particular pile type based upon the weight of the pile based upon the size of the pile and based upon the soil conditions? How to make the selection of the pile hammer? Also, we have discussed.

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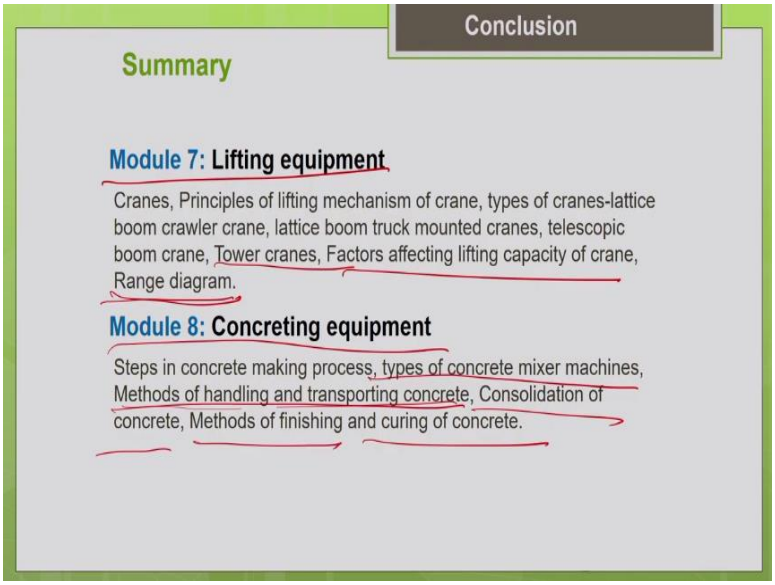

Then, coming to Module 7, we have discussed about the cranes. Under the lifting equipment, we have discussed a lot about the cranes. So, I introduced to you what are the different types of cranes? How they classify based on mounting like a truck mounted or crawler mounted and based upon the boom type whether lattice boom or telescopic boom? All these types, their merits and limitations we have discussed.

And also I told you, I hope you remember every crane is economical only for a particular situation. If you need a crane for a longer duration, then you can go for a lattice boom crane. There it will be justifying. But if you need a crane only for a very short duration, it is preferable to go for a telescopic boom truck mounted crane because the mobilization, erection and dismantling of the lattice boom cranes involves more amount of time and cost.

So, that is why as I told you every crane is economical for only a particular situation. So you have to make the selection accordingly. Then we discussed a lot about the tower cranes also. The special type of tower cranes like climbing tower cranes also I have introduced to you. So, the erection and dismantling of the tower cranes using the climbing cage. So, all these things, I hope you remember.

Then, what are all the factors which affects the lifting capacity of the crane? We have discussed in detail. So, for example, the influence of outriggers, particularly for the truck mounted crane, the influence of the outriggers on the lifting capacity and the stability of the machine we have discussed. So, I am also introduced to you what is the significance of range diagram?

Like from the range diagram, you can make the selection of the boom length needed for a particular crane. For this particular working range, what is the crane boom length needed? I can identify from the range diagram. So, what is the importance of range diagram? We have discussed. So, coming to the last module, Module 8 on concreting equipment, we have discussed in detail, what are all the steps involved in the concrete making process?

Right from the batching of the ingredients, then we moved on to mixing of concrete then transporting it, placing it, consolidating, finishing and curing. There are so many stages involved in the concrete making process. And I have provided you enough guidelines for all these steps to make a good quality concrete. And particularly we discussed about different types of concrete mixer machines, like free fall mixer machines, power mixer machines.

And we discussed in depth about the ready mix concrete. So, what are all the different ways of ordering the ready mix concrete? All those information was provided to you. Then regarding the methods of handling the concrete like from the simple method like starting from wheel barrows or buggies then we also discussed about the advanced methods of concrete placing like pumping, belt conveyors.

So, whatever method you choose you have to be very careful that the concrete should not get segregated while transporting it or placing it. So, I have given you enough guidelines regarding the selection of the handling method. Everything depends upon your productivity requirement for the particular job because every method has its own productivity. And, what is your job productivity?

You have to see and then you have to make the selection of the machine accordingly. Then coming to the consolidation, I introduced to you the different methods of consolidation like the needle vibrators, surface vibrators and foam vibrators. How to select the vibrator according to the consistency of the concrete and how to select the frequency and the amplitude of the vibration corresponding to the consistency of the concrete?

All those things were discussed in detail. Then coming to finishing, there are different stages of finishing like screeding, floating and troweling. So, what are the guidelines for those steps? Also, we have discussed. So, it can be either done manually or it can be done using power

trowels or power floats. How the productivity varies for the manual finishing and the machine finishing? Also, we have discussed.

And, what is the optimum time period for the finishing process of the concrete? Then we moved on to curing of concrete. So, curing also it can be done in stages like initial curing, intermediate curing and final curing. So, when to initiate the curing? It all depends upon the environment in which the concrete is going to be placed. And also it depends upon the bleeding characteristics of the concrete.

For the concrete which is very cohesive and which has a very low water to cement ratio and for which bleeding is negligible, in that case, you have to start the curing as early as possible. So, for that we need the initial curing. So, when you are supposed to start the initial curing? What are all the different methods of curing? Either you can go for water based curing or you can go for water retention based curing.

So, those methods are being discussed in detail. So, we have come to the end of this summary.

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So, I would like to thank my teaching assistants who have helped me a lot in the preparation of the lecture contents. So, I would like to say my thanks to Mr. Chandrashekhar and Mr. Uday who are my PhD research scholars who are working under me in the area of foam concrete. And once again, I would like to thank all the listeners who have enrolled for this course.

I hope that the course would have been beneficial to you to learn some knowledge related to construction equipment management and the construction methods. Thanks a lot.