Principles of Construction Management
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Lecture – 12
Depreciation of construction management

[FL] and welcome to this lecture on principles of construction management, today in the 12th lecture in this series we will be talking about depreciation of construction equipment as part of our ongoing discussion on economic considerations in decision making as far as construction projects are concerned.

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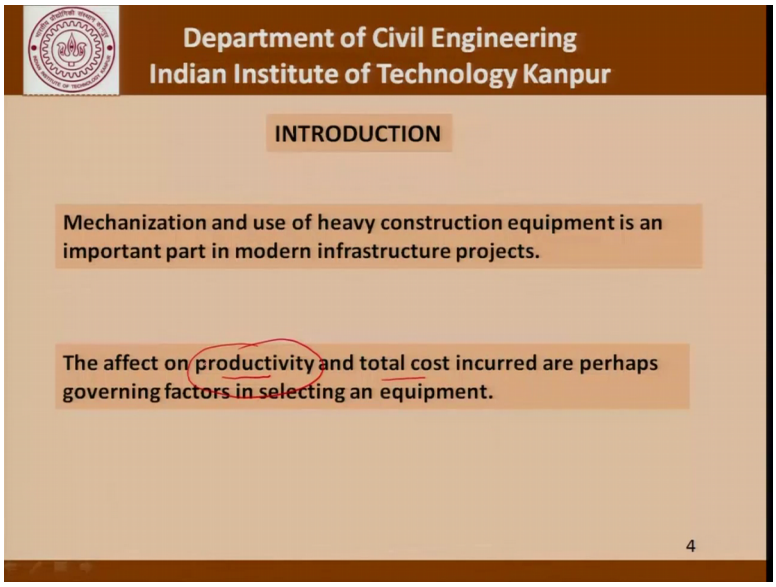

Mechanization and use of heavy construction equipment is an important part of modern infrastructure projects. Any infrastructure project that we see we will see it has a large amount of machines as part of the site work, as part of the construction work, it could be cranes, it could be dozers, it could be the ready mix concrete plants, it could be transit mixers and so on and so forth. The effect on productivity and the total cost incurred or perhaps governing factors when it comes to selecting an equipment.

In the last class, we did see how the maintenance cost and the initial investment and the whole concept of time value of money how that was helping us trying to find out whether one equipment was better than the other apart from the purely economic consideration there is this issue of productivity and the total cost. The productivity has to

be also brought into over thought process apart from the total cost which was discussed in the last discussion.

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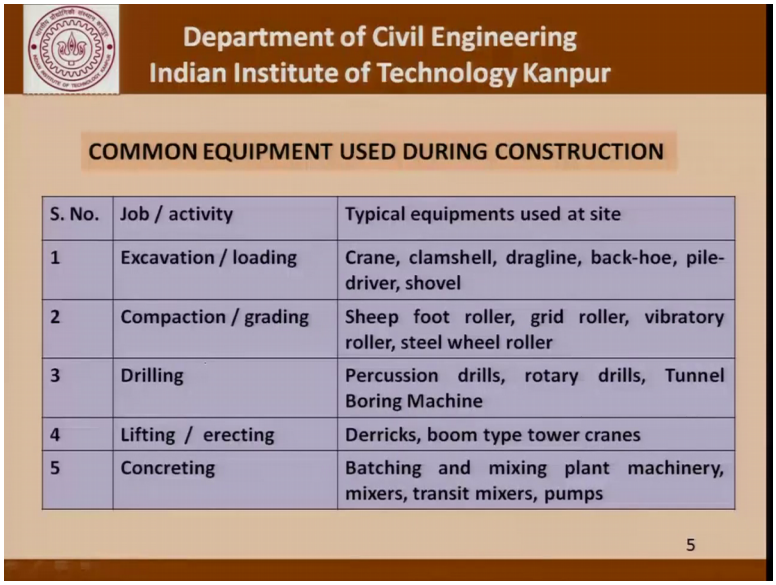

Now, this table here just lists some of the commonly used equipment in the different construction sites depending on the kind of work being done. If it is excavation it could be draglines, back hoes, pile drivers, shovels, if it is compaction it could be the sheep, foot, roller, grid roller, vibratory roller and so, on. If it could be concreting there could be a lot of equipment like the batching plants transit mixers pumps, if it was lifting and erection, it could be derricks, booms tower cranes and so, on and so, forth.

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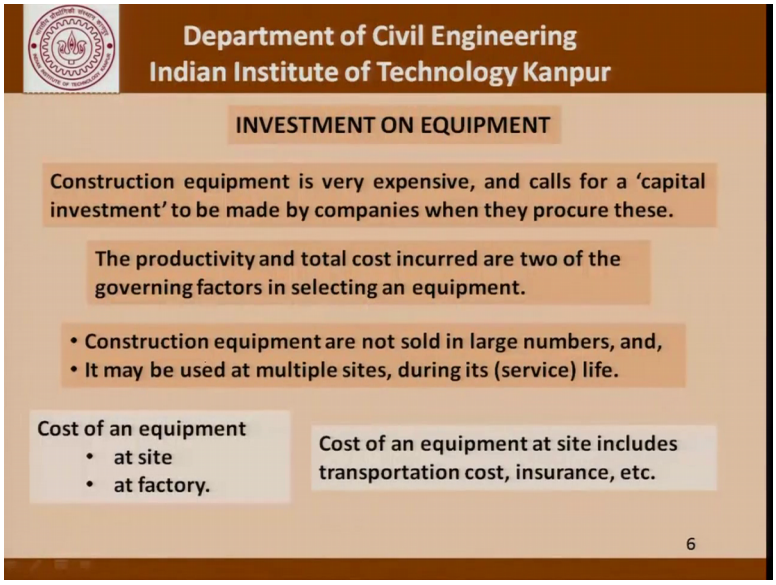

Now coming to the investment in construction equipment which is the focus of our discussion today, we must remember that construction equipment is very expensive and calls for 'capital investment' to be made by companies when they procure these. Productivity and total costs are 2 of the governing factors in selecting an equipment, we must also keep in mind that construction equipment is not sold in large numbers and it may be used at multiple sites, during it is service life

For example, a crane or a batching plant can be used over multiple construction sites, when we are talking of the cost of the equipment, there is the cost at site and there is the cost at factory. At site when we talk of the cost it should include the transportation cost, insurance and so on, these are some of the finer details when it comes to talking about investment on equipment.

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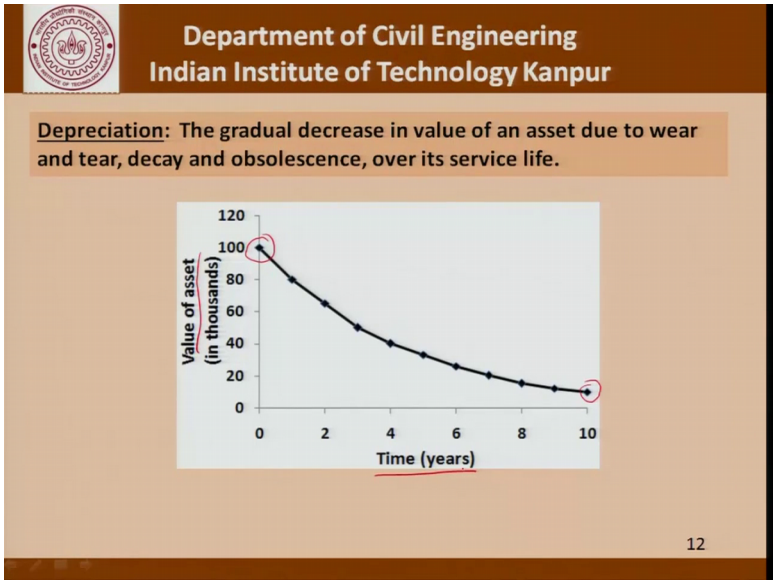

What is Depreciation, which is the focus of our discussion today, we should remember that depreciation refers to the gradual decrease in value of an asset due to wear and tear decay and obsolescence over it is service life

This picture here shows a schematic sketch where the initial cost or value of the equipment is let us say 100,000 and over a period of time, let us say it is 10 years it reduces to something like 10,000. What is the value of this particular asset at a given point in time is something that we need to know and this is what is called the book value. At the end of it any company when it invests in assets those assets have a certain book value because the assets owned by the company are to be accounted for separately, as to what is the total assets that are owned by the company, that something which we will talk about later on in this lecture.

One concept is what is the book value of the asset at a given point in time, the second thing is that if during this service life of 10 years or the actual service life of 10 years and the difference between the actual service life and the accounting service life is something which will touch upon very shortly, what should be the amount of expenditure which should be booked to a particular project this equipment may be used let us say for this period of time at one project, this period of time is for another project and this period of time for a third project.

If this is what is happening then it would be unfair for this project alone, to be told that the entire cost of the equipment will be recovered from that project, this is the kind of thought process which we need to address and that what we do in this discussion today.

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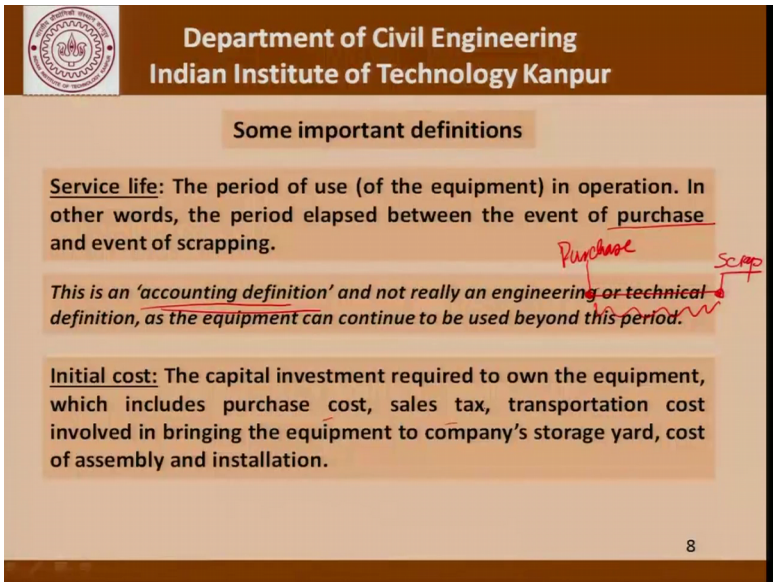

Let us talk of some important definitions; to get started Service life is the period of use of the equipment in operation. In other words it is the period that elapses between the event of purchase and the event of scrapping. Purchase of the equipment is basically an event as far as that time is concerned, at a particular point in time a purchase happens and at a particular point in time later on the equipment is scrapped.

This time is basically what we are talking about as the service life, this; however, we must remember is the accounting definition and not really an engineering or technical definition as the equipment can continue to be used beyond this period. Now why do companies have or try to have a shorter accounting service life compared to the actual service life is something what we will see subsequently in our discussion today.

Another definition that we must keep in mind is the initial cost, this is the capital investment required to own the equipment, which could include the purchase cost, taxes, as may be applicable transportation cost, involved in bringing the equipment to the companies storage yard, cost of assembly and installation.

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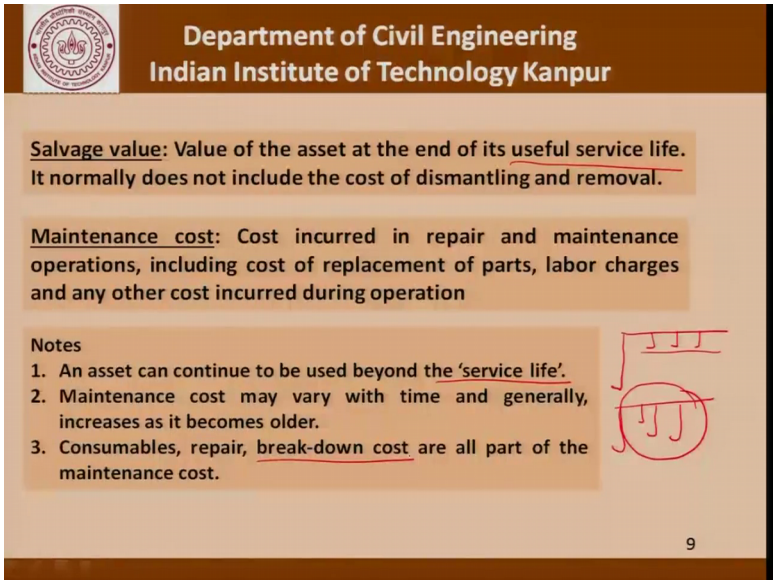

Then there is the concept of Salvage value, this is the value of the asset at the end of it is useful service life. It normally does not include the cost of dismantling and removal, but it does include the cost of scrap, at the end of it if the asset has a certain value for which it can be sold even as a scrap that becomes it is salvage value.

Then of course, there is maintenance cost which is the cost incurred in repair and maintenance operations, including the cost of replacement of parts, labor charges and any other cost incurred during the operation of that equipment, whether it is at one site or another. Let us try to take some important notes from here, one is the fact that an asset can continue to be used beyond it is service life, this is the accounting service life and that what we already said that if an equipment has a service life of 3 years, it does not mean that it has to be necessarily scrapped at the end of 3 years, this the decision to scrap or not described would depend on whether the equipment has really become a drain on the resources of the company.

So, long as it continues to perform a useful function the company would like to continue to use it. The second thing is that the maintenance cost may vary with time and generally increases as it becomes older, this is something which I had referred to an ad said in the last lecture also that for the sake of argument or as a model or to just make it easier to understand we may say that well there is an initial investment and over the next 3 years or 5 years the maintenance cost is the same. But actually what is happening is that this could probably keep on increasing and this is something which the company has to

watch out and see that when the maintenance cost or the cost of the replacement of parts becomes unacceptably high that is the time when the equipment is actually scrapped.

Consumables repair breakdown costs are all part of maintenance cost, we are not getting into the discussion of breakdown cost, but that is something which we must keep at the back of our mind, because as the equipment becomes older the probability of the breakdown increases and once the breakdowns increase the cost of idling increases. These are things which we are not talking off directly here, but they are important considerations when it comes to purchase of equipment, replacement of the equipment and so on and so, forth.

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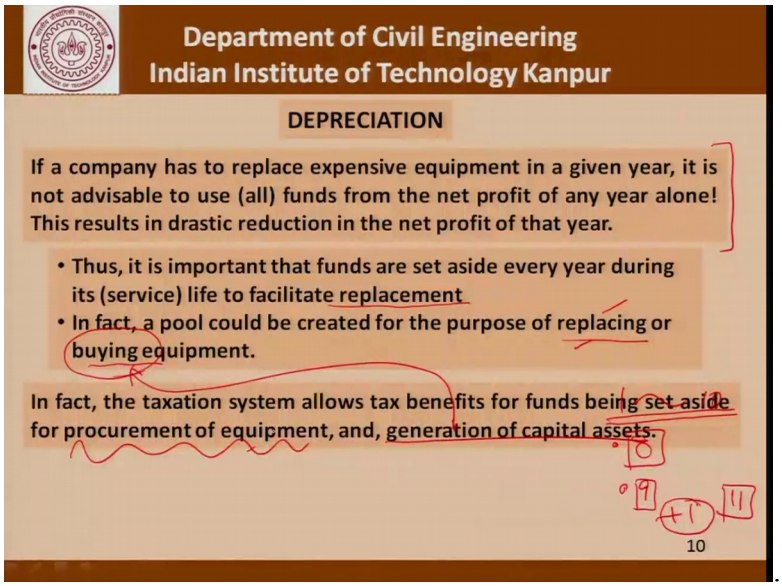

So, going back to the definition of depreciation if a company has to replace expensive equipment in a given year, it is not advisable to use all funds from the net profit of any year alone and this could result in a drastic reduction in the net profits of that year. What is being said here is that given the fact that construction equipment is quite expensive, it is not proved it to use all the funds for procurement of equipment from just a given year because that would have a very uneven effect on the profits and the accounting statements.

Thus it is important that funds are set aside every year, during the service life of an equipment to facilitate replacement, what we are saying here is that if an equipment costs a 1000 units, it has a service life of 3 years. It is known that at the end of 3 years or

maybe 5 years or whatever it is that equipment will need to be replaced, now at the time of replacement we would need let us say a 1000 units which it costs today and maybe something else.

We almost know that at the end of it is life, we would need a certain sum of money to be able to replace that equipment and if over the service life, we are able to set aside certain amounts of money over that period, then it becomes easier to replace that equipment at the end of the service life when that replacement is really needed. Basically what is being said is that a pool could be created for the purpose of replacing or buying equipment. There are 2 things being talked about here one is replacing the equipment that is you already have an equipment base of let us say 1 to 10 and at a given point in time you find that equipment number 8 needs to be replaced, in the next year you might find equipment number 9 needs to be replaced and so, on.

The buying of equipment refers to increasing this pool to equipment let us say number 11, this is the thought process that we are talking about we are talking of a system by which depreciation is used as a concept to help us replace equipment or buy equipment at a given point in time . In fact, in certain situations the taxation system allows tax benefits for funds being set aside for procurement of equipment and generation of capital assets. So, generation of capital assets is basically the buying of new equipment and procurement of equipment is a larger umbrella which includes replacement and addition of equipment.

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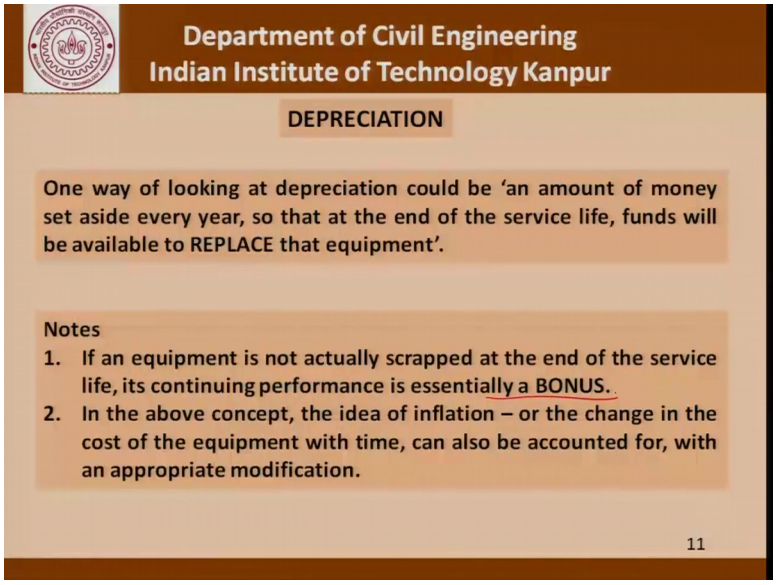

Continuing with our discussion one way of looking at depreciation could be an amount of money set aside every year, that at the end of the service life, funds will be available to replace that equipment' and again some notes we have already stated that an equipment need not be scrapped at the end of it is accounting service life and therefore, if an equipment is not actually scrapped at the end of the service life it is continuing performance is essentially a bonus.

Even though the scrap value or the salvage value of the equipment has been reached it does not have any further depreciation, but if it continues to perform, it continues to improve the productivity of the construction site; it is performing what can be called a bonus. In the above concept the idea of inflation or the change in the cost of equipment with time can also be accounted for with an appropriate modification. Even though we have not accounted for inflation directly, but the framework being set up is such that it can be easily allowed. We have already defined depreciation as the gradual decrease in the value of the asset and what we are looking for at is the methodology as to what should be a common accepted and acceptable reasonable variation of the value of the asset over time.

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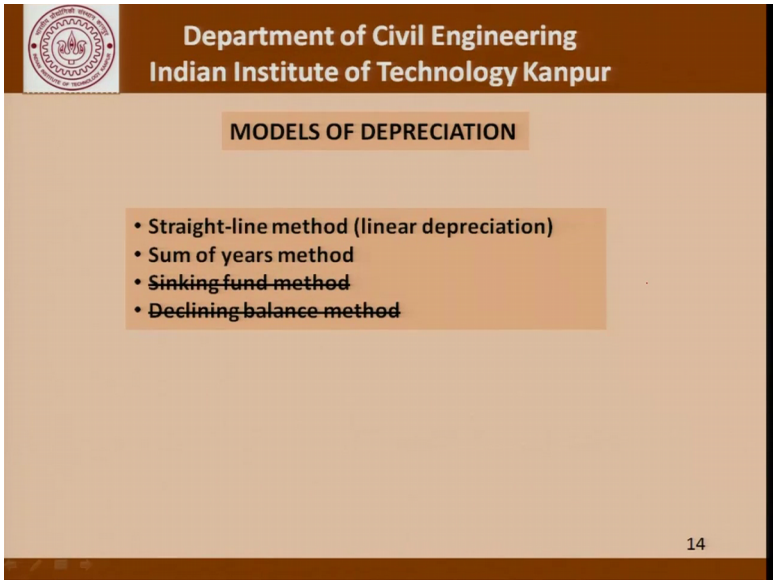

So, for this we have different methods that are available to us the Straight- line method or what is called linear depreciation, the Sum of years method, Sinking fund method and the Declining balance methods, these are some of the commonly used methods for applying depreciation and determining the book value. We should remember that the book value changes from the initial value to the salvage value, over the service life and this change occurs because as depreciation increases the depreciated cost is reduced from the book value. We will not be talking about the sinking fund method and the declining balance method as part of the discussion today and restrict ourselves to the straight- line method and the sum of years method.

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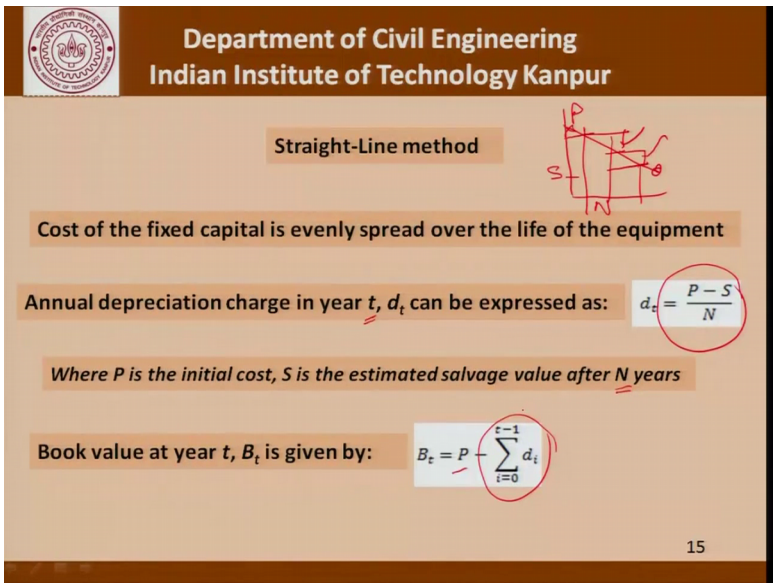

What does the Straight-Line method mean the cost of the fixed capital is evenly spread over the life of the equipment? In other words that annual depreciation in year t can be expressed as P minus S upon N, where P is the initial cost, S is the estimated salvage value after N years where this is my service life. What we are saying is that, if you are moving from P to S, over a period of N years, each year we are having this amount of depreciation and the book value is the P minus the total depreciation which has happened up to that point in time.

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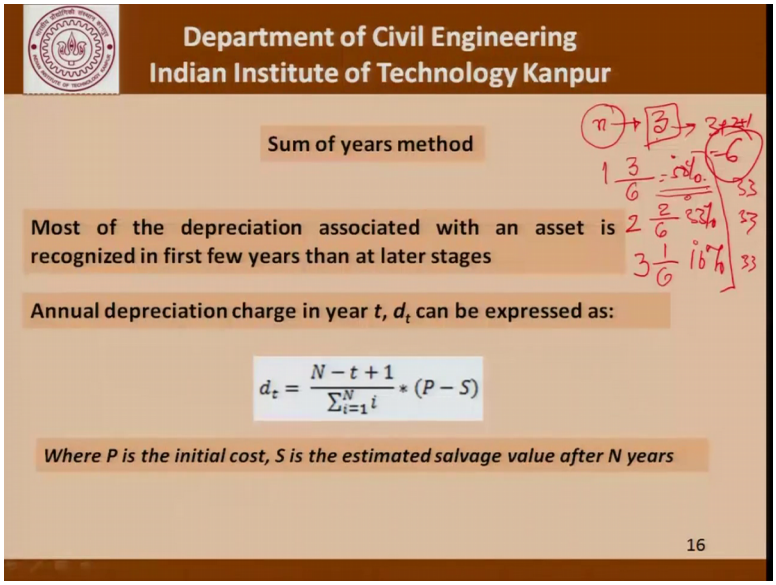

The sum of years method is another method of determining the depreciation every year and also finding a book value with the similar concept, here most of the depreciation associated with an asset is recognized in the first few years than at later stages. The annual depreciation for a year t is given as the formula here what it is basically doing is that if we have N years as the service life. So, for the sake of argument and illustrative example let us take an asset which has a 3 year service life.

The sum of years method says is that, if we add the sum of years of the service life, in which case this will become 3 plus 2 plus 1 which is equal to six. The depreciation in the first year will be basically 3 divided by 6, which is 50 of the total depreciation. In the second year it will be 2 upon 6 which is 33 percent of the total depreciation and in the third year it will be 1 upon 6 which is 16 percent of 16 and a half percent of the total depreciation.

The total depreciation is distributed over the 3 years as 50 percent in the first one, 33 percent in the next and 16, 17 percent in the third year. If it was linear depreciation it would be 33, 33, and 33 well, 1 percent we can add whichever way we want, but 33, 33, 33. What we are doing in this sum of years method is that in the first year, we are allowing and having a higher amount of depreciation. This method is not something which is laid down in stone, it is only a matter of accounting practice as to which is the method adopted to find out the depreciation and what is the method adopted therefore, to determine the book value of the asset.

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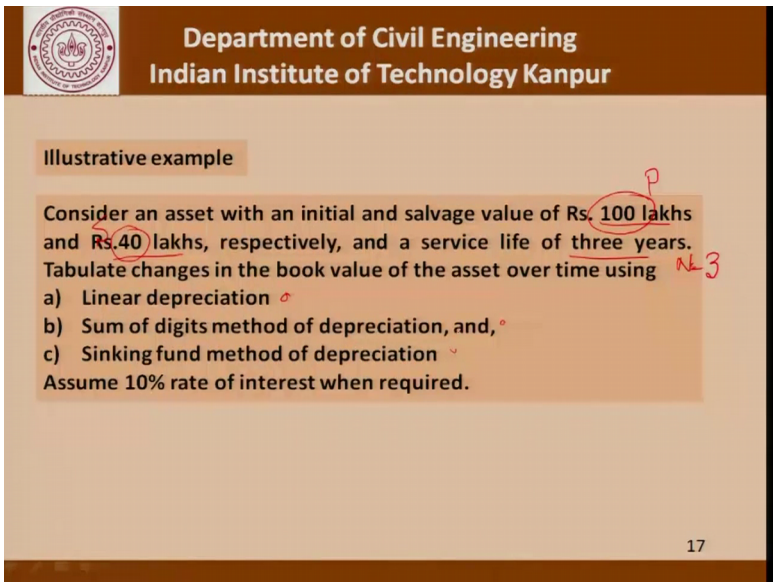

Let us take an illustrative example we consider an asset with an initial and salvage value for 100, 00,000 and 40, 00,000. We have an initial value of 100, 00,000 and a salvage value of 40, 00,000, this becomes my P and this becomes my S, if I was to follow the nomenclature used and a service life of 3 years. My N is equal to 3 and we want to tabulate the changes in the book value of this asset over time using linear depreciation, the sum of years method and the sinking fund method, if required we could use a rate of interest of 10 percent.

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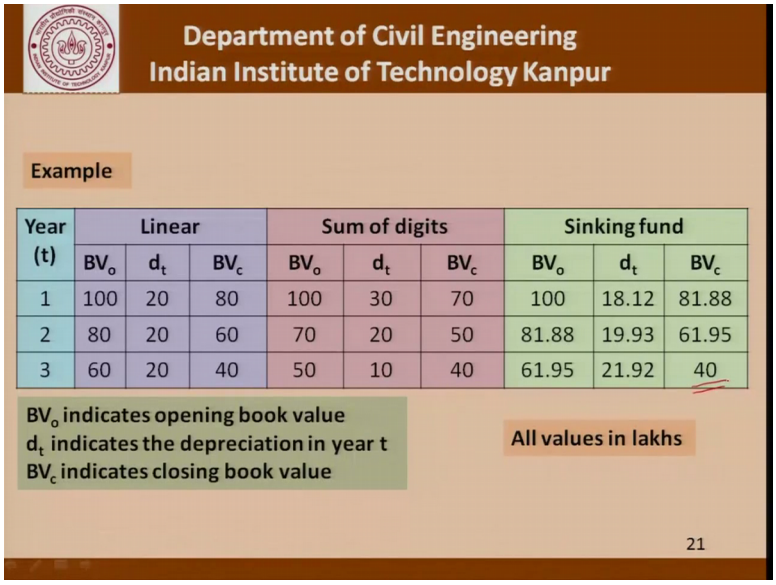

Let us see what happens as far as the linear depreciation is concerned we begin with the book value of 100 and we know that the total depreciation is a 100 minus 40 which is equal to 60 and this is what we distribute over the 3 years. What happens to the book value at the end of first year is 100 minus 20 which is 80, at the end of second years it is 80 minus 20 which is 60 and at the end of the third year it is 60 minus 20 which is 40.

BV 0 indicates the opening book value at that year and dt indicates the depreciation in that year and BVc indicates the book value at the closing of the year. Obviously, the book value at the closing of this year would become the book value at the opening of the next year. Further if the equipment continues to be used beyond these 3 years which is the accounting service life, then the depreciation would remain 0 and the book value of the asset will not be allowed to fall below 40 as far as the accounting books are concerned.

Let us do the same example with the sum of digits method, we know that the total depreciation in this case will still remain 60, because that is just the difference of the initial value and the salvage value, it is only how the 60 is distributed over the service life that is different in the 2 cases. In this case it was 20, 20 and 20, whereas in this case it becomes 30, 20 and 10. As I have already discussed before the sum of digits being 6 and in the first year we are talking of 3 upon 6, which is 50 percent of the difference of 100 and 40. We get 30,00,000 depreciation here, 20 ,00,000 here and 10,00,000 here, the book value has gone from a 100 to 70 in the first year, 70 to 50 in the next year and 50 to 40 the third year.

In the third year of; obviously, the values are the same, but at the end of the first year and the second year the book values are lower, than what is the book values in the case of linear depreciation and this here even though we have not covered the sinking fund method in detail gives you what will happen, if we were to use sinking fund at the interest rate of 10 percent and here also we find that the final book value is 40. So, having understood the basic concept of depreciation that is an equipment loses it is value and the book value is what is being talked about. It is not the value of the equipment from a technical perspective or the productivity and so, on, but only in terms of what is the book value, what is the accounting value of that equipment, we have gone through this exercise.

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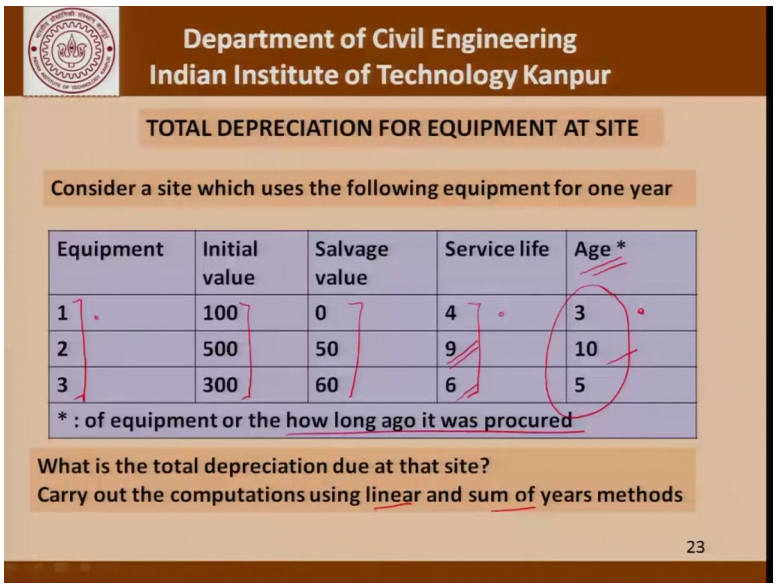

And now we are ready to see what is the Total Depreciation for Equipment at a given site? Let us consider a site which uses the following equipment for one year. There are 3 equipment being used at the site they have their own initial values, their own salvage values and their own service life's. Now the age of the equipment at which the equipment was delivered to the site or how long ago it was procured is given in this column. This is an important column what it is telling us is, that for equipment 1 the service life is 4 years and it was already 3 years old when the equipment was brought to site.

In case of equipment 2 even though the accounting service life was 9 years it was brought to this particular site at the tenth year that is it had already gone beyond it is service life. Similarly in the case of equipment 3 the service life being 6 years age of the equipment when it was brought to this site is 5 years. This table if we complete for any given site we would be able to determine what is the total amount of depreciation in equipment that is happening, while that equipment is being used at that particular site.

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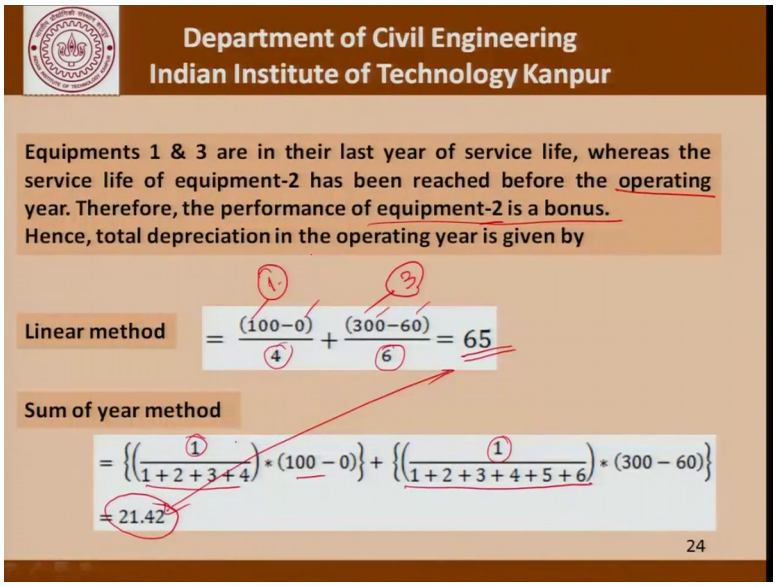

If we want to do this discussion in terms of the linear and the sum of years methods, let us try to see what happens equipments 1 and 3 are in their last year of service life, service life of equipment 2 has already been reached before the operating year, operating year being the year in which it was used at this particular site. Therefore, the performance of equipment 2 is a bonus, this is what we had talked about a minute ago when we said that the equipment may continue to perform beyond it is service life and that performance is a bonus because it does not cause any depreciation expense to that site. The total depreciation for this operating year for this site would be, if we use the linear method a 100 minus 0 upon 4, plus 300 minus 60 upon 6, which is 65.

Now these numbers are coming from this is for equipment 1 and this is for equipment 3, equipment 1 had an initial value of 100 and the 0 salvage value, equipment 3 had an initial value of 300 with a 60 salvage value. They had different service lives and therefore, we come up with this number as far as the total depreciation in the 3

equipments that occurred while being used at that site, please note that there is no depreciation being counted for equipment 2.

If this exercise was to be carried out by using the sum of year or the sum of digits method the situation will be something like this. This is the sum of the digits or some of the years that we are talking about and since it is the last year of their service life, the numerator in both cases is 1 and we find that the depreciation is only 21.42, which is less than one - third of the depreciation which is occurring in the case of linear method. In other words both these equipments that is equipment 1 and equipment 3 most of the depreciation has already occurred before they came to this site.

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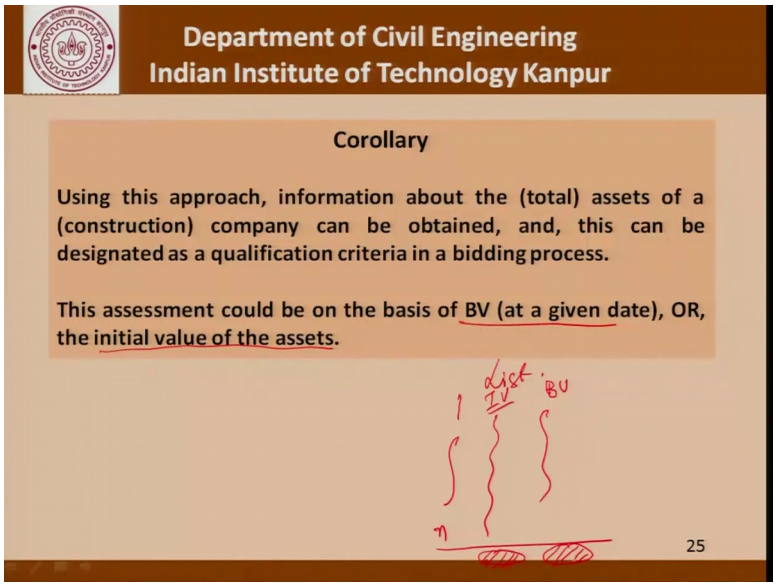

As a Corollary to this information about the total assets of a construction company can be obtained, and, this can be designated as a qualification criteria in a bidding process, what can be done is that as part of our pre qualification, as part of qualifying a company whether or not a company qualifies to bid for a project or not. We can say that the company should have an equipment base of 10 million, 100 million 70 million, whatever number is reasonable depending upon the kind of project involved.

Of course, in this case the assessment can be based on the book value at a given date, or the initial value of the assets. So, what we will have, essentially is that for a given company we will have a list of equipment ranging from 1 to n, there will be an initial value of all these equipments, there will be a book value of all these equipments, which

will be different depending upon how old they are and. So, on and, if we sum this thing here we will have the total equipment base of that company based on initial value. We can also have the total equipment base of that company and sometimes it can be argued that a company with a higher equipment base is more financially sound it is more technically capable and so, on.

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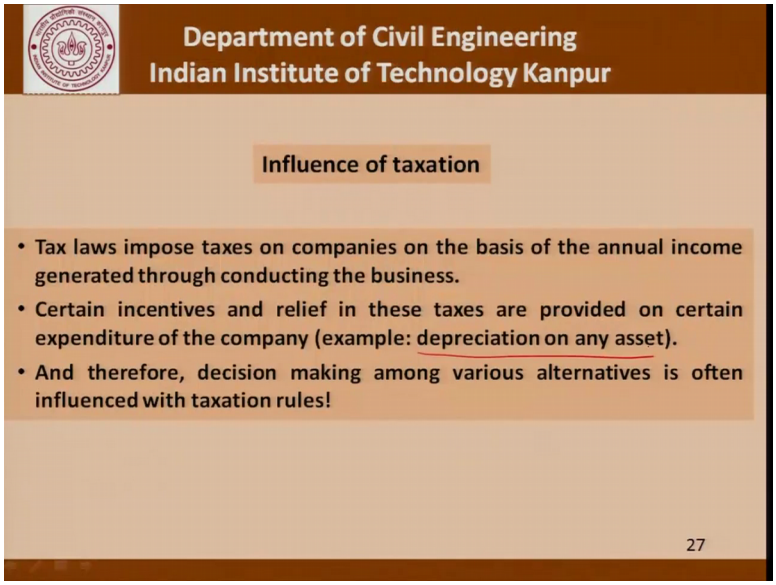

Let us talk about how taxation or policies related to taxation can help us procure equipment in the wider sense of the word in that either it is removal of obsolescence, replacement of equipment or buying new equipment. The weekends have tax laws to in principle tax laws impose taxes and companies on the basis of the annual income generated through conducting business certain incentives and relief in these taxes can be provided or are provided on certain expenditure of the company for example, depreciation of the assets that what we have been talking about and therefore, decision making among various alternatives is often influenced by taxation rules.

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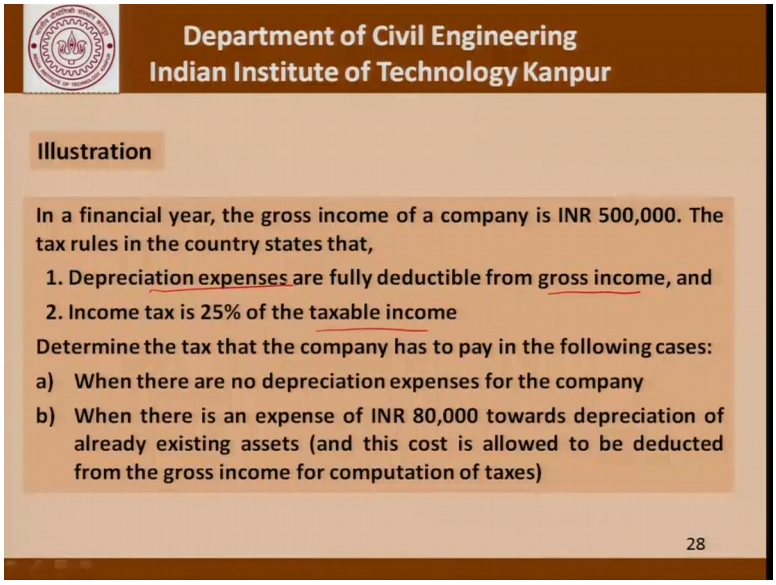

Let us take up an illustrative example, that in a financial year, the gross income of a company is let us say 500,000. The tax rules state that depreciation expenses are fully deductible from the gross income, and income taxes 25 percent of the taxable income. This taxable income is determined from the gross income after deducting the depreciation expenses. So, if that was our simple understanding, then, let us say what we have to determine is the tax if there was no depreciation expenses for the company and compare it, when there is an expense of 80,000 towards depreciation of already existing assets and this cost is allowed to be deducted from the gross income for computation of taxes as already stated here.

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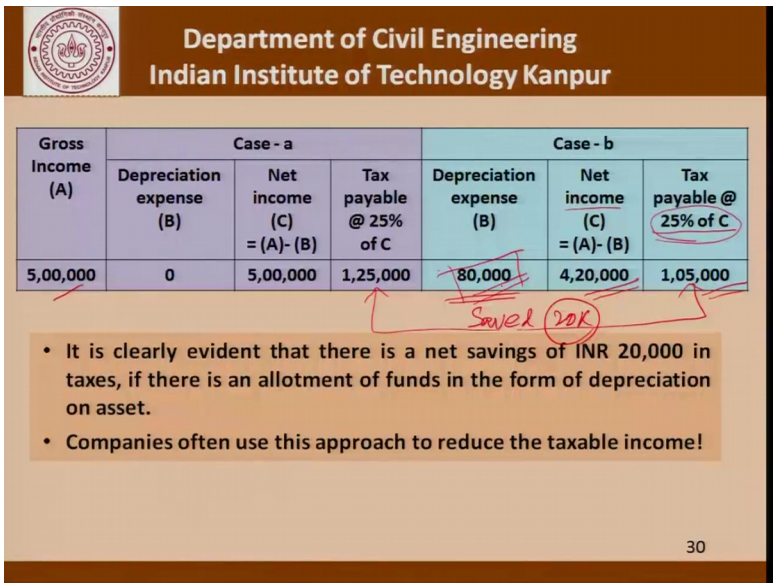

If we do that exercise as far as Case a is concerned that is, there is no depreciation you have a gross income of 500,000. The net taxable income becomes also 500,000 at the rate of 25 percent of this value the tax payable is 125,000. Now compare this situation with Case- b where there is an expense of 80,000 which is debitable as depreciation expenses as calculated in the previous examples. Now if that was the case then the net income becomes 5, 00,000 minus 80,000 which is 4, 20,000 and the tax payable is 25 percent of C which is 105,000, compare this 125,000 with this 105,000.

What you have done is you have saved 20,000 as far as taxes is concerned by having a depreciation of 80,000 and this 80,000 is what is being set aside for replacement of equipment as and when it is required, this is what is going into the depreciation pool. It remains with the company and that what is written here it is clearly evident that there is a net saving of 20,000 in taxes, if there is an allocation of funds in the form of depreciation on assets and companies often use this approach to reduce the taxable income and the taxes.

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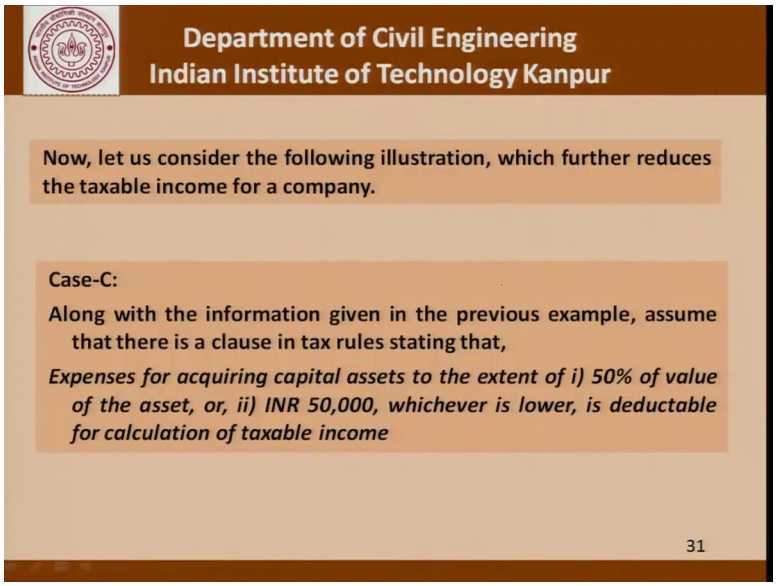

Let us consider the following illustration, which further reduces the taxable income of the company and encourages a company to increase the asset base of the company. In this case along with the information given in the previous example, let us assume that there is a clause in the tax rules that states that expenses for acquiring capital assets to the

extent of 50 percent of the value of the asset or 50,000 INR, whichever is lower, is deductible for calculation of taxable income.

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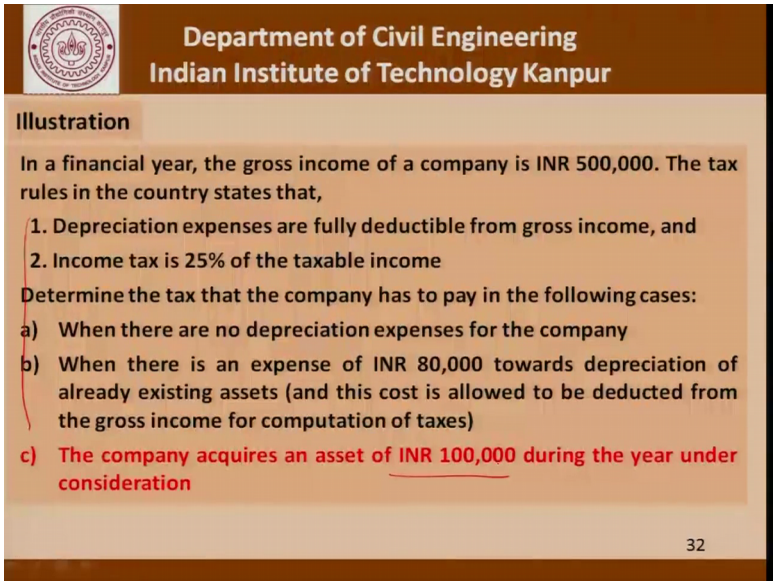

All these things being what they were earlier let us say the additional condition is that the company acquires an asset for a 100,000 INR during the year under consideration.

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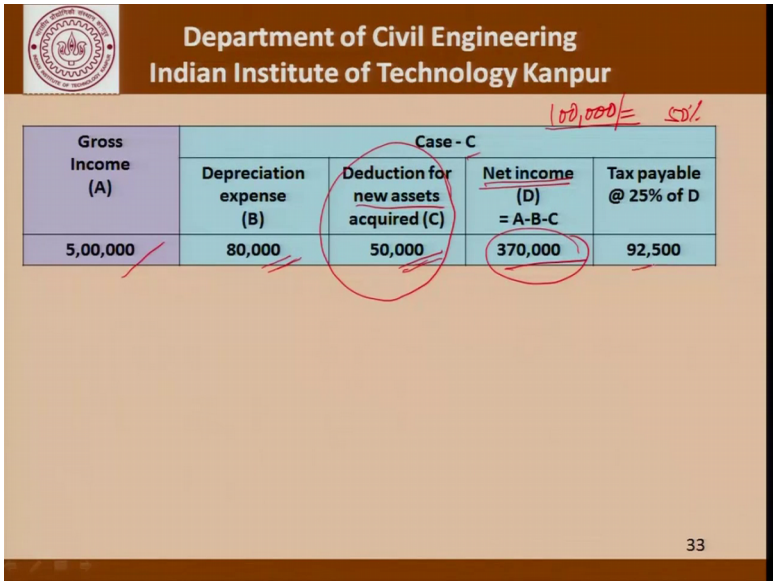

What happens in this case is that this column gets added to my deductions, in this case we have 80,000 already being build towards depreciation and since we have acquired a

new asset of a 100,000 and the conditions was that either 50 percent of this, or 50,000 whichever is lower.

So, in this case of course, the 2 numbers match, if this 50,000 is to be deducted the taxable income itself becomes 5, 00,000 minus 80 minus 50, which is 370,000 and on this 370,000 the tax payable is 92,500.

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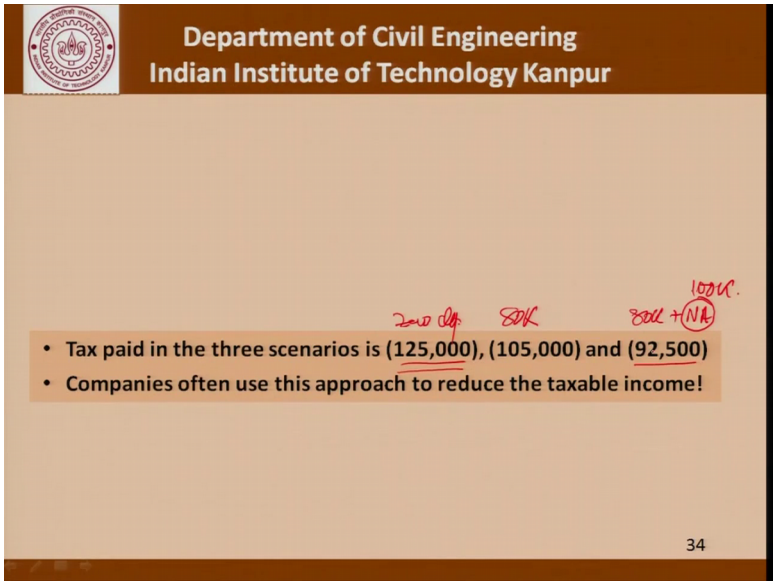

So, to recapitulate the tax paid in the 3 scenarios is a 125,000, 105,000 and 92,500, this was the case of 0 depreciation, this was a case when the depreciation was 80,000 and here was a case where the depreciation was 80,000 and we had a new asset of 100,000. We can see that the tax paid actually is reduced substantially I mean if we look at just the percentages it could have be argued that the tax has been reduced by as much as 25 -30 percent and the companies often use this approach to reduce the taxable income and increase their asset base as we have already been talking about.

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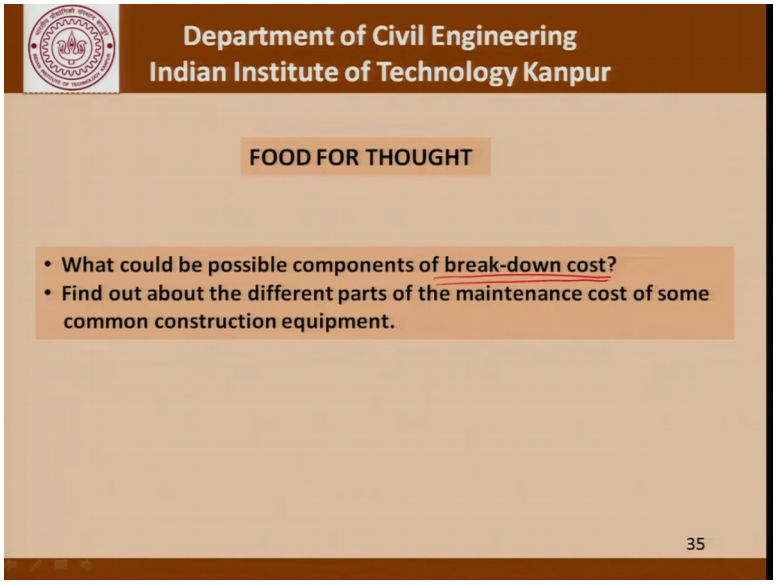

So, coming to an end to our discussion today, I am leaving you with some assignment and what could be the possible components of break-down cost. Now this is something which we have not talked about in this discussion, but we did allude to it and say that this is an important part of our considerations, when we talk about replacement of assets, determination of service life and, so, on and find out about the different parts of this maintenance cost of some of the common construction equipment with this.

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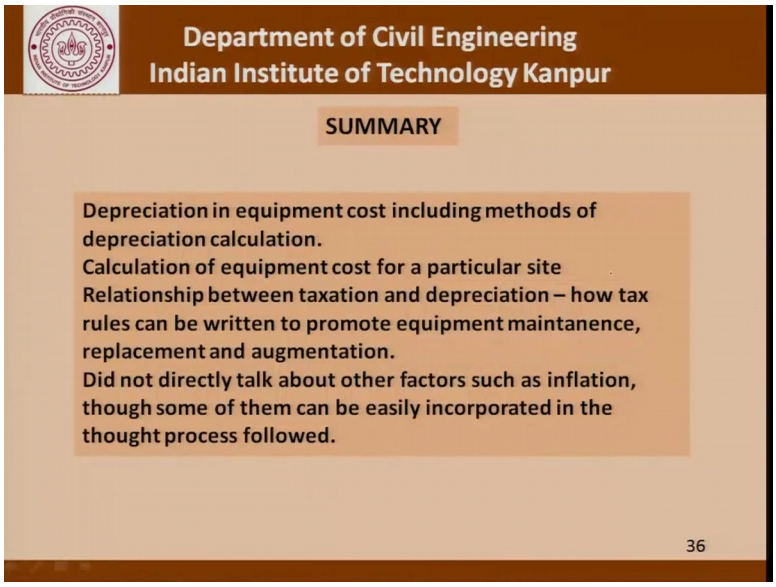

Let us try to summarize once again depreciation in equipment cost including the methods of depreciation calculation is what we talked about today, we did not talk about the sinking fund method and the declining methods, but that is something which you can do

on your own. Calculation of equipment cost for a particular site by saying that which of the equipments were new, which of the equipments were old, which were beyond the service life and, so on and, so forth.

What is the total amount of depreciation which is debitable to the expenses at a particular site and we continued our discussion to relate taxation and depreciation and how tax rules can be written to promote, equipment maintenance, replacement and augmentation and finally, though we did not talk directly about other factors such as inflation though some of these can be incorporated in the thought process followed.

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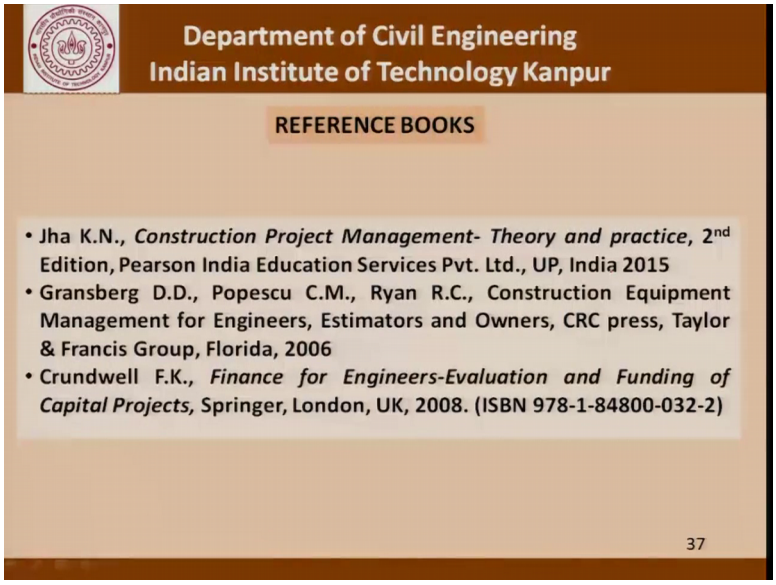

So, with this I can give you a list of books or references which would help you understand the subject better and we close this discussion on economic considerations in construction management. In the next module or the next set of lectures we will be talking about how we schedule activities, what is the importance of managing time in our construction projects.

Thank you.