Landscape Architecture and Site Planning – Basic Fundamentals
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Module-07 Lecture-35
Landform Design

Now you have understood about the slope limits of different functions. I am going to discuss now about certain criteria that is to be adopted for landform design. This set of criteria which is almost like a one liner, it gives you sufficient amount of guidance about what you should do. But I will tell you each criterion has to be evaluated with respect to the requirement of the site contextually and then adopt it. But most often, we have found the criterion that or list of criteria that I have made over here, they works, are fixed well in area of these projects.

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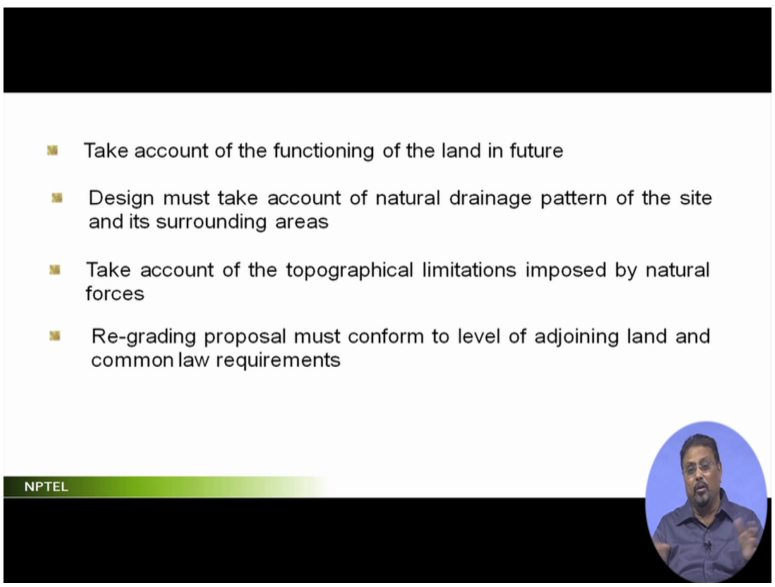

First one, take account of the functioning of the land in future. What happens is, I will go very quickly on this that when you have a site and the whole site may not be developed at one point of time and you are going to assign functions to different area. So when you are planning, you start planning in such a way that different functions are planned together. Execution may be done at different point of time.

Once you put it together, then the area which you are now detailing it out in terms of landform must take into account the consideration for what is going to happen in future. It is something like this. If suppose you have a site in which you have decided that this area is going to be lower terraced and this area is going to be higher terraced. In future that, this is going to be the higher terraced and this higher terraced when you are going to build, at this point you are not building which may be at this level.

So when you are making the landform design of this detail, then you have to also be very much concerned about what is going to happen in future. This you keep in mind. The next one is design must take account of natural drainage pattern and the site, of the site and the surroundings. This is very, very critical because what happens is I have shown an example earlier. If suppose you have a site in which you are changing the profiles and the profile is now becoming an impediment or obstruction to the natural drainage channel which is coming as a sheet of water. It may not be a channel, a sheet of water. That is not permitted.

You have to be very careful. What you have to do is you have to find out some technical solutions for rerouting. You have to take a decision in terms of either rerouting or realigning this water drainage channel so that your profile that you want to create is created but the drainage does not become a problem. So, you take this into consideration.

Take account of the topographical limitations imposed by natural forces. What we are talking about the topographical limitations is the angle of repose, the slopes and such things. And if you find that, there is something which is very, very steep and do not try to make it flat unnecessarily, contrary is also true. If there is some area which is flat, do not try to make it unnecessarily sloping. So topographical limitations must be taken into consideration because ultimately as soon as you change the profiles of this, the stabilization of that costs. Maybe functionally very effective, aesthetically very effective but technically, cost-wise, topographically it might pose some problems. So, take note of that.

Re-grading proposal must conform to level of adjoining land and common law requirements. Re-grading means, grading is changing the levels, that is what is grading. Change the levels at different places, regrading, okay? In this case, you have to be very careful about the common law requirements. I am telling you very frankly that in Indian situation, we do not have much very strong law requirements or by laws it is not very strongly mentioned anywhere that what should be the level up to which you can change so that it does not affect the next property.

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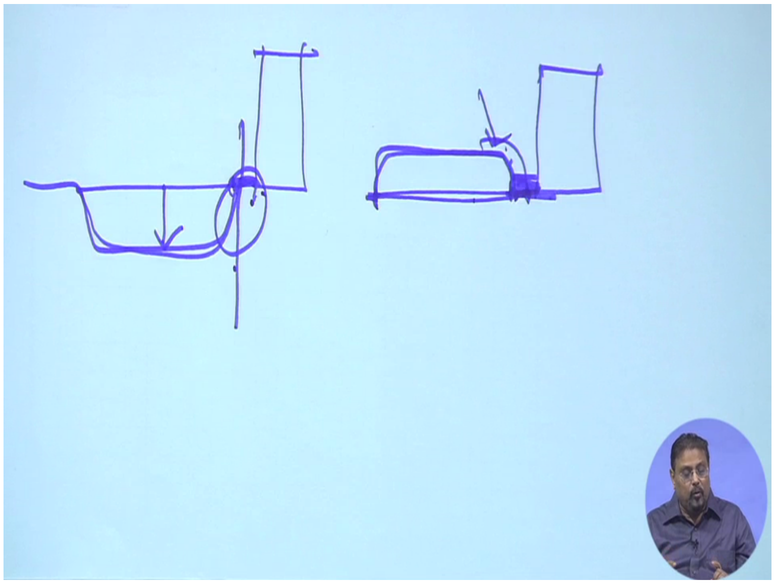

But the situation is this. That, if suppose you have a property and there is a building. This is another property where there is a building. And you decide that my profile of the site is going to be lowered, you decide this. We can always do it, that I will lower it down to this. The moment you do it, this is a property line, moment you do it, actually what you have done? You have caused instability to this which was originally very much stable for which this particular building was sanctioned.

But the moment you have done this, you have made this unstable. This instability you have brought in, now the local regulation has to come in. Okay? Another, suppose another situation is suppose there is a building which has a property line, this is your property line and you decided that you will be building it up like this. This will not have in general any negative effect that way but the thing is if you now see that originally the drainage which was happening because of this flatness, now this drainage is now being pouring the water into this particular area and causing floods. These are the things which you have to really take note of and be very, very cautious about it.

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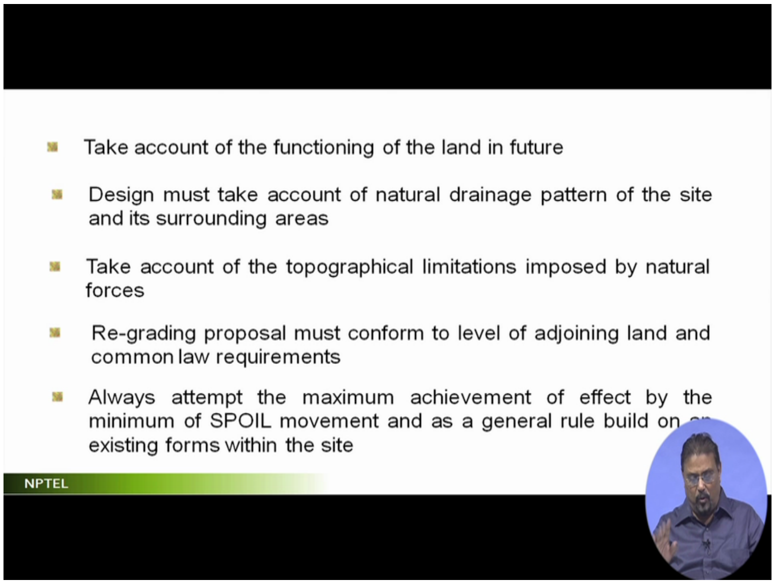

Always attempt the maximum achievement of effect by the minimum of SPOIL movement. The meaning of SPOIL, S-P-O-I-L, I have written it in bold, the reason is SPOIL is nothing but disturbed soil. This is nothing to do with the linguistic meaning of our English. SPOIL is the disturbed soil. So you should try to plan your landform design in such a way that minimum amount of disturbance that you are causing. These are many more effects. That effect I will talk about in the next, some. So in general, the rule is to build over the same topography. If it is undulated like this, try to build over this. If it is laid in this form, try to build over this. If it is flat, try to build over this. That means do not try to change unnecessarily the topography just for the sake of creating a landform.

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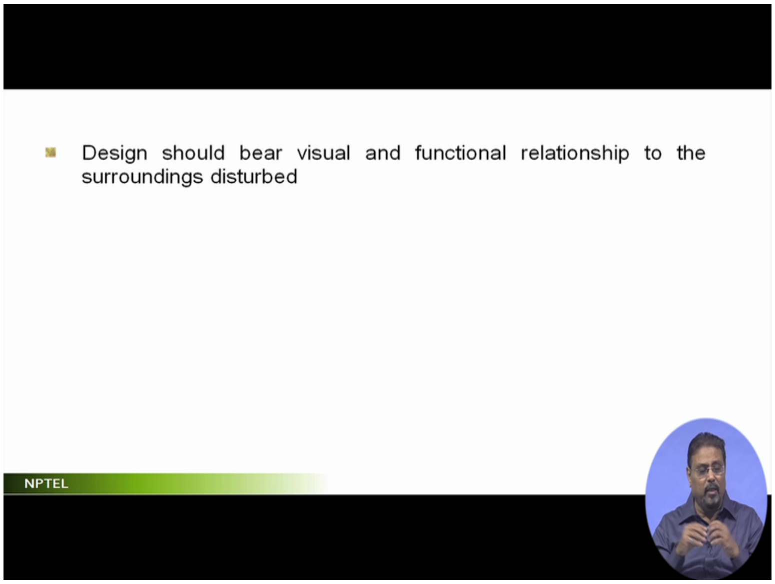

Okay. The next. Design should bear visual and functional relationship to the surroundings, surround disturbances. Basically, what you should do is here I would say, sorry, this particular word let me correct it because here I have to, I will consider. I will rather take this out. Okay.

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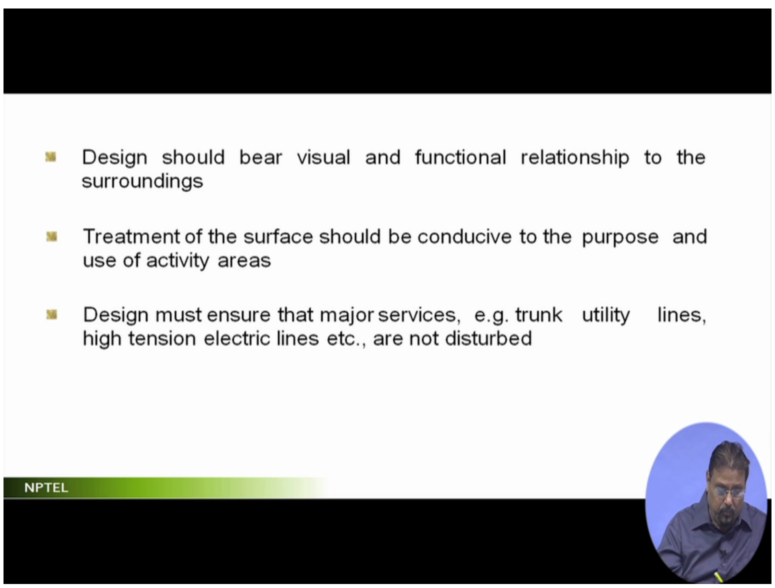

You consider this. You take note of the surroundings. Here, this is not a very strong criterion. If suppose but it is, if something like if you try to draw an analogy with the building forms of the hilly areas, you will find since the hills are of different profiles, the roof profiles are also of the similar nature. It has two reasons.

One is that you should have a good amount of drainage if it is very rain prone or else it fits well with the profile of the hills. So the thing is what kind of profile that you are going to have, try to keep a little bit of harmony with the surrounding landscape profiles, landform profiles. In the hilly area do not try to flatten everything just to, just for the sake of creating contrast. Or in the flat area, do not try to make too much of hilly profiles just for the make of, sake of making contrast. So this is what is the point which I am trying to hint at.

Treatment of the surface should be conducive to the purpose and use of activity areas. That means treatment is here. See in the whole landform work what you have done, you have found out the stability of this, you have finished the top surfaces and you have made some kind of treatments with the materials. And do it with the, in its such conduciveness to the purpose of that particular activity area.

If it is, like say an example I will tell you. If it is the lawn that you want to make, do not try to make the lawn over the rock. But I have also seen situations where people have, they have almost gone diametrically opposite. In the Middle Eastern countries, the dunes that we do have had been converted to a green cover as called course. That is something very extreme, is also very praiseworthy and noteworthy. But now let us see.

Try to convert a sand dune which is full of sand. You want to convert this to a green lawn. Objectively, I will not have any objection, very correct. You find, you can always have a sand dune covered with the green and you want to have curvilinear greens but where it hurts is the cost. Stabilization of the sand and then making the grass cover on this and then maintaining the grass cover to such extent that it becomes usable, it costs. So when I am writing this criterion, it is not essentially to say do not do it. It is only take note of all aspects of it before you take a decision in favor of it. This is what it is.

So if the purpose is, if the purpose is that you want to make a green cover with undulations and you do not have any other space but the sand dune, do it. But if you have other options, why not do there where the cost will be minimal, topographical limitations will be minimal and also aesthetically the same results. Okay.

The next is design must ensure that major services such as trunk utility lines, high tension electric lines, etcetera are not disturbed. This point is very, very important. What happens is, I am not sure whether you have experienced this situation. There are different trunk lines or say services which has some limitations of the heights in terms of clearance of depth. I will just cite two examples which will make it very clear to you.

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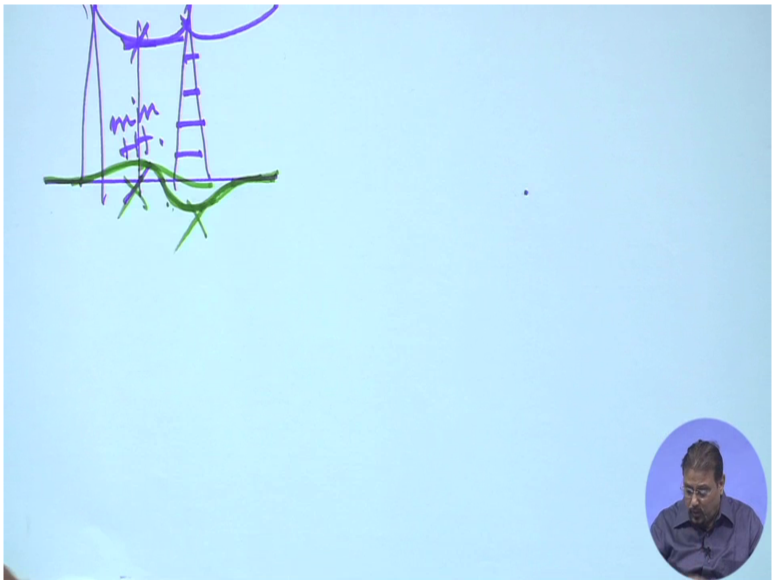

Suppose there is a, you are designing a landscape in an area where we have the electrical power lines going. In such cases, what happens is between the two pylons, there is a sagging point, the lowest point in which as per the electric rule there is a minimum height. This has to be maintained. This minimum height is for essentially for safety. And in case the minimum height is not being, in such cases suppose it is, I would say even people have gone for caging that so that in case the where it snaps out, it does not fall on the people who are walking below and get hurt or there are accidents. So what? There is a minimum height.

Now the suppose an example in this that you are making a landscape design in which somehow eventually your design is calling for a mound here. This is one. In this itself I am drawing another. And not only mound here, it is also desired, you are eventually resulting into a place where you want to lower this particular soil. Because you wanted this profile over here and it clashed with these two, this is not permitted, this is also not permitted. This is the point which I am trying to say here. The reason is at this point once you are raising the soil which is now violating the minimum height clearance requirement and at this point you are exposing the foundation which is going to make this vulnerable in terms of stability. These are not possible, not allowed.

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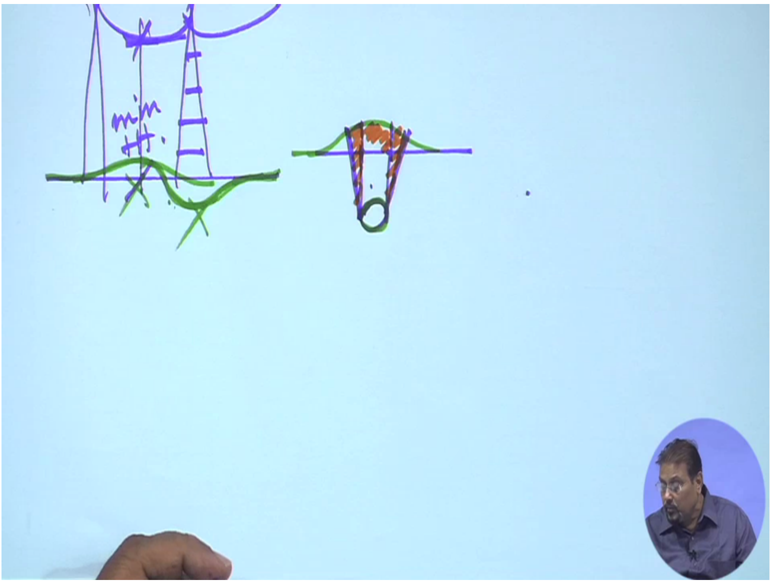

So the thing is, another one. Another example let me give you. Suppose you have, in your landscape site there is a service trunk line below, civil line maybe or drainage line maybe, whatever. Okay. Here it is not advised to have a mound over here. No, not advised. Why? The reason is when this particular, in case of replacement or maintenance of this particular function, you have to cut this. Where? This particular portion at the top. Maybe the depth is worked out in such a manner that this is a trench that you can cut. The moment you have made it higher, the trench is going to be deeper passively.

Now from this if you go upward and this is your level, the trench is going to be deeper. Once the trench becomes deeper, in such case you will find that the side wall stability is now in threat. Once the side wall stability is in threat, then it is likely to have the kind of profile like this for digging. Now you try to analyze it. In this, first of all, so much of additional thing that you have done for your good design, now has to be removed and again replaced, cost twice. Okay.

And not only that, just to maintain this particular height and the stability of the site, you have to cut more. That means you are now in fact cutting not only this much extra, you are also cutting this much extra which is going to be costly. Okay? So that is why you do not gain much by making a mound over this where you are going to subject it to this kind of situations. It is take this very seriously that never disturb all these areas. Okay?

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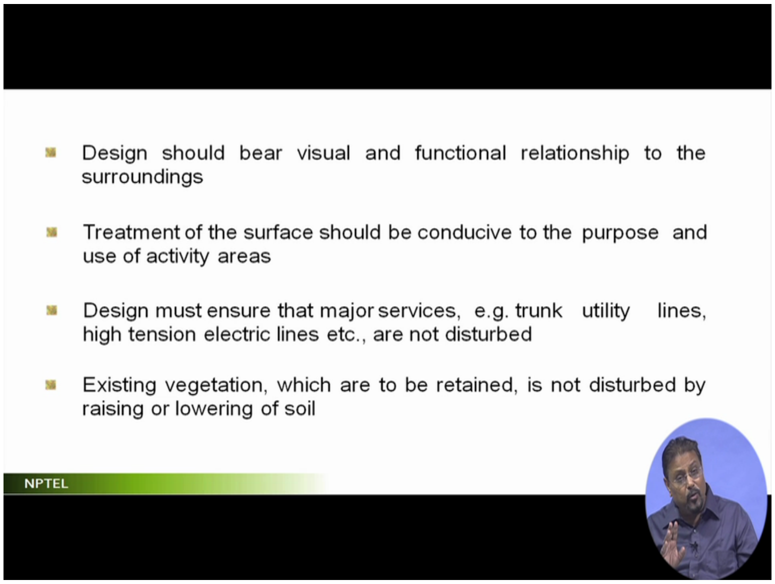

Existing vegetation, similar rule for vegetation as well, okay? But for different reasons. Existing vegetation, which are to be retained, is not disturbed by raising or lowering soil.

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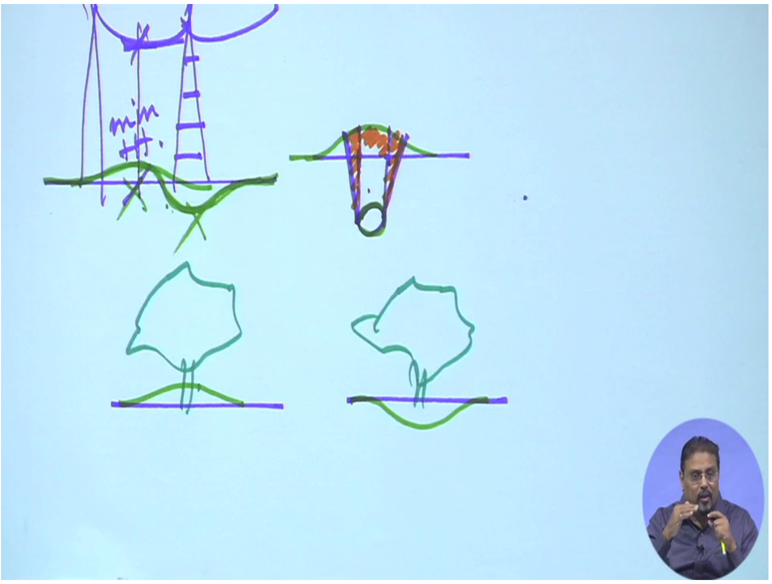

Two things, one is if suppose you have a ground here and a ground here. I am just drawing it in this situation. You have a vegetation here. You are advised not to raise the soil below, number one. Number two is that you have a vegetation here, you are advised not to lower the soil below. Two different reasons. This reason is very well understood that similar here. If you lower this particular soil, then what happens is that you are making the root structure bare. Two things happen, instability of the tree and the same time, decay or exposure of this root structure to the extremes of the nature and this tree is going to die. So you are not supposed to do this.

Here, what is the problem? This problem does not exist as it exist here. Here the problem is each tree which you are retaining will have a clear trunk height, this I will discuss in my next lecture. It will have a clear trunk height. And the clear trunk height which human body, human person, once somebody is passing below a tree, always assesses that okay this is the height I have a clear and I go through it.

It is just like passing through a door. If you have a differential height of a door, if I make you walk from one door to the next door, to the next door with differential heights, at some door you will be stopping and you are thinking that is the height adequate enough that I can pass through straight. Your intellect works, your perception works, your sensation works and intellect says, no, no, it is probably I am going to hit. You are not going to hit maybe three inches above your head but the thing is your mind says you are likely to be hit.

So what you do is at that, while passing through that particular low height door, you duck. The same thing will happen over here. The trees will have a clear trunk height. The moment you have done this, people will be oblivious to this and suddenly coming to this particular point, they will have a feeling that I might get hit at the head. These are very, very sensitive thing in our landscape design and this you have to consider. So, you are not going to raise or lower the soils at this foot of this tree, neither at these situations.

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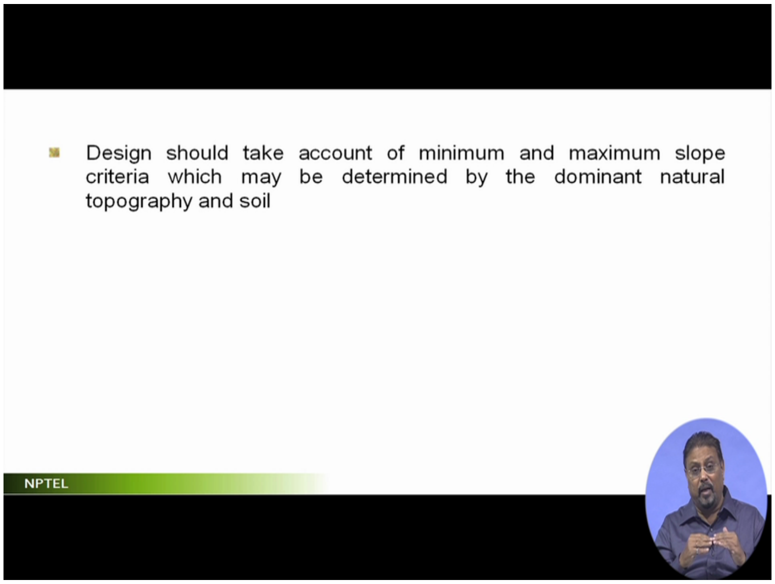

Another set is ‘Design should take account of minimum and maximum slope criteria which may be determined by the dominant natural topography and soil’. This point is what I already explained this. Each function has its minimum and maximum slope criteria. Always try to match it with the actual existing topography. Or means this action starts when you are trying to see the slope analysis and trying to put all these functions together.

At that point of time, you decide okay, at this site I am going to, at this slope I am going to put this function because it is matching with your maximum, minimum. If not, then in such case what you will do is you will try to make your modulations of the land or the called modeling of the land in such a manner that it corresponds to the minimum and maximum slope criterion.

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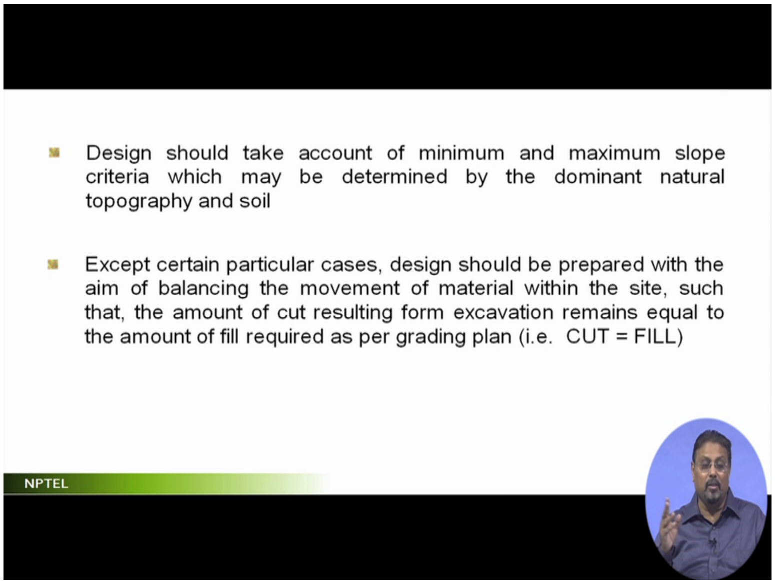

This is another very important criterion that I consider, that you should note and you should always keep in mind. Two things, out of this entire set of list of criteria, I will always ask you to keep in your, at the back of your mind. If suppose I say that out of the entire set of criteria, two criteria you should keep in your mind, one is minimum of SPOIL movement, so maximum on the same slope and the second one is this one.

In this, what you are saying is always try to balance your soil movement or SPOIL movement within your site itself, within your project itself. Means here is that if suppose you are making some mounds, try to get the soil from your own site. If suppose you are digging somewhere at lake, then try to dump the soil within your own site. This will have a strong effect. The effect is like this.

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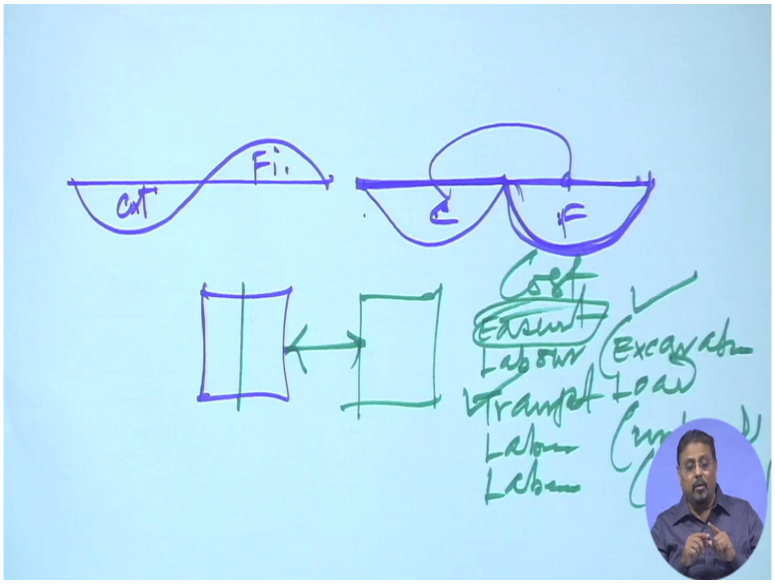

I am drawing it conceptually. If this is a site if you are digging, then must be filled. So this is cut and this is filled. And if suppose you want to fill this particular part, you want to fill this part, then you have to cut somewhere. That means you cut from here and then fill here. So this is you are doing the cut here and then fill it up here. Originally, this was your surface, now you have to take the soil from here to here. The connotation of this is very, very strong.

What happens is whenever you are making a movement of the soil from a particular existing position, cost comes, creeps in. What kind of cost? Imagine that this is your site and you want to fill it up. You have to get the soil from somewhere. If you do not follow this criterion, then what? This has to be filled with the soil from somewhere. You are going to find out another almost equivalent area. I am just giving a very notional area. Another equivalent area from the soil has to come. So the cost, what kind of cost? Easement cost. Easement means the rights of taking the soil from here, number one. Second is the labor cost. Labor for what? Labor for digging. Okay. So labor for excavation, then labor for loading. Then your transport cost, okay. Then the transport cost, bring it here.

And then here, labor for unloading and then labor for finishing. Have you noticed one thing? The whole thing that you are doing, your easement cost is pretty high in this. Two costs which are going to be different, say labor cost for excavation and loading and labor cost for unloading and finishes within your site itself will be almost same. But the cost of easements and cost of transportation, these two are going to be greatly different. And this makes your project not viable financially maybe.

So it is you are ready to bear this cost of labor, do it. You do not have to pay anything for the easement because that is within your site. And you do not have to pay anything for the additional transport. With this transport, I am referring to is between these two. I am not talking about the internal transport. If you start counting and really make counting of this, you will find, you will be discouraged to dig soil from somebody else's site. So rule is then in that case, try to follow the landform design in such a way that your amount of cut and amount of fill is almost equal. If you want to fill, then with the objective of filling, amount of cut has to be equal. So the cut is equal to fill, that you never forget.

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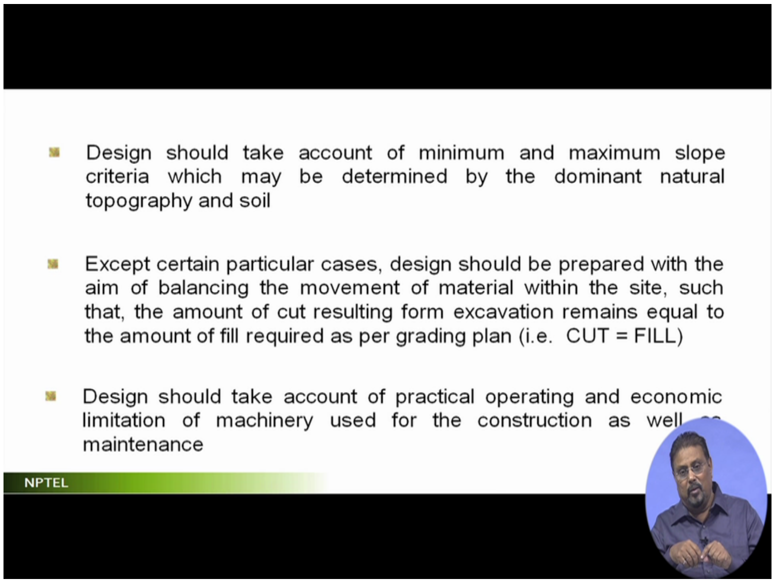

Design should take account of the practical operating and economic limitations of the machineries, this I explained. That, if suppose you have a certain kind of profiles where machinery could be solving a larger area's problem but you made such kind of profile that machineries cannot be used because there is too much of slope and then you have to go for large number of human labors which are costlier. Because if you use the machine for a larger area, then the per square feet cost ultimately reduces.

It is because of which the excavation by the JCB machines nowadays is more beneficial and most cost-effective than thousand labors digging and pouring the soil somewhere else. So similar is a situation here. So whenever you are giving a slope, always try to see that which machine can be used and whether the machine can be effectively used within this. That is how you have to check. Okay? These are the set of criteria. I would always advise you that keep at the back of your mind whenever you are handling the landform.

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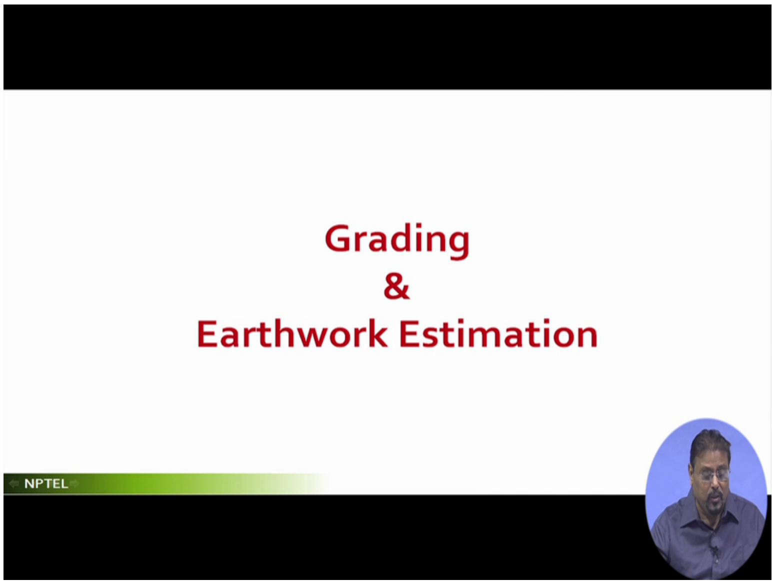

Very quickly, I will go through this: Grading and earthwork estimation. You remember the last step was the earthwork estimation. Grading is the changing of levels.

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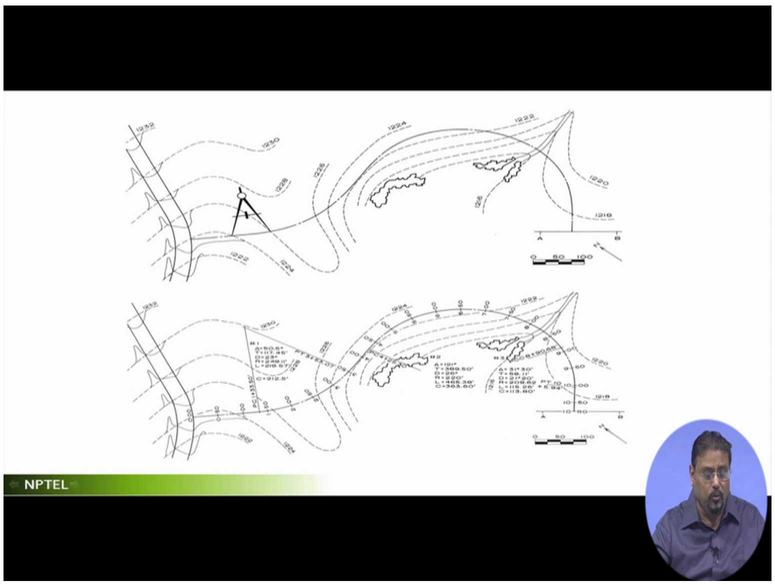

In earthwork estimation, basically the same picture which I have shown earlier. In this, let me tell you how it is happening, how do you do it, how do you do grade. I will show you with respect to very simple example which is already given in the one style book I think. See, imagine the situation where you are trying to make a road in the contours. So here the project is or the problem is trying to understand that how to do the manipulation of the soil and make a landform design for a road. I am giving that example because that is best understood.

First what you do is you make a alignment. And this alignment you have done at your contour analysis level if you recall. After alignment is done, then you decide about the slope. So at certain distances, you find out the points and then you decide about the levels at this particular point, elevation at this particular point which you have taken, almost studied when you are doing slope analysis. So the change between this and this is, this is giving you the alignment and this is giving you the slopes.

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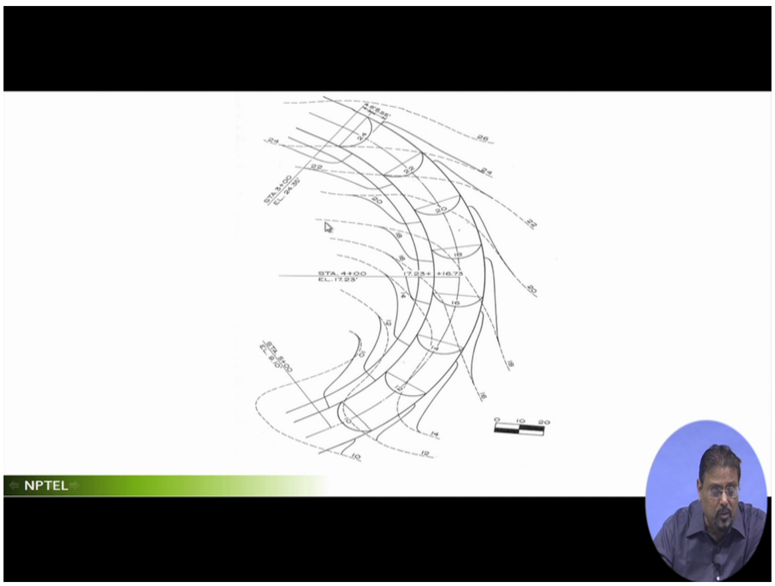

Once you have done this, then say one component that you have come into this is this particular road. And this particular road, just I am drawing your attention to this. If you see, the dash line is the original existing contour line. Let us focus at this line 18. This is that existing contour line. To bring it to a level which is 18 which comes here at this particular point, then the whole contour has to be changed by this profile.

Look at 20. Original contour line was this and you have to change to this particular profile as a graded contour, this is what is grading. Now see in this particular picture one thing is very much visible that all these points, intersection points between this, this, all these are at equidistance in this curve. If you look at what is a profile of this, of this particular road, first of all this is horizontally curved. At the same time, the slope changes from 26 to 10. That means it is not only horizontally curved, it is also vertically going down.

Making up landform design for this kind of thing is not easy. Take this as an example on your sheet and then try to work it out. What I suggest is this is, this kind of assignment you do yourself, is that you take this particular picture and then eliminate the proposed lines, proposed contour lines. Only draw the existing contour lines and then you decide about the levels and then you try to work out the profiles with respect to the proposed line. You will definitely become a master of it. Okay? In this what happens is once you have changed this, then naturally at every intersection point, the soil either has been dug, cut or filled. That must have happened. And that cut and fill when you are doing it, now it is the question is, how to estimate this earthwork? What you do is you take that information.

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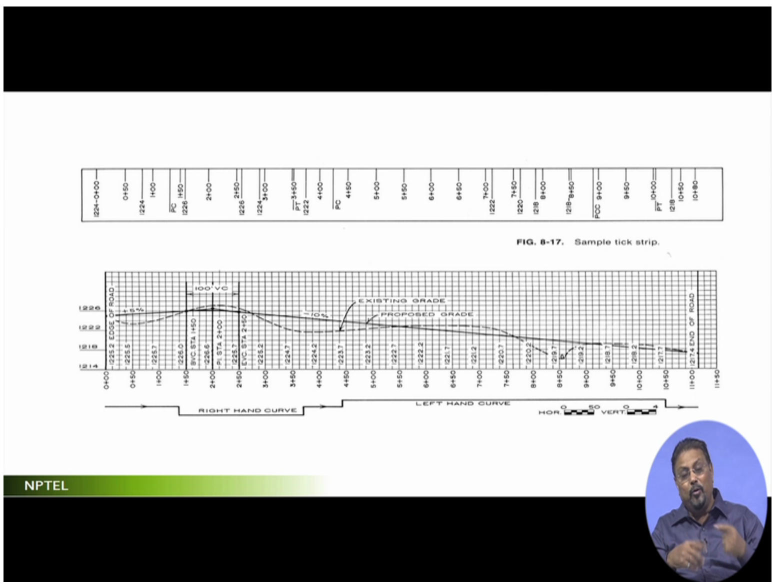

This particular diagram is showing as if the whole same road which was originally, if I take the central line of that particular road along that here, central axis, then this was the original line for my existing contour. And the dark continuous line is the proposed line. That means it gives me a very clear indication that at the center point, this portion must have got filled up and this portion must have got cut. This portion got filled up and this portion got cut. This portion got filled up, this portion got cut. Just have a close look at this, you will understand. That means to bring a central line level from this existing to this one, there had been some portion cut, some portion filled. But this is not one line, it is not one line, it is a width.

So in such cases and also the road is turning. If the road is turning, means super-elevation or banking also going to call for a raising at one edge and the lowering at another edge at the curve. If you take this, then the only central line will not work. So you have to do is you have to do this for all the three edges, extreme two edges and the central line. So similar such things should be drawn for three such things and then we try find out and make an average.

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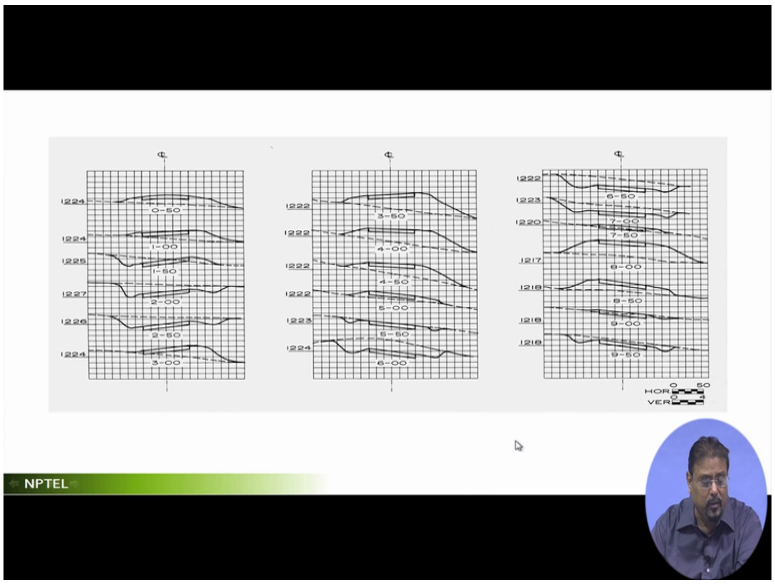

And there is one demonstrative picture, drawing for this that at each of these intersections, there would be a situation like this. This graph is only giving an idea how much is the area, okay? Once you have this, that means if this was the central line which was depicted in the earlier picture, then this, if this was the original level, then this got filled and the other part also got filled.

Let me just take one or two spot cases. In this particular picture, this got filled and this got filled. In this picture, less got filled but more got filled here. In this picture, this got cut and this got filled, it changed. Okay. In this, the entirely got cut. Now if you take into this consideration for these four, what you have to do is you have to find out what is amount of area, that area that got cut over here and how much got filled here, how much got cut here.

Now if you take a distance between this to this, you will find from this particular point to this particular point, this much got filled and this much got cut. Now if you take the point at this distance to the 0 to this, 0 means where there is a zero cut, zero fill. So this got filled, this got zero and this got cut. This conical volume and this conical volume, one conical volume is for your fill, another conical volume is for your cut. Now if you take the average of all these things and the multiply with the distance with the Average End Area method, you get the volume that is, that has gone through that particular stretch. This I will just show you very quickly in the next slides.

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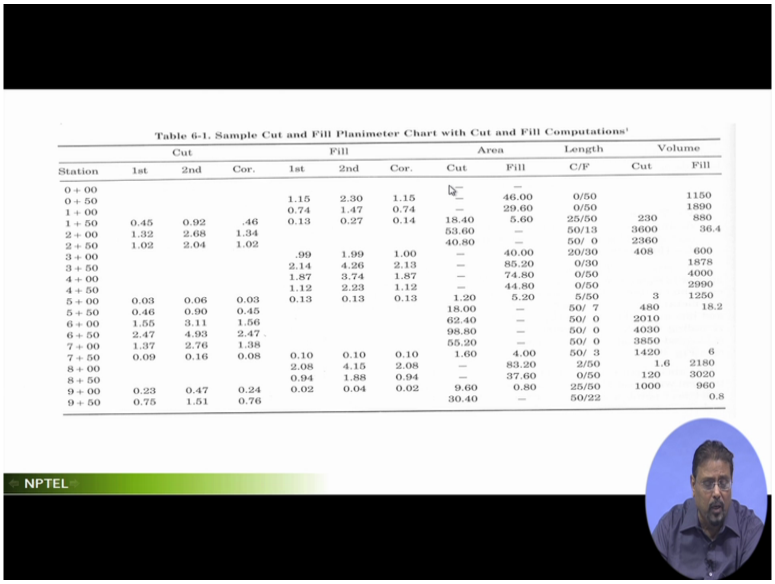

Table 6-1. Sample Cut and Fill Planimeter Chart with Cut and Fill Computations[1]

	Cut			Fill			Area		Length	Volume	
Station	1st	2nd	Cor.	1st	2nd	Cor.	Cut	Fill	C/F	Cut	Fill
0 + 00							—	—			
0 + 50				1.15	2.30	1.15	—	46.00	0/50		1150
1 + 00				0.74	1.47	0.74	—	29.60	0/50		1890
1 + 50	0.45	0.92	.46	0.13	0.27	0.14	18.40	5.60	25/50	230	880
2 + 00	1.32	2.68	1.34				53.60	—	50/13	3600	36.4
2 + 50	1.02	2.04	1.02				40.80	—	50/ 0	2360	
3 + 00				.99	1.99	1.00	—	40.00	20/30	408	600
3 + 50				2.14	4.26	2.13	—	85.20	0/30		1878
4 + 00				1.87	3.74	1.87	—	74.80	0/50		4000
4 + 50				1.12	2.23	1.12	—	44.80	0/50		2990
5 + 00	0.03	0.06	0.03	0.13	0.13	0.13	1.20	5.20	5/50	3	1250
5 + 50	0.46	0.90	0.45				18.00	—	50/ 7	480	18.2
6 + 00	1.55	3.11	1.56				62.40	—	50/ 0	2010	
6 + 50	2.47	4.93	2.47				98.80	—	50/ 0	4030	
7 + 00	1.37	2.76	1.38				55.20	—	50/ 0	3850	
7 + 50	0.09	0.16	0.08	0.10	0.10	0.10	1.60	4.00	50/ 3	1420	6
8 + 00				2.08	4.15	2.08	—	83.20	2/50	1.6	2180
8 + 50				0.94	1.88	0.94	—	37.60	0/50	120	3020
9 + 00	0.23	0.47	0.24	0.02	0.04	0.02	9.60	0.80	25/50	1000	960
9 + 50	0.75	1.51	0.76				30.40	—	50/22		0.8

So this how when you do it, you just keep on recording this information in a kind of table over here. That means from this station point to this station point, from here to next to next to next, that means between two station points, how much is the amount that is cut or how much is the amount that is filled. Here since it has been used with a planimeter, so that is why there are three such recording. Two recordings are by the planimeter and the next one is the by corrections. Okay?

I would advise you in today, nowadays since you do not use the planimeter, use the straightway computer polygons and then its area. I would suggest that you can ignore this first and second reading and just think about the corrected reading. So what you have is in the, from at this particular point, the amount of cut is this, okay? And that is the planimeter reading. I would say if I now see that from, let me focus up on this particular part of the chart that from here to here, there is no cut, there is no fill.

From at this particular point, there is no cut but there is a fill, okay? And then at this particular point, there is no cut, there is a fill. And how much is the length which is under cut or under fill? If you see 0 by 50, it is not 0 by 50, it is basically 0 for cut and 50 for fill. Please do not misunderstand this as by something, it is not division, it is 0 length for cut and 50 meter or 50 feet length is for this. So this now, say the difference between this cut and fill since it is 0 to 46, so naturally take the average of this and multiply with this distance, you will get the volume of this which is a fill volume.

And similar, let us take this one. Here at this particular point say, 1 plus+ 50, at this particular point, it is so much of cut area and so much of fill area. So up to 25 unit is the cut area and 50 unit is the fill area. I am saying in terms of unit because you may consider this for any kind of scale. Okay. Now that means for so much of distance with this much of, from here cut to 0 cut will result into 230 unit of volume. Then 5.6, 0 to 5.6 of fill for a length of 50 will now generate 880 unit of volume. Now if you start adding this up and add this up, the balance sheet should be, the total should be same. That means the amount of cut that you have done over here and the amount of cut that you got at this particular field point should be same. See, it need not be same to the, for so much of precision but as close as possible. Okay. This is how the whole thing is worked out.

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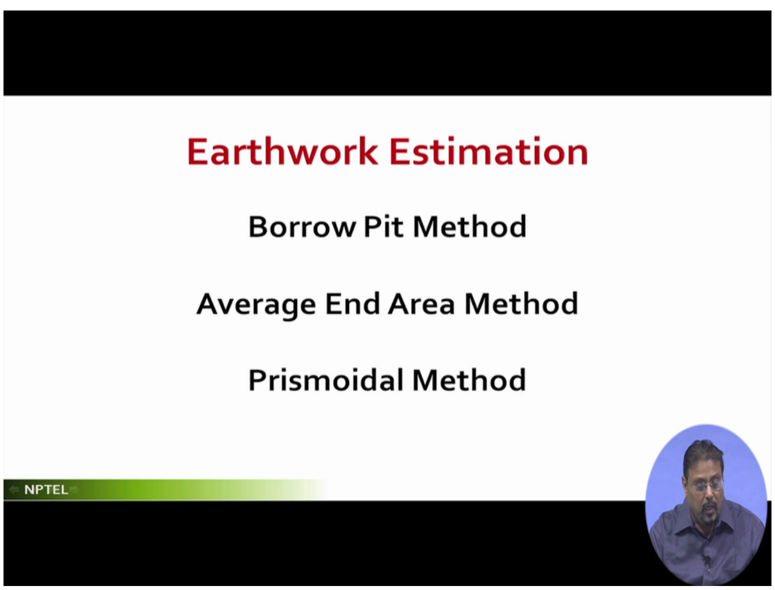

Very quickly, I will just conclude this. When you do the earthwork estimation, there are three methods that you do follow. One is the Borrow Pit method, another is the Average End Area method and there is a Prismoidal method.

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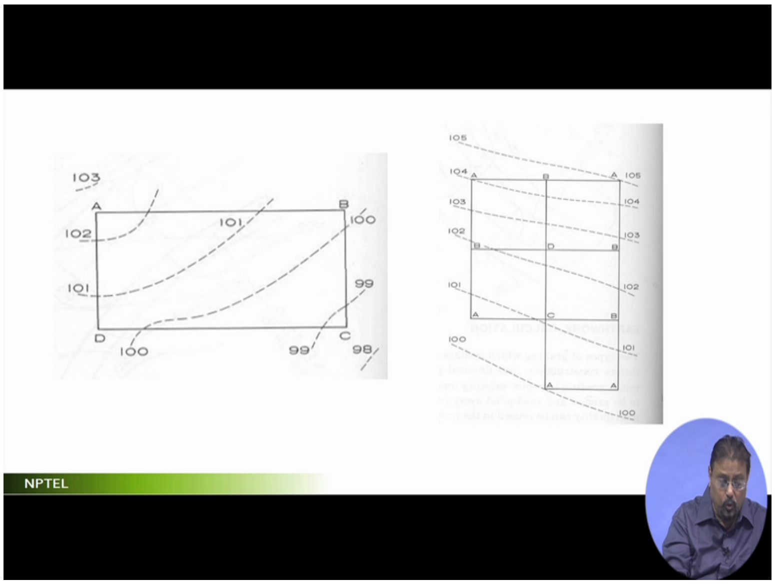

I will show with respect to this picture itself. Borrow Pit method generally you use when you have a larger area and you are going to cut. An example I am just showing on this piece of paper.

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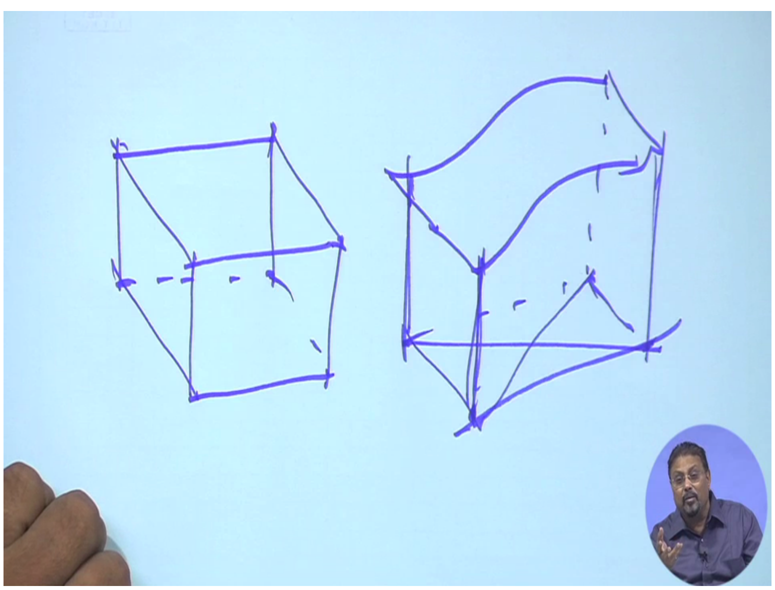

Suppose you have certain area which has to be now cut, dug to a certain depth. Here, I have drawn a very simple cuboid. But imagine if your site was something like this. Okay. If it is something like this, then you know this particular level, lower level which is same for all. So you find out the length, height of, differential height of this and make an average of this. So once you get average height of, between this plane and this, average height and then you multiply with the area, you get the volume. That is what is a Borrow Pit method which is used for ponds, tanks and such things or excavations of the basement foundation and such things. Okay.

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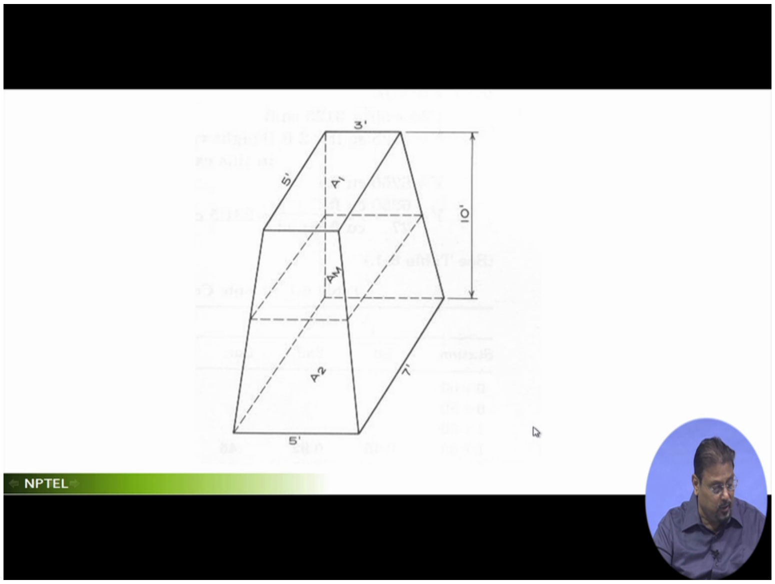

And this is for the Prismoidal formula but before this, before this Prismoidal, I will come to the Average End Area. In this paper itself I am showing.

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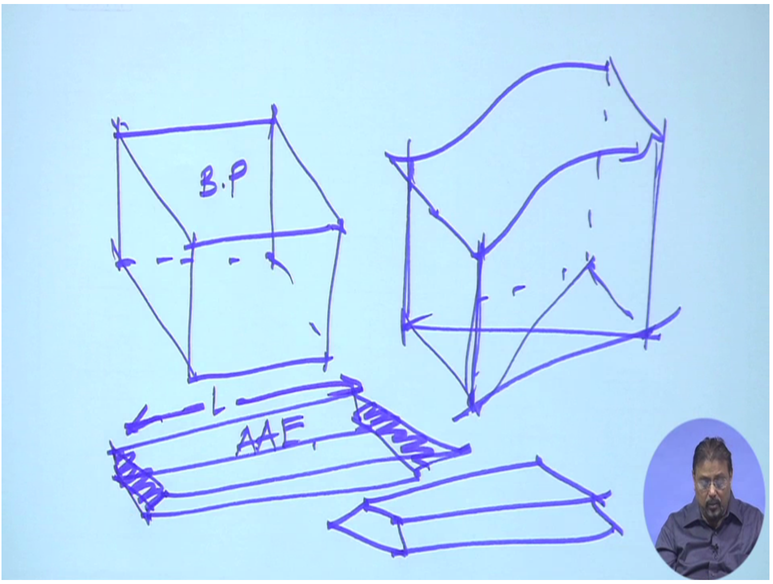

So what happens is if suppose you have a channel to be made and imagine that the channel is of differential width, this is a situation. This is for linearity. So for this Borrow Pit method, here I am writing here BP method and here it is Average End Area method, I am writing that way.

Here, basically what you do is since it is changing in cross-sections, it may be for drain, it may be for even embankments. It is reversed, matter is same. What you do is you find out the area of this, so A1. You find out the area of this, A2. And take, add this up and divide by 2, so you get the average area. And then you multiply with a length, you get the volume. Same is true here. Okay. This is Average End Area method. But what happens is quite often, many of the situations you do not really get the right picture with respect to this. At that time, this Prismoidal formula is used. Okay.

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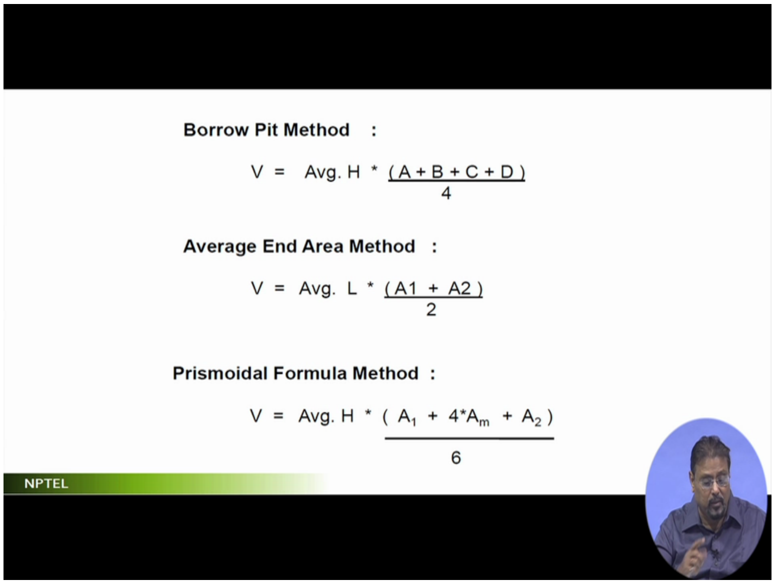

The Prismoidal formula, basically this I am coming to only after I discuss.

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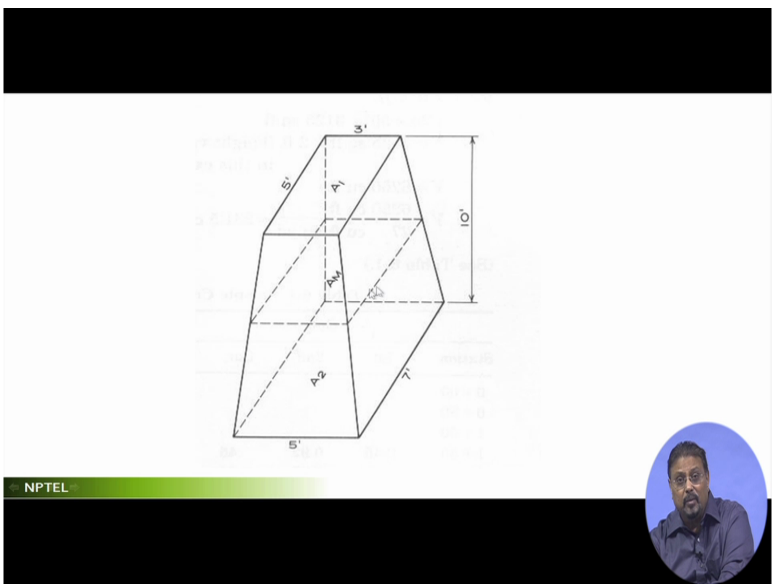

In the Prismoidal formula what happens is what you see in this particular picture is you consider this as the first one plane, and then you get the base plane and intermediate there is another plane. In the Prismoidal formula you consider these three planes. Why you consider this? It could have been very easily calculated and then you take the height between the, this average height of this. But why it is very important? I am just showing you with one such diagram.

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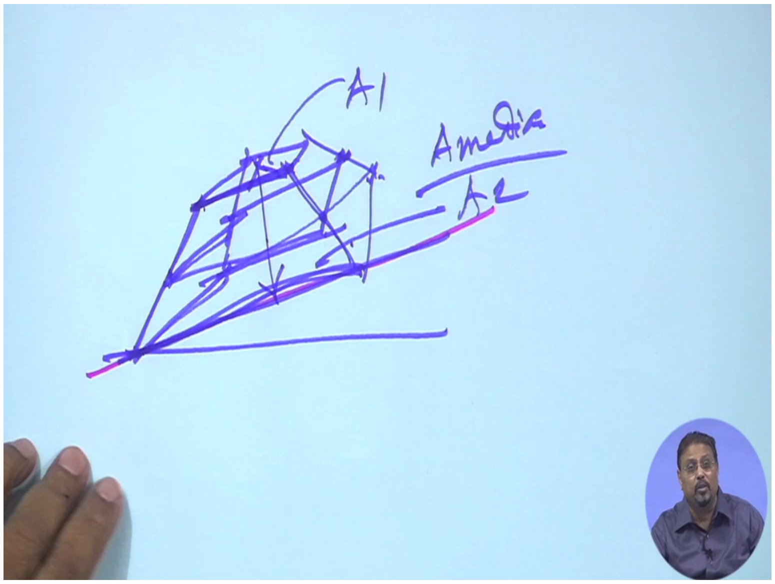

If suppose your site is of this profile with respect to horizon, like this profile and now you want to find out how much is the volume of earth. How will you do it? Will you now start drawing virtually a line like this and then try to find out? No. You do not have to really do that way. What you do is you, okay, you take this as a base and this one is sloping not parallel to this, not parallel. What you do is you take the area of this, you find out the center point, midpoint of all the slanting edges. Okay?

And connect all those midpoints of the slanting edge, find out the area of this. So the first one is A1, Area 1 and also find out the base of this and that is Area 2 and this one is area median, so it is a median which you have found out. And once you have these three area, now you try to, have to find out the average of this. And then after that, the average height that you have to consider, okay, which is 10 feet like in this particular picture is shown, in this it is shown 10 feet, similar.

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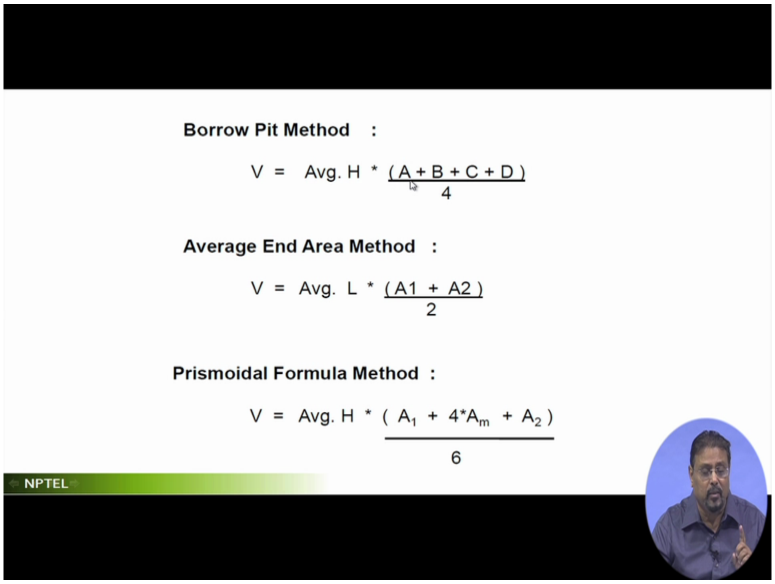

So what you do is in this particular situation, you follow this formula. Just see here Borrow Pit, in this what you are doing, you are taking average height and you are adding. Suppose there are four corners, so you take the height of A to bottom, B to bottom, C to bottom, and D to bottom and then you average it by 4 and then multiply with the H, you get the volume. Look at the Average End Area, you have the Area 1, you have the Area 2, take the average of this and multiply with the length, so you got the Average End Area.

In this Prismoidal formula what you do is you take the Area 1, the top, area of bottom and the intermediate one you multiply with the 4, add this up and divide by 6 and then multiply with the average height, you get the volume of this. This is how you can always find out earthwork's quantity for any kind of things, landforms that you are creating in your site. I will conclude at this particular point because this gives a very clear idea about how really you go ahead with it.

Next day, I will discuss about the Storm Water Management but till then I would advise you look at this landform activity altogether, listen to my lecture repeatedly till you become absolutely clear and if you have any query, please write in the forum and I will be happy to clarify this particular point. But your landform activity is one of the very strong foundation of the landscape which is highly, highly technical. So landscape again, I am reiterating, landscape is not a pattern making game, it is a highly technical exercise and it is not limited to any discipline of engineering. And you are I hope by now convinced about it. Okay. Happy journey. Thank you very much.