Surveying
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Module - 11
Lecture - 3

Project Surveys

Welcome to this video lecture on basic surveying. Now today we are in module eleven and this is our last lecture of module eleven that is lecture number three. In lecture number three what all we will be covering we will be talking today about the building setting out as well as road setting out. When I say road I mean it could be a canal, it could be a railway line, it could be any corridor you know. Also, so we will be talking about some basic principles here some basic steps and those steps can be extrapolated to any application there in the field. What we have done so far in our last lecture, we were talking about the curve setting out.

We were talking about the curve setting out, why we need the curves types of the curves and then finally we saw some methods and following those methods it is possible that we can set out a curve there in the field. So now we will go for first building setting out. Okay. About the building setting out what all steps will be involved there? As in the case of the curve or in our very first lecture of this module we talked about the basic principles of setting out. So the simple steps we are going to use here also. In the case of the building setting out the various steps will be number one it is surveying of the site

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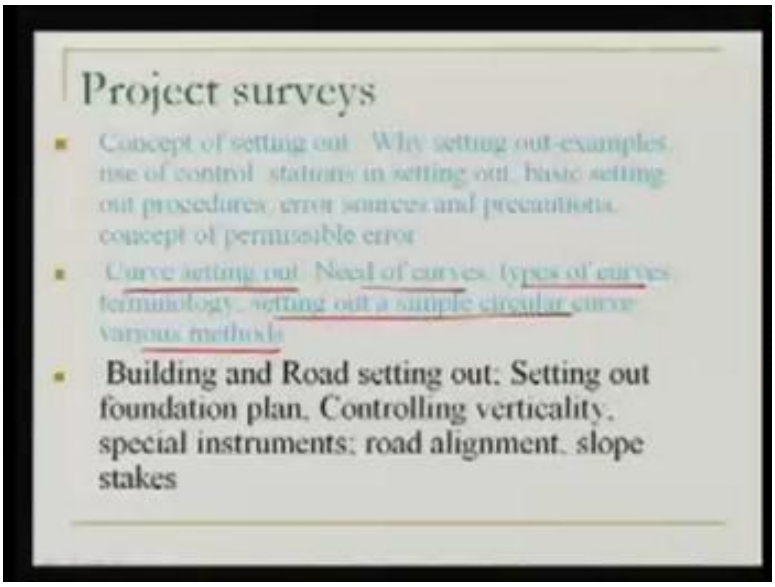

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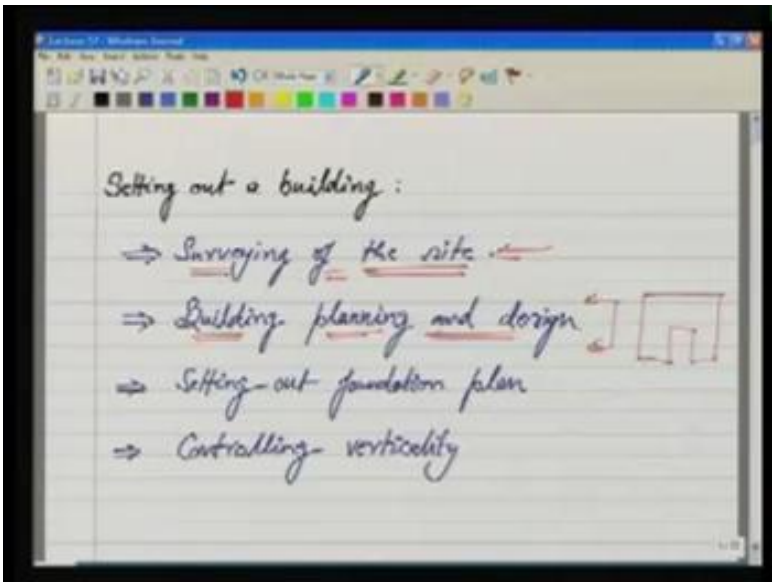

So we are going to the field the area where we have to construct our building. We will make a map of that area we measure the contours, then on that map what has been prepared we are taking that to laboratory and planning the building and as well as designing the various elements of the building. Of course when I say the various elements we also come out with a foundation plan. So that is the foundation plan for example. So then the next step is this foundation plan needs to be transferred on to the ground/ so we do setting out of the foundation plan. Well while we are setting out the foundation plan that means the horizontal control in any setting out observe operation. There are again two things, you know, horizontal

control and vertical control. In the case of the building we have done the horizontal control the moment we have set out the foundation plan.

The next we have to at every step see whether the building is really going vertical or not. So for any structure we have to ensure its verticality. So again we will be making using of surveying instruments or some surveying methods in order to ensure that the verticality is there in the structure okay. As our very first step now let's start with the site survey the site. You know it could be any site it is selected by the owner of the building and he wants to construct his building there, so as a surveyor you go to the site and you observe you will make a map of that site you will map the undulations of the site

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So for example let us say a hypothetical site is over here and in the site we can see there are different kinds of you know, forest, water body and a road and this is just you know land which is available. So first of all a map of this area will be made the methods of the map we have already discussed. Now let us say this is the map because planning a building on the site is not possible rather we would like to do it on the map. So once the map is there the building planner or the design can come up with various kinds of outlines or the possibilities for the building well it may be of this odd kind or it may be of a different design okay. So this will depend upon the requirement of the owner what all we require. Let us say the final design which is selected is this this is the final design which is selected. So what we are doing at the moment we are putting this design or rather doing this design on the map on our drawing

board. So the building has been planned, that is the planner of the building. So right now if you go to the field it is still in the field, there is no building of course.

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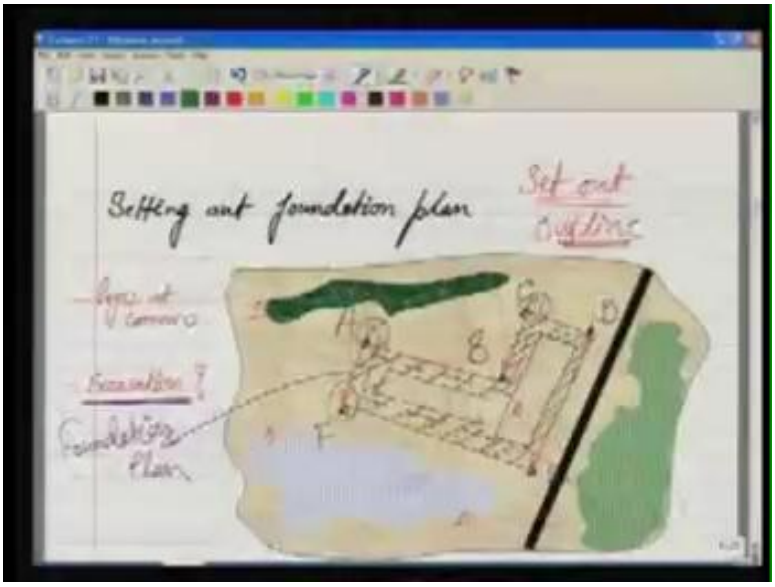

But there in the field we will have fortunately the control points because in order to make a map of this area we made use of some control points. What are the method? Let us say the method used here was traversing so this is a traversing and using this traversing the area was mapped . These control points are also on our map okay. So by making use of course this line is not possible if you are doing the measurements by tape because we have to go there and it is a water body. However we can measure this line if we have the edmi. Well then again in the ground because we have these control points which were used for the mapping purpose and these control points are also there in the map where the designing has been done or where the planning has been done. So what we will do? By making use of these control points we can now fix the corners of the building it could be by any method. The method could be the method of intersection or the method of we measure the angle and we measure the distance, we say the polar coordinate method.

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So whatever the method we are able to now fix there on the ground the corners of the building. So these corners have been fixed by making use of the control points which are available there okay. What is the next now? In each of these corners of the building we can now put some pegs so I am showing you the pegs here and the building outline is like this. So basically at the moment we have set out the outline the building outline. Once we have set out the building outline we can also set out its various center lines because we know the dimension. We know how thick are the walls. So the center line can be marked here as well as here also here so the center lines can be marked but at the moment this once this this is the foundation plan actually. What we are setting out there on the field is the foundation plan it is foundation plan. Now once the excavation starts what will happen? This entire area will be excavated or wherever the walls are for example the walls are there the or the footing the foundation. So this entire area will be excavated. Now if this excavation is going on what will happen? The pegs or the reference pegs which we have put here, for example these pegs at a, b, c, d, e at all these corners, these pegs will be dismantled.

So these pegs will not remain there on the ground any more. So if this is the case what should we do, because so far what we are able to do by using the plan of the building which is on the map and by taking the polar coordinate method or intersection method or any other method we are able to transfer the corners of the building there on to the ground. Now these are the corners of the building and excavation is going to take place there so these corners if I put a peg it's not going to remain there any more because the lot of soil will come out and this soil

will be dumped next to it. So what to do? We need to have these outlines we need to know where is the center line of the building because once we are going for any footing so you need to know where is the center line of the building or the center line of the foundation. So we need to know the center lines we need to know the outlines of the foundation and as well as we need them throughout the construction okay? So we what we would like to do? We would like to do something there in the ground so that even if the digging is taking place is still we can mark the outlines as well as the center line of the foundation. Now how this is realised? We will see it now.

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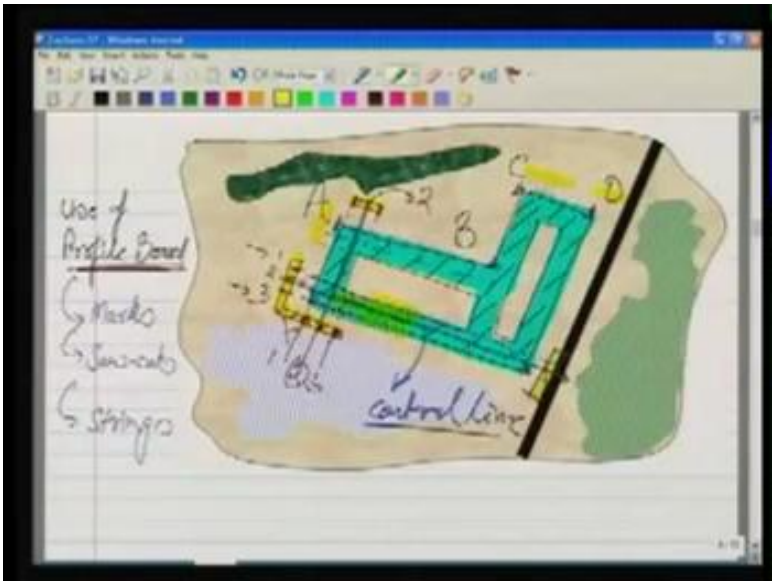

In order to realise this now over here we have again this entire shaded part is the wall or the footing because these are the foundation plans. So this is the foundation plan here which will be excavated now. What we do? We make use of a bore which is called profile bore. What this profile bore is like? It is nothing but a wooden board with some support and on this board we have some notches these are being cut. So by use of some you know saw or whatever the mean these have been cut or we can also because these are this is just a way of marking on this board as well as what we can do we can also drive some nails here as our requirement in order to mark some point. So this is the better board or profile board.

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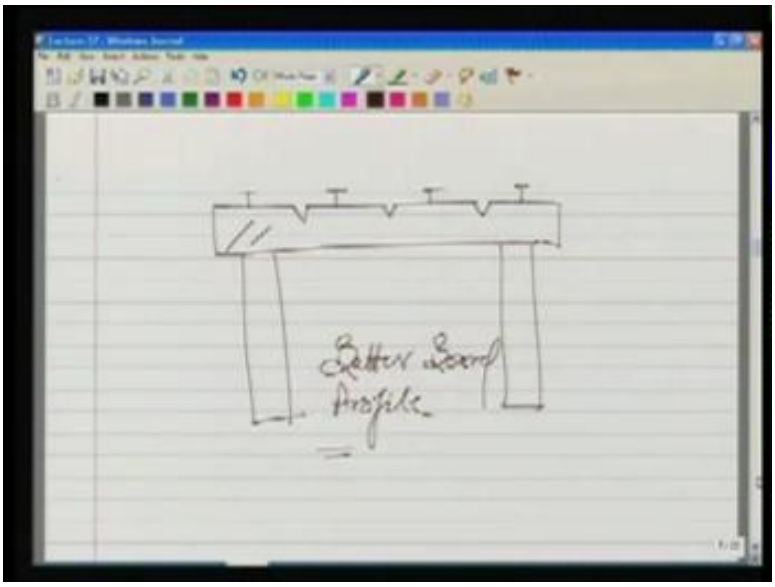

Now how we use this better board or profile board in the ground? Well we will use this, of course we are drawing in plan so a better board or a profile board is put here and we put a nail here, another nail here, another nail here. Similarly one more better board is put here and this is connected on this side also and we are putting the nails in these locations. Now location number one, two, three; one and three these two corresponds to outline and two is corresponding to the center line. Similarly here also one two three so we have a nail here we have a nail here and we have a nail here. So by these nails if i highlight these nail positions again nail number one nail number two and nail number three and over here nail number one nail number two and nail number three. So these nails or these saw cuts on the board are basically the locations of the outlines and the center line. Now what we can do by making use of a better board here and a better board here because we have put them at both the ends at any moment at any time we can stretch a string.

So if I connect nail number two here and a nail number two here by a string. I will draw this string a bit thick so to make it clear so this is the string which I am drawing here. So if we join them by a string this basically marks the center line. Similarly here also we can do in this direction a string is put the better board is here and we have a center line. So this is the center line over here so what we are doing even if this area is being dug. Now which area, the area I am highlighting the entire area this area will be excavated but still we have our better boards. Our better boards are here and here and they are able to give us the directions and the

locations of the center line and the outline. So this is how we can set a foundation. This is the operation of setting out for the foundation plan.

So these better these profile boards will remain there throughout because we will make use of these whenever the footing is also going on to check the alignment of the footing. So these profile boards will always stay there. So this is just one example how we are making use of simple profile boards in order to set out a building or the building founders foundation plan. Well next we will see the vertical control the vertical control means.

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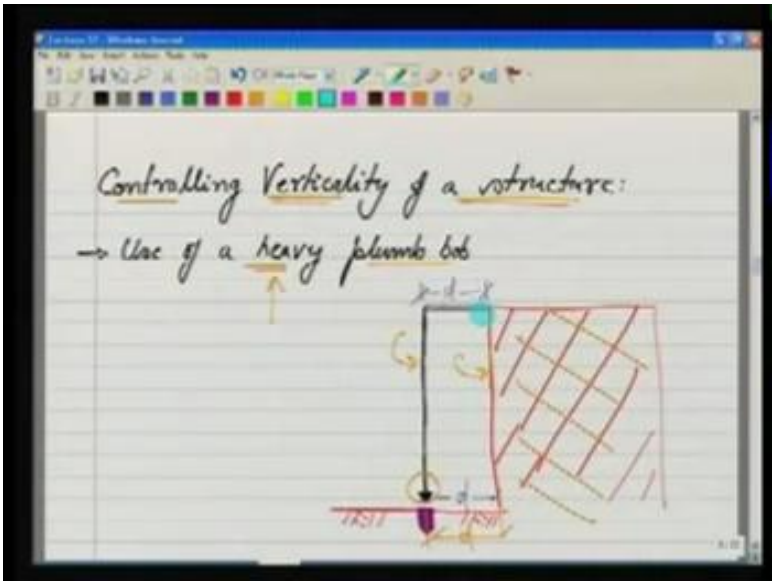

Now we are talking vertical so we want to ensure the verticality of a structure. Well we can use a heavy plumb bob, why it is heavy? It should be very obvious because it should not swing with the wind and over here in this diagram we can see over here we have a building here and we want to ensure the verticality of the wall this particular wall, whether it is vertical or not. Now what is done? From the base of the wall at certain distance d a peg is driven and we suspend a plumb bob this is the string of the plumb and here is the plumb bob. It is heavy plumb bob. So this plumb bob is suspended so that it is exactly over the peg here. Then the distance from the plumb line to the wall of the building d is compared with the distance there at the bottom. If these two distances are same then the wall here is vertical, if it is not sure the wall will not be vertical and it can be assessed.

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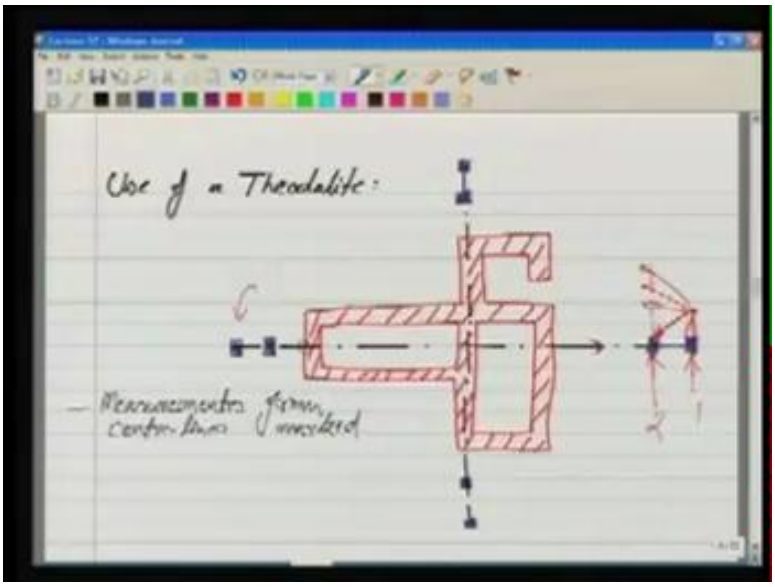

Well there could be another method. Use of plumb bob has got some problem because if the building is too tall we cannot use the plumb bob. If the building is you know two storey using plumb bob is all right. Then if there is lot of wind we cannot use the plumb bob and there is inaccuracy in wall in as making the things vertical using plumb bob because there on the top of the building also if we are suspending the plumb bob we may string a little bit and this distance it is d but the actual horizontal distance is not d. So those things may happen there. So it is not very a accurate method and for very complex structures we cannot do it large structures. So another which we are seeing here now is the method based on theodolite. Well what we do in this case? If we have a building and because you know before the building was constructed the foundation plan was there and we want to ensure now the verticality of various parts of the building, what should we do?

For this building on the sides of it on both the sides you know we will make one big line, which we say the center line of the building and as well as this way the central line of the building at right angles to each other and these central lines somehow will transfer towards the top. How that is done? Let us do it now. If you look at the video over here we have a foundation plan. This is the foundation plan and for this foundation plan we have drawn the central lines. How the central lines have been marked? These central lines have been marked by putting two pegs: peg number one, peg number two, peg number three and peg number four. So two pegs on both the sides of the central line. So one, two, three and four similarly here. Also one, two, three and four and we can consider this as it need not to be but well let

us say this is the central point of the building. Now as the building is coming up because what we are seeing right now is the foundation plan as the building is coming up we would like to see the various parts whether they are following the verticality or not or is there any problem. So how we can do it?

We will use the theodolite. Keep it on one of the pegs. Let us see how we can do it. So we use the theodolite for example here and keep it here, then we also know the center point the center point of this peg and the center point of this peg means where this line is going. Then by bisecting the point here we can now because this theodolite is centred over here and we are bisecting this point. Now if i raise my theodolite, raising means i am elevating the telescope so after bisection i am elevating the telescope. If i am taking so wherever i am taking basically i am looking along the line which is marked by point one and two. So what we can do wherever this line is going i can put points there on the walls of the building so various parts of the building again put the points there. So this is one part, then second i can do this exercise from here also. So what i am doing? Well let us say we are locating these points on the building.

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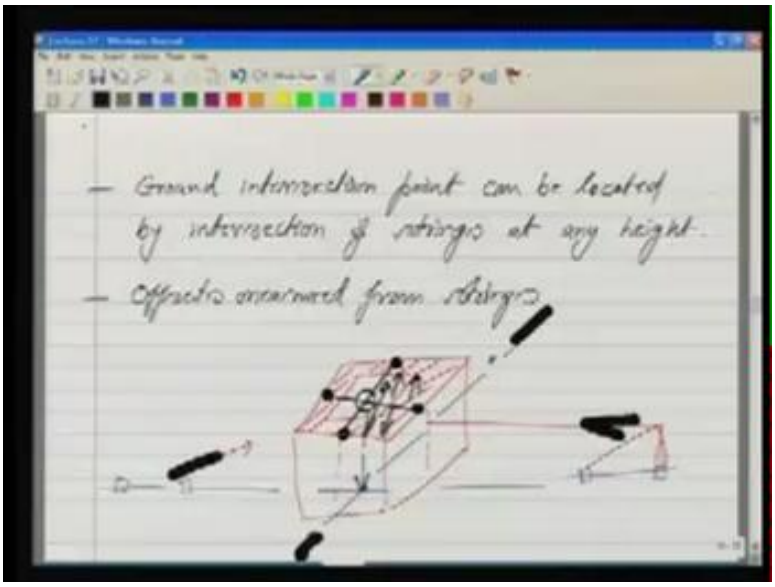

If you write now separately let us say we have a building and this building I am drawing now in perspective. Let us say building is of this shape and these are the walls of the building so these are the walls. I simplified it in order to understand it. Now the points which are there on the ground peg number one peg number two similarly here three and four and also on this

side peg number one peg number two and here three and four and what they do? Basically if you join these they intersect at the center of the building. This is what we ensured before the building was being erected. Now we are keeping our theodolite here bisecting this and then by raising the theodolite I can put various points here on the wall. Similarly from this direction also and from here also. So there on the building I will draw it a bit thick so we have a point here a point here and a point here and a point here. So these are the four points which are coming from four directions.

Once we have these points what we can do? We can stretch strings and the intersection of these strings will be the same point as there on the ground. So basically what we are able to do that by this method. A point which was a center point there on the ground we are able to transfer it up as well as once we have this strings there. When i say strings it could be any other way of making the line of sights. May be some telescopes. So strings are just to indicate the line of sights. We can have of course physical strings also. Now there on once the strings are there i can start offsets also from this string. Offset means i can start measuring the various distances a various features. So this will help us to ensure whether we are really going vertically up or not.

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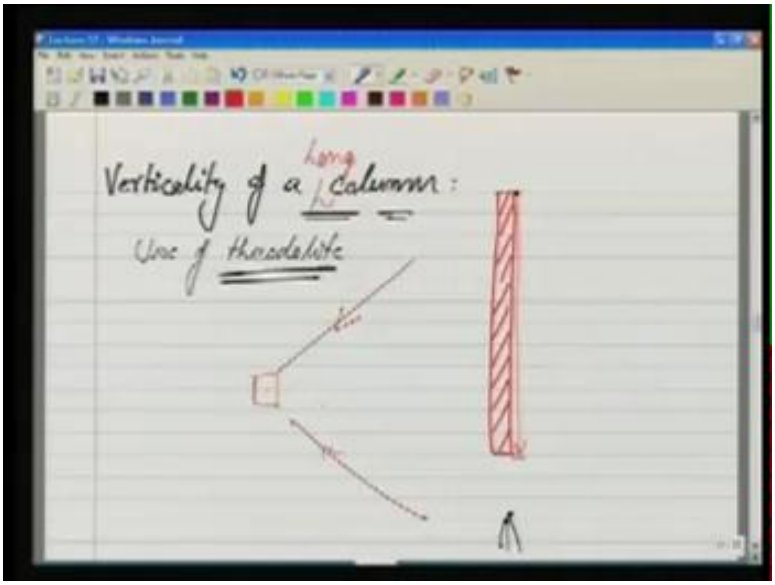

Now there is a very long column another way of doing it. We can also make use of a theodolite. For example if there is a very long corner column we can bisect the top of the column by a theodolite. A theodolite is kept somewhere here and i am bisecting the top of the

theodolite and i am lowering it. Lowering it means i am bringing it down like this. Now we know it once the theodolite is properly levelled and also is it is adjusted okay. Then if i bisect a point there i bring the theodolite down or bring the telescope down so this plane which i am forming should be a vertical plane. If there is problem in the theodolite we need to do this exercise on both the faces face left and face right but by doing this exercise it should be possible in that we can ensure whether a particular structure is vertical or not and this exercise is not that simple. If you are talking of a single structure like this column and in plan the column is like this. We need to do this exercise from different directions doing it from only one directions will not give the right result because if we have a column here and a column is tilted like this and if i keeping my theodolite also here so my theodolite will not be able to judge whether the column is tilted or not i need to keep the theodolite in the other direction also okay. So these are the small things which we should consider with we should keep in mind when we are working in the field.

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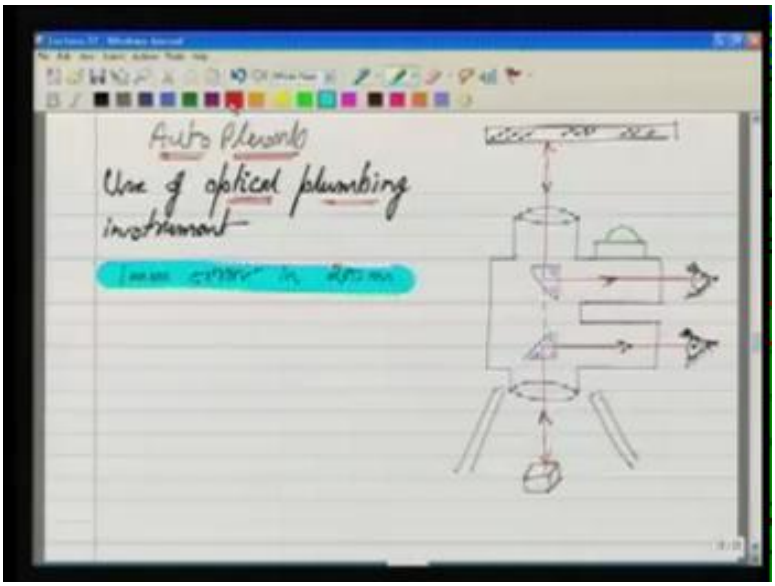

Fine we have one more instrument here which we say auto plumb and this is basically using some optical train in order to ensure verticality. Now we will follow the line diagram here and it is basically you know very accurate. It will give you only one millimeter error in a height of two hundred meter so if it is a small error one millimeter in two hundred meter. So it is a very precise instrument. So whenever a very large structure is there or a high precision is required in transferring the vertical we would like to use this kind of instruments. Now what is the line diagram? If you look here well down there there is a point and which we say

is our point there on the ground which we need to transfer somewhere up. It may be a ceiling very far so we need to transfer it there. Well the way this instrument is made this is the instrument here and from the line diagram it is very clear we first of all take this instrument we put it over the point which is there on the ground okay? Put it means we center it. We center it over it once we centred we level it. Then only it is ensured as in the case of the instrument that we will see exactly above that point so we center it we level it.

Next so this instrument is centred and levelled, so it is exactly looking at this point here which is the point which we need to transfer there. At this stage the ray of light will travel like this will get reflected and go to our eyes. So basically what is happening in the process of centering. I am able to see the point there on the ground and this instrument is also levelled. Somewhere in the instrument we will have the bubble tube and we make use of that for levelling fine. At this stage through a different optical train this train. We have the reflectance of light coming from here again getting reflected and reaching our eye. At this stage if i see from here and provided provided that this line and this line are constant there is no deviation these two there is no eccentricity between this line and this line in that case the point there on the ground is vertically transferred up there. So in using the auto plumb we are taking it to the field putting it on the ground station the point which we need to transfer up and then centering it levelling it then we look through the upper telescope and we will be able to see the point there. So that point is the point corresponding to the point there on the ground. So vertically up as we have seen in the principle of this.

However there is one problem. If this instrument is not adjusted; adjusted means we are assuming here we are assuming that this line and this line these two lines of sights are constant this is what we are assuming, there is no eccentricity between these two. If there is eccentricity between these two, for example here this line is slightly inclined like this and as it may happen that there is slight eccentricity here E is still.

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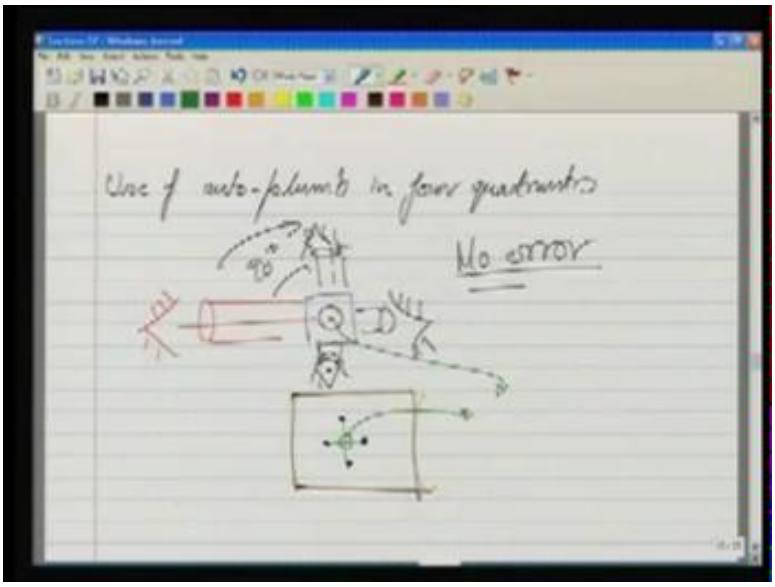

We can use this instrument. What we should rather, we should do this operation in four quadrants. What is the meaning of that? This is the point there on the ground and first i use this instrument in such a way that i am looking at from here and correspondingly if i draw the roof over here and the point on the roof. Let us say that is the roof. The corresponding point on the roof is somewhere here that is the point. Next what we do? We change the direction. Now we keep our instrument in such a way that we are doing the same operation from ninety degree apart. If there is no error in the instrument our next operation will also result in the same point. So basically what we are doing? Once we have taken the instrument to this site again we are looking at this ground point and trying to find a point there on the roof, so if there is no error we will get the same point on the roof top however if there is error we will get a different point. We repeat this exercise again. Now we keep this instrument such a way like this and then finally also in this fashion. So basically we are doing it in four quadrants and if there is error we might get the points like this. So by joining this the center of this is the point which is exactly over our point there on the ground.

So even if there is error we can still transfer the point there on the ground but yes it is advisable that we should check this instrument. This is also a check for the instrument and we should adjust this instrument as we have discussed in case of theodolite, okay? Now after seeing the building setting out we will go for another important area and this is setting out of a road. As i said in the beginning also setting out of road is similar to setting out of a line setting out of a you know oil and gas pipe line or may be a setting out of canal also setting

out of a railway line also. Though yes there are minor difference in between all these but the basic principles will remain same. So in setting out of a road what all the steps are involved? Of course as we know if we have if we have to plan the road between two points, so what we do? Initially we will have a map up the area in that map we will have alternate roads you know various possible ones and then we will go for the best possible one which we say the optimum one. Once that has been decided it is marked on the map at that particular area that corridor is also mapped also surveyed very rigorously.

The meaning is we have in planimetry, all the details, all the things, where are the forest, where is the water body, where is the rive,r where the adjacent roads, where the villages. We have all these features as well as we have the contours. See contours are very important in case of a road because we know the road has to go up has to go down. So we will try to fix the formation of the road formation means the surface of the road. We will try to fix it in such a way that we have as we have seen before also minimum cost in terms of you know cutting and filling and there are many more criteria in which are involved in to that in fixing the formation of the road the design criteria in which are they. So basically once that road is marked on that map a very detailed map then that map is being worked there in the laboratory or in the office. So those points are so far on the map. Next we have to transfer these points on to the ground. Then we will see now they are not only the center lines. It is not only the center lines which need to be transferred on to the ground, rather many more things. What are these the various components of setting out road. Well let us look one by one.

First one we say of course we want to set out this stakes along center line. What is stake? Stake is a term which is used for a peg where some information is written. You know at this particular point how much excavation is to be carried out or how much filling is to be done and this stake or this peg also marks some particular location there in the ground. For example the center line. We also want to set out the stakes for defining the formation width again we will discuss this formation width a moment. Then also we want to set out this stakes which is a slope stake to locate the points where the road slope meets ground. Then finally we would like to set out the slope rail these are called slope rail

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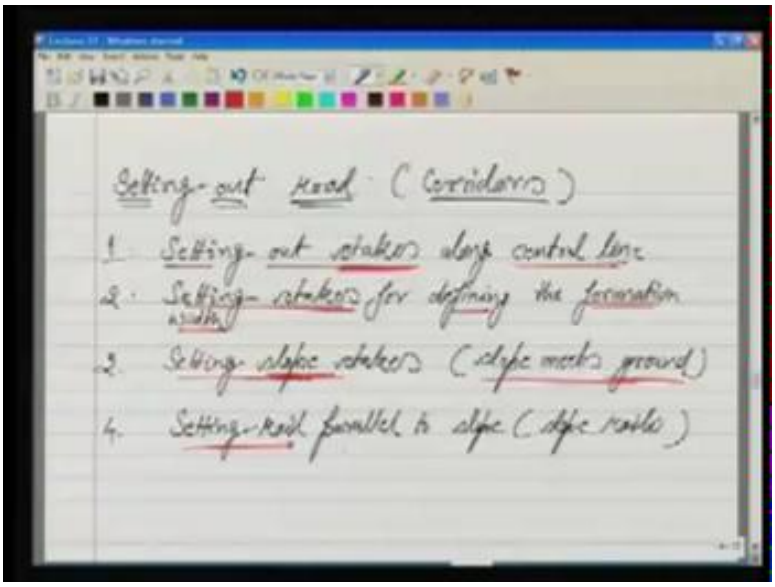

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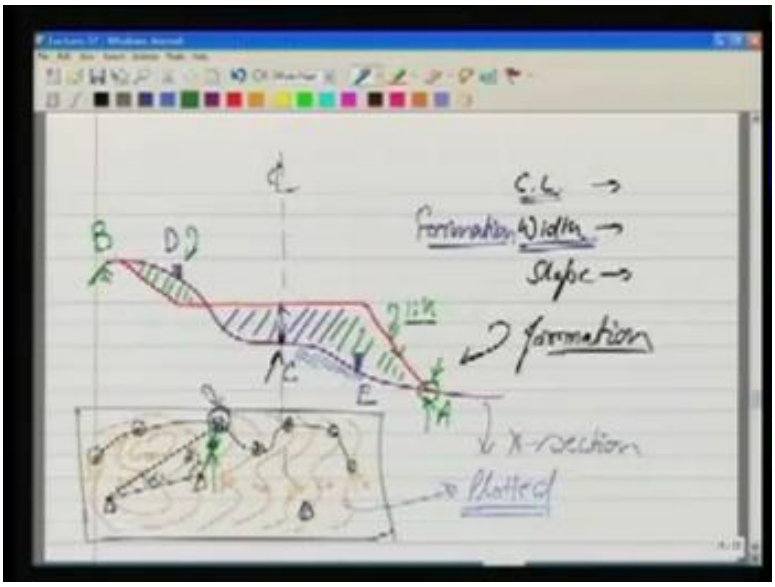

Now what these are, we will look at them okay. First of all as we discussed if we have the map on this map we had various contours, of course the contours should not intersect so i will draw it like this. These are the controls here and as well as we will have their values written there may be you know thirty twenty ten thirty forty fifty sixty seventy. So these are the contours and on these the center line of the road has been planned okay. It is decided that the road will go like this. This decision has been taken. So now we are transferring first of all these center points or the alignment of the road there on the ground. So the center line means a peg see look at look at here this purple line is the ground is the raw ground and this is the

ground which is plotted here. This is the ground which is plotted. So far there is no road on that ground so initially when we go to the field we do not have any road of course and we have only the ground like this but now by making use of the map, for example here at this location we have a center line point and we will try to locate this with the help of the control points.

Because we have the control points also as we have discussed previously and what about the method this method could be by total station or by only tape or by you know intersection by the thedolite alpha one beta. Whatever the way we are locating this point there on the ground. So let us say this is the one peg and this peg shows you the center line. So the center line passes from here and this is cross section. Next in the design itself it was decided that at this particular location the what is the formation of the road, you know there in the design stage only because road has to follow some particular gradient. The road has to go along some particular curve so road cannot stick to the ground rather road will be either slightly above it below it or even if it sticks into the ground you know at some point it will deviate a little bit. So the surface of the road is the formation level and that formation level is also being given by the design. So at every point a particular formation level is being given, so at this point over here a particular formation level has been given and let us say the formation level given here is like this and as well as this also coming from the design. So these lines that is the formation level and here slope another slope.

So this is also coming from design so so far we don't have this formation level with us. So far we don't have the formation level with us but what what our job is, the job is we want to construct the road as per this formation level. We know only the center point at the moment. So next step is we would like to fix the formation width well moving perpendicular from the center point. We can now fix there on the ground two more and these pegs are for the formation width. So now we have the pegs we can say this as c and this is d and this is e well. Once we are starting the construction so at this point we need to fill it up so we need to because in order to raise the ground we have to do all this filling up while over here we need to cut. So we if this information on these stakes also about the amount of cut and fill which is required. One more thing at this moment we know only from the design that this slope is for example one is to n this is the information which is known to us but we do not where this point exactly will meet the ground.

This is also important here because once the controlling was done in the field and this formation level has been decided on the basis of the contours there in the ground okay. It had been taken into account but the point here where the slope will meet the ground. This point should be somewhere here i can locate this point also by making use of the contours but the contours are not that accurate. They do not represent the true ground so what we would like to do we would like to locate the point a and point b where this slope meets the ground because that is the ground and slope is meeting at b and at a also there in the field itself. So you know about the field the basic job we have is we have to locate the center point. We have to locate the width on the width the two stakes here and then finally as per the cutting or filling we have to find where the slope of the road because if the this is the formation that is the slope where it meets the ground.

So that particular point also we need to locate because to those people who are doing the construction all these information needs to be given and as well as we need to tell them okay. From that point where the slope is, where we have put a point which we say this slope is **stake,** at what slope they should proceed further so this information is the part of the setting out. Now how we do all these first of all the center point setting out this is easy and we have already discussed you know we make use of thedolite tape or total station whatever and we make use of the control points which are there on the map and also available on the ground and we locate the center stakes.

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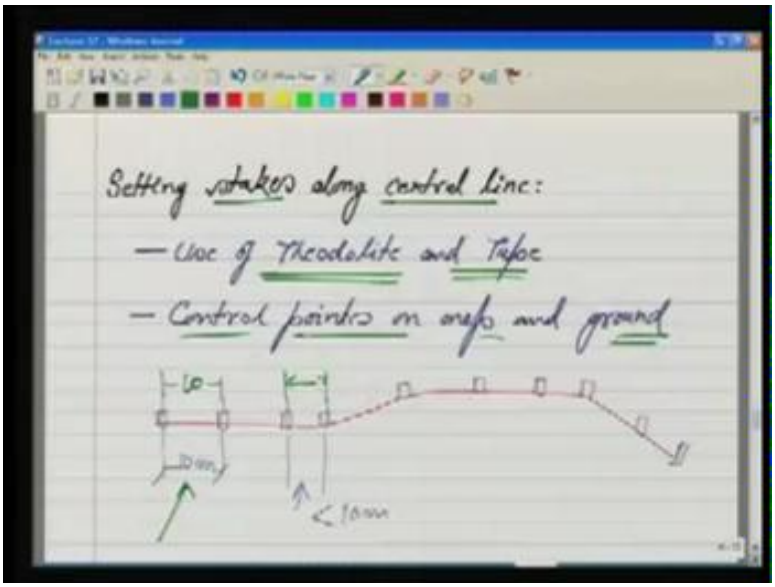

Now these may be located at ten meter distance or twenty meter depending where you are working. If there is change in gradient because for example from here the gradient is changing of the ground. So we would like to have this distance even if smaller as per the requirement so these are the center line stakes. Once these are done as we saw in the previous one also we would like to locate the formation width stakes.

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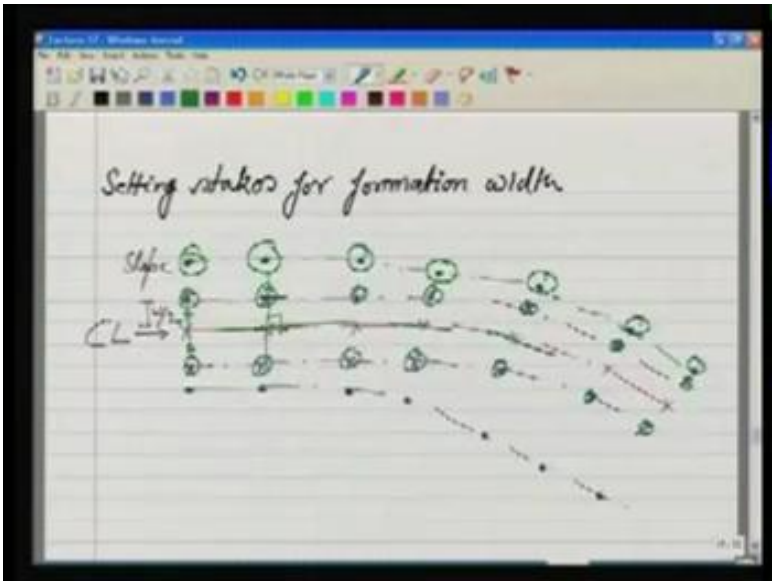

So these are marked there on the ground. This is the center line and these are the formation width stakes and how we are doing it. From any point here we are going perpendicular and we are going equal to the width of the road and mind it please equal to the width means we are going in the horizontal direction obviously. Once this point is located then our final step is to locate the point where the slope of the road meets the ground so these points we have already seen for the width for the slope and for the center line, okay?

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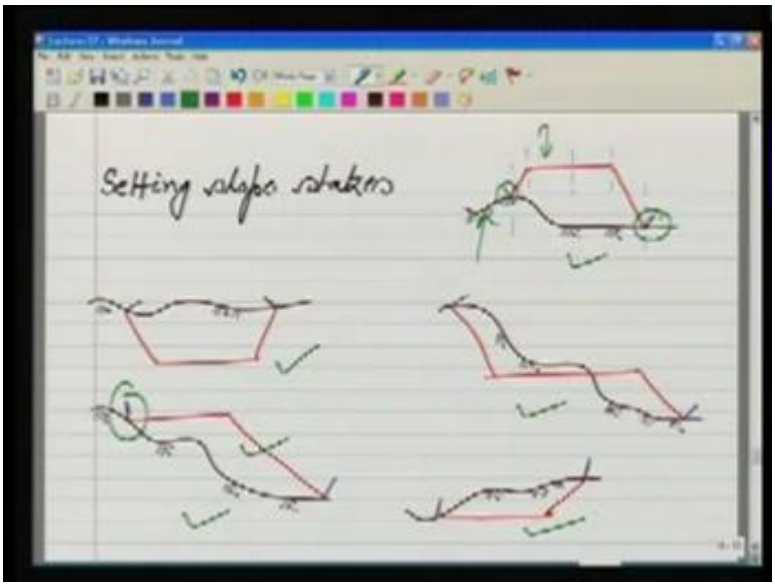

In the case of the slope stakes the slope stakes means over here I have represent to the ground here and that is the formation. So the slope stake has to be formed here, has to be located here and there may be different kind of situation. It is totally on cutting totally on filling part cutting and part filling and this has again no slope on the other end but the slope here and it's all in filling all in cutting. So there could be different kinds of problems which we which one can face in the field. We would like to see only one of these now as an example.

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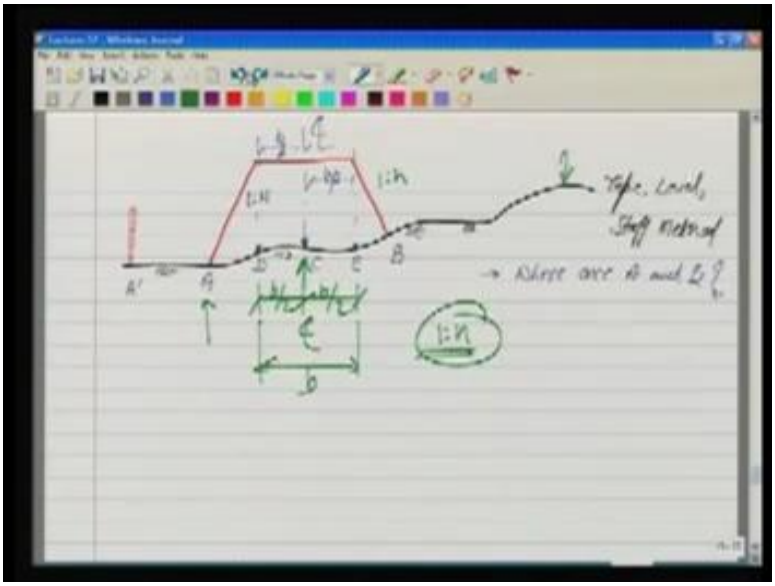

So at this moment we know how to locate the stakes for center line, how to locate the stakes for the formation width and then the last thing that we would like to do is to locate this stakes for the slope because we need these locations there in the ground in order to start construction in order to start filling or cutting. Well over here we have our ground here and this red line this is the formation something which is coming from the design the very first step of course we will locate the center line stake so this stake that is next we will measure the distance equal to the width so this is b by two and b by two if the width is b. So we can fix these two stakes also now we know that the slopes are one is to one how these slopes are fixed one is to one. Again this is coming from the design depending the requirement depending the material which is used here this slope is fixed. Now we would like to know where we should begin our filling from. Is this a point here? In the beginning we do not know where from we should start filling. So how we go about it?

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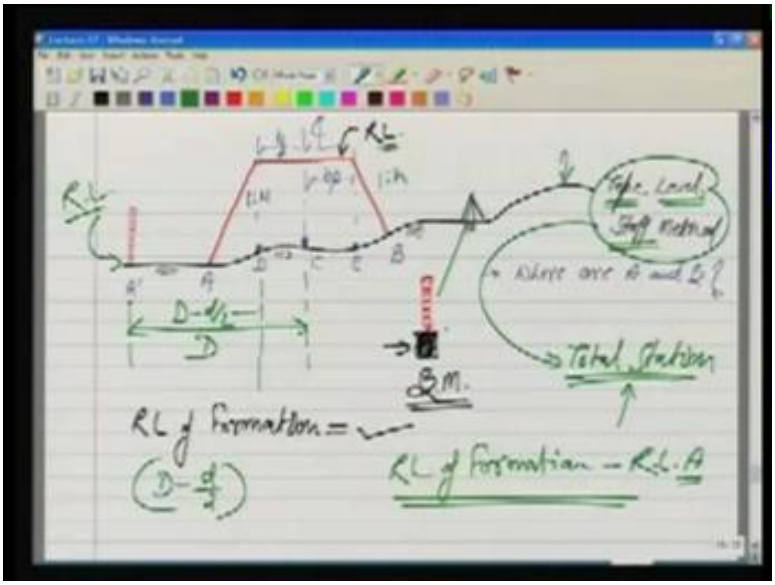

Well this is done by a method of trial and error, in this case let us start from a point A dash and right now we are using tape level and staff. Of course the same thing we can do also by total station. What we are trying to do? We are trying to see the basic principles, here the basic concept and the same can be extended even if we are working with the total station. Well we are standing at a point A dash with our staff next there is a benchmark somewhere. Let us say the bench mark is somewhere here, this is bench mark from design. I know the RL of formation that that we know. It is a known value to us. So we know the RL of this. We know from the design using the benchmark using the benchmark here and we keep a level

somewhere, wherever. You know it does not matter, just we need to carry out the measurements we are keeping the level.

Now first we would like to keep of course there on the benchmark, also staff and then from the level we will take a back sight and then on the staff which is kept here we will take a foresight. We have already discussed these things back sight and the fore sight. By doing these back sight and fore sight what we will to do we will be able to determine the rl of a point where my staff is kept. So we know now rl of this point. We already know the rl of formation level and now we know the rl of point a dash. Well we can find the difference of rl of formation minus rl of a. So this we can find as well as this c point is known on the ground as well as we know A.

So what I can do? I can measure the horizontal distance between these two. So this distance D is measured from this D. I can subtract d minus two. What does it do? It gives me the distance here. So we can say D minus d by two is the distance here. Fine? For this D minus d by two we already know difference of RL.

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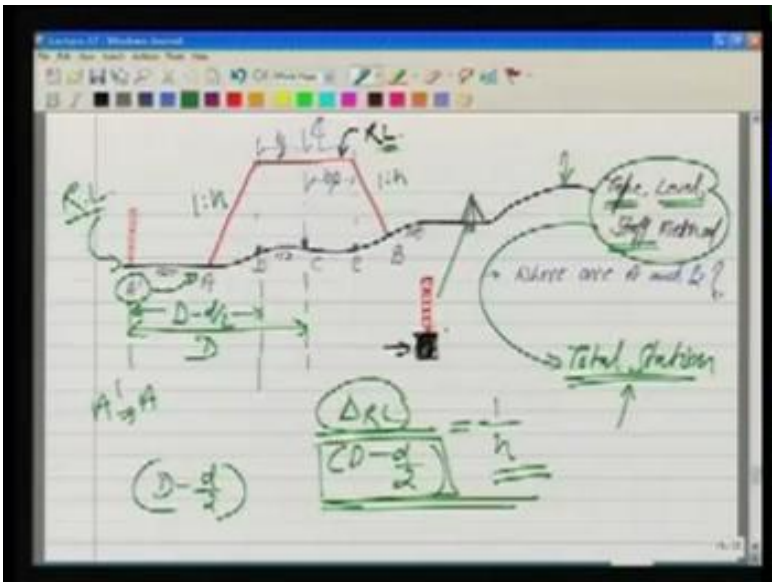

Let us say the difference I write as delta RL. This divided by D minus d by two we compute this. If point A dash is exactly over the point where we want to be then this will be one is to n. As we see over here because we want a slope of one is to n. So if A dash is exactly over A this slope will be our the difference of RL divided by this distance will be exactly equal to

one by n. However it will not be so in the very first go so what we would like to do if it is not so we would like to change the position of A. So what we do? We move this A now. We move this A to a different location. So this A is moved now here and that is our staff again. We do the same procedure we take the back sight and the fore sight and we determine the RL of this point, which is now A dash again. So keep doing this process till we reach point A. So what we try to do in this case by using dumpy level or any level and the staff and the tape? We started to form an arbitrary point and we found the RL of that.

We found the difference of RL of that point and the formation and then we found. Okay, from the corner of the road to that particular point what is the slope, which is possible in this case? If this slope is same as the slope is desired then this is our point, if it is not then will have to move our point here and there. This particular exercise can be also done very well by using the total station. The concept will remain same of course it is trial error method because there in the ground we have to locate that point and what is our aim? Our aim is finally when the road which constructed the formation level should have certain RL this slope should be the slope which is given by the design. So we are ensuring this by doing this staking process by doing this setting out process, we are ensuring that the formation level will be at that RL and the slope will be along that slope this we are ensuring here.

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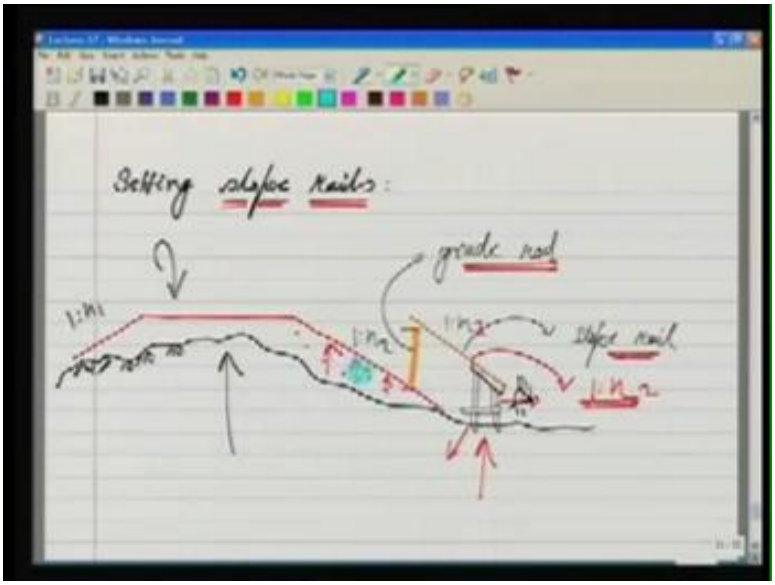

Now one more term here, that is slope rails. So this is something you know the people who are there on the in construction they would like to make use of this, slope rails. For example

if the ground is given here that is our ground and this is the desired formation with these slopes one is to n one and one is to n two. Now in order to help the people who are doing the filling with this area is being filled so once it is being filled how much the filling should be. In order to control it a very simple device can be used which we say grade rod is a rod of of finite height and we move this rod along with a slope rail. Now how this slope rail is fixed we can see the design of the slope rail made of some wooden planks the only thing is this edge of the slope rail is having the same slope as the slope down there. So if you are writing n two one is n two so the slope over here the slope of this edge is same as the slope of this. So what we can do now?

We can now after fixing this, someone can also sight from here or by moving this grade rod everywhere all along this we can ensure whether we have done this filling equal to as it is desired or not. So basically this slope rail is a helping device. Not every time one has to make use of you know tape and other things because we know from the slope rail our slope which is the desired slope is at this depth. So just by moving this rod over here just by moving this rod it is possible that we can now set our slope.

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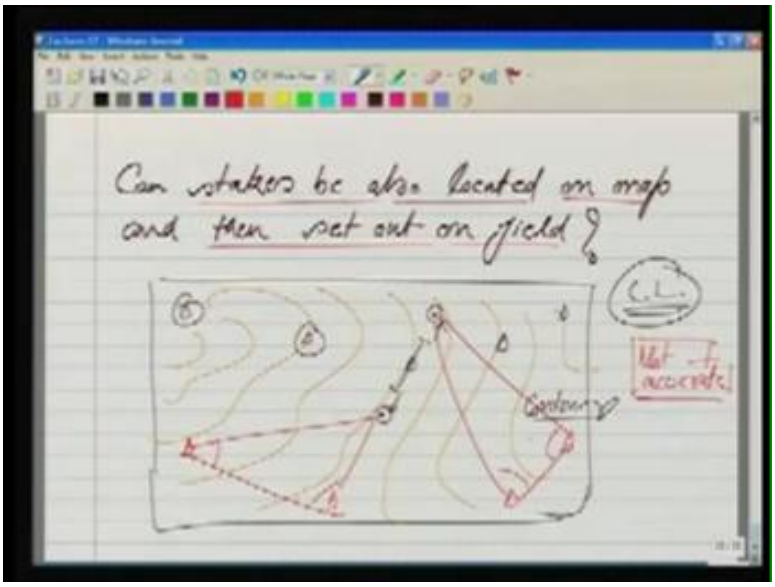

Now one question which we part partially discussed, can stakes be also located on map and then set out on the field? We partially discussed this if this is our map on this map we have the contours and we have also now the center line of the road marked here. Well, what we did, we transferred these center line points directly to the ground. What we can do while we

are working in this map, because i know the undulations of the ground working on the map means i know the undulations of the ground. So i can also fix the width as well as the slope stakes here because i know what is the slope in this direction because once we have the contours we have the three d structures or three dimensional structures of the ground with us. So using this map also i can also fix this and then as the procedure of setting out these center points on the ground i can use the same procedure. For example by making use of control points i can also transfer these slope stakes there on the ground but the question is should it be done or not?

If you do it in this way, because our contour map is not very accurate; contour map it does attempt to replicate the ground represent the ground but it cannot represent the ground very well, we do not have all the details of all the undulations so that is something which we are locating this way there in the ground, it is possible that it will not give us the desired slopes. So what we are doing right now? We are on our contour map we have located the slope stakes because we can do those computations there and then we can transfer those slope stakes again by control points there on the ground but because the contour map is not accurate, it will be observed now the slopes of the road which are being given by these set out points it is not as per the design. So rather what we are doing? We are more importantly you know setting out the formation the slopes which is given by the design as such there on the ground. However if we have very accurate data, for example the data which is coming from the photogrammetry or there is a new technique of radar; we have the data which is coming from the radar, in that case because we have got full data, full distal elevation model is available with us.

So if you make use of that data on that data in our computer within the laboratory we can do this staking and then we can transfer that on to the ground and then check whether it needs to be shifted a little bit here and there, so that we have this slope as per the design. So what we discussed today? We discussed about the building setting out, the basic principles of that, foundation verticality, the instruments which we can use and then in case of the road what we desire in the case of the road. In the case of the road we desired to set out the road in such a way that is follows the or rather it is same as the design. We have seen some procedures you know we set out the center line formation and then the slopes. Thank you.