Surveying
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Module 8
Lecture - 1

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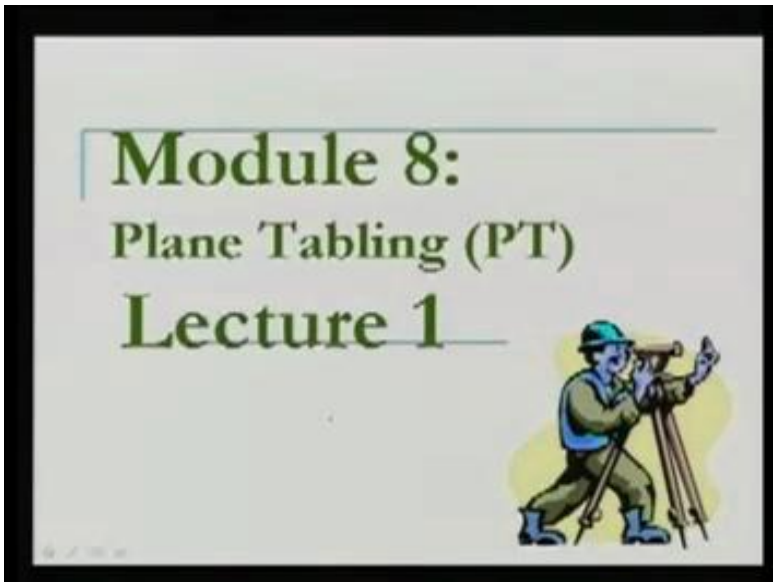

Welcome to this lecture series on basic surveying. Today, we are on module 8 and here we are going to talk about a new method of surveying which is the plane tabling. We will be discussing this Z plane tabling in 2 lectures and we will talk about lecture number 1.

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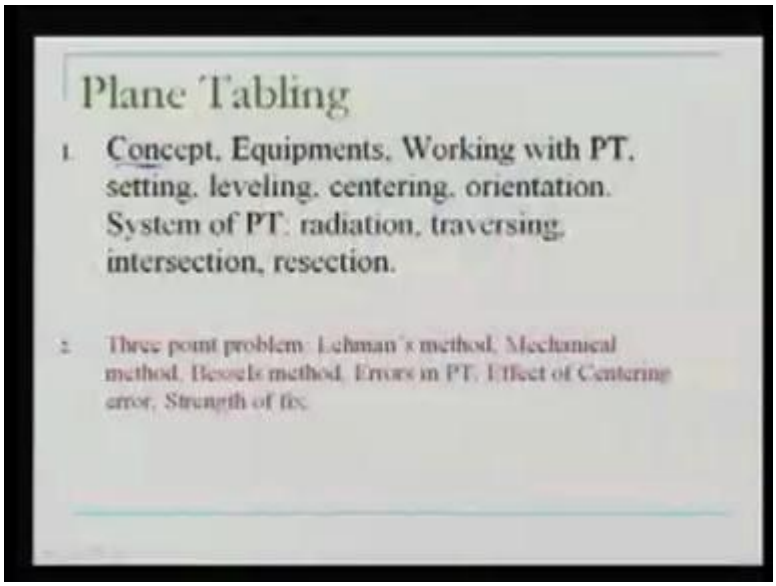

In lecture number 1, we will try to cover the concept what are the equipments which we use in the plane tabling? How we work with that? The various steps setting, levelling, centering, orientation all these and then finally to plot details. How we make use of radiation, traversing, intersection methods also we will try to see another concept which is the resection. Let us start with the basic concept of plane tabling. Now, when we say this you know what is the concept, why we need to do it? Let us revisit our some of the things the basic things about the surveying. One example is let us say we are going to make a map if we are going to make a map what we do.

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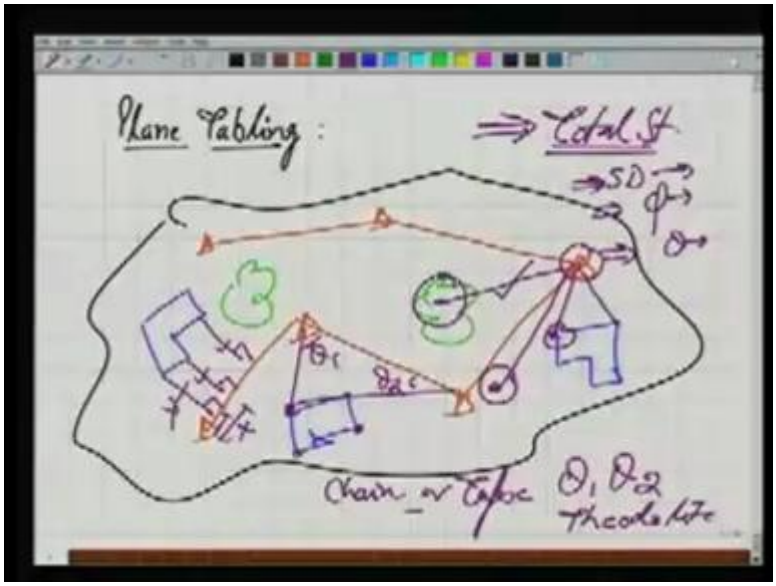

The procedure is for some area we would like to establish first of all a set of control we know about that. Now, this control can be established using triangulation or traversing now here in this case we have established the control using traversing. The next in this area there may be some buildings let us say all these are the buildings here also some trees or the feature.

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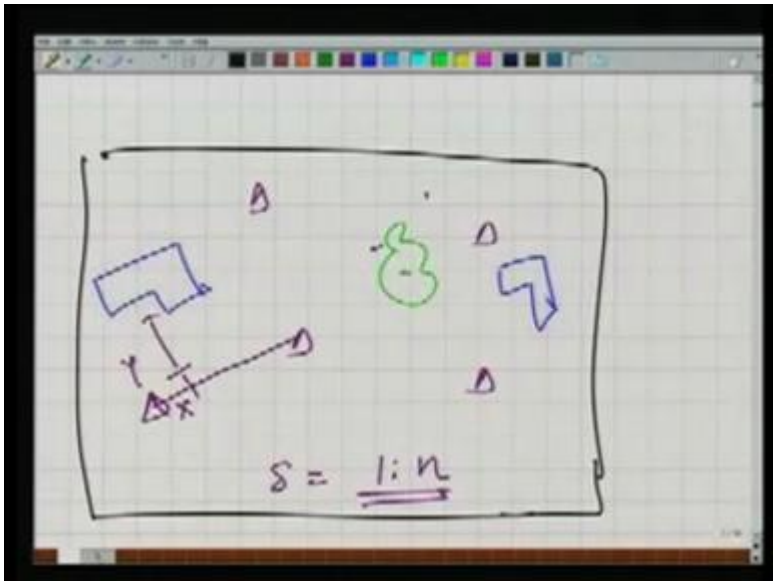

Now, what our job is we want to make a map. So, having established this control, because we can plot this control now on a map sheet with some scale let us say that is the scale. Having done that here in the field we can plot these details now by various methods this method is offsetting. From my traverse lines I am using the offsets at certain chain edges. These are the chain edges x are the chain edges and Y are the offsets. If you can do that we can now mark those chain edges X and as well as the offsets Y and plot the features here in my map. So, this is one method, the other method could be taking these 2 points I start measuring the angles no by intersection. So, I am using theta 1 and theta 2 and I can locate all the point similarly, there could be many more methods. You know in the case of the total station in the first case, we were using simply chain or tape for taking the offsets.

In the second case when we were measuring theta 1 and theta 2 we are making use of theodolite. We can also make use of total station. In case of total station you keep your total station at one of the points and start measuring the objects. Because the moment

you take one single observation the total station is taking sloping distance SD the vertical angle and the angle from azimuth theta. By making use of these 3 as we have seen before also the coordinates of all the points can be determined and all these can, but what about the method plotted here? So, all the buildings and as well as trees, and other things can be plotted on our map so, map will be ready. So, what we see here? We are seeing 2 things.

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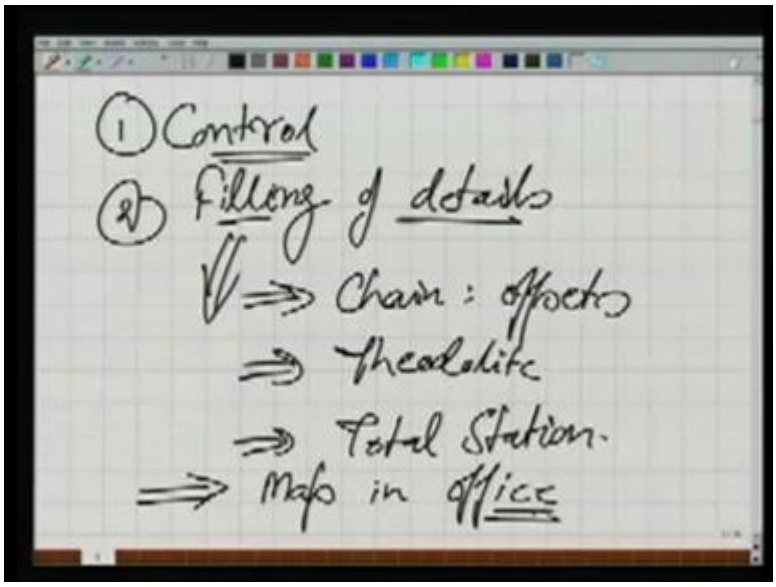

Number 1; control, number 2; filling of details so, in these methods, we are filling the details, because we already have a control whatever the method the control has been established by. Now, in this filling of details one thing is very important the kinds of the instruments which we are using are as we saw chain. We are using the offsets or we have made using the theodolite or we are using the total station. Well, there are problems with these problems means if we are using offset method we are measuring the offsets how many offsets can be measured in the field. There are so many details which we need to put, how many offsets we can measure and measuring the offsets in the field is difficult. So, we have problem there. Then measuring the offsets may not be also very accurate. Well, we can do the intersection by the theodolite 2 angles, but the problem is that is a costly instrument and is going to take lot of time.

In case of total station also total station is a very costly instrument yes it can measure the things very accurately. But the problem is are we going to use a total station which is

very very costly for this purpose. In addition to this there is one more problem and this problem we write it as we are making the map in office what is the meaning of this. There in the field we are only taking the observations the observations are being stored inside the total station or we are recording them. Now, once we are in the office we make use of those observations and then we make the map. So, the ground once we are making the map once we are plotting the details the ground is not in front of us. If there is some problem with the observations we cannot correct that either we have to go to the ground again. So, there is a problem like this. Now, can we have a solution in order to avoid this?

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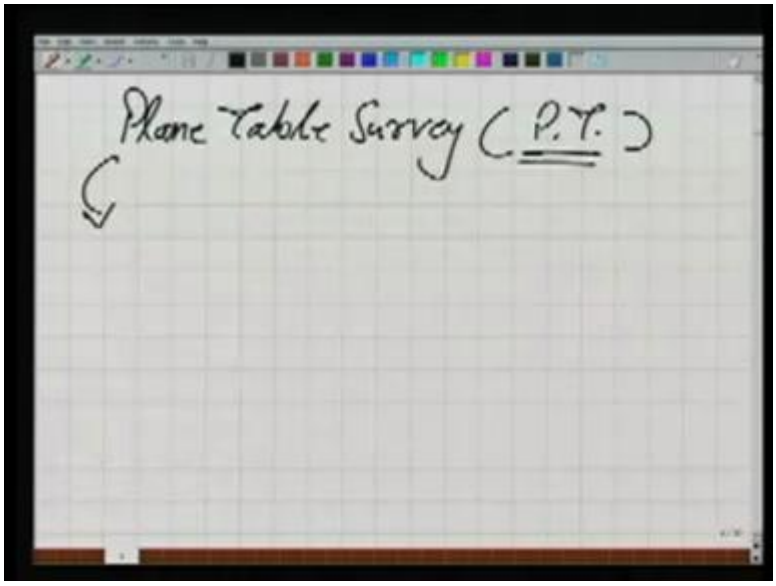

And that solution is plane table survey this is also called many times as P T plain tabling survey. Now, in the case of the plane table survey what we do? We will see the methods in a moment. But we go to the field there in the field itself we make a map. So, it is something like you know we are making a sketch of the ground it is not only the sketch, but it is a sketch in which the geometry of the ground is also represented. So, there in the field we keep measuring the things we keep plotting them. So, in the field we have a map ready with us.

Of course, there are some limitations of this method also which we will see in a moment. But it is a very good method, because we can fill up the details in the field; the features; the trees; the houses. Everything is in front of us and as they look there in the field the

contours in the ground; the topography. We can plot them as you know by measuring as well as by observing them in the field we can plot them. Now, let us have a look at the equipments which we use in plane tabling. The very first equipment which we use in the plane tabling is.

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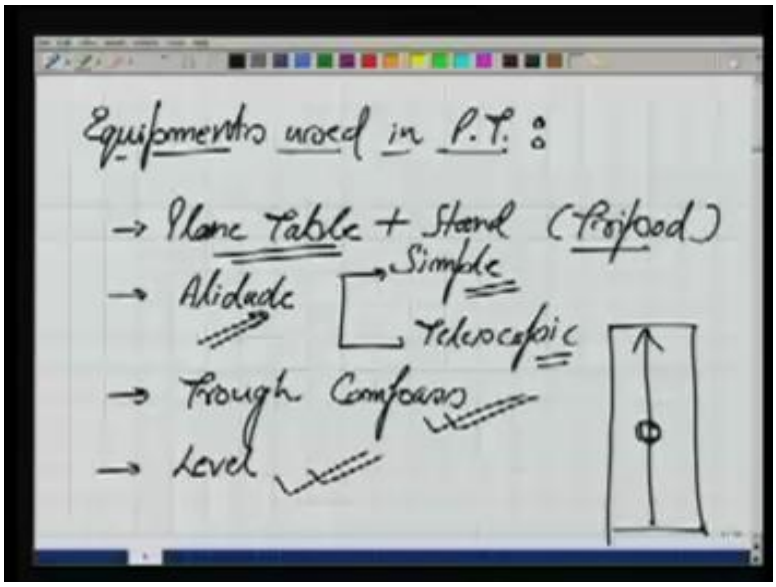

Plane table; it will come with a stand or a tripod. Now, let us look at the plane table.

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This is plane table as you can see here we have a tripod on the tripod this plane table is fixed. So, wherever we want to work in the field we carry this plane table and tripod with

us. And we first fix this tripod we level the tripod height and then on top of this plane table is fixed. Having fixed this plane table I can change the levelling of this to change the levelling I can make use of the legs. So, I can rotate the, at you know single legs radially or circumferentially also. Having done that we can level this plane table and we will see in a moment a little spirit level which we will put in the plane table in order to ensure that the plane table is levelled.

In addition this plane table can be rotated and as well as I can clamp it if it is clamped I cannot rotate it it is fixed for plotting. And then on this plane table as you can see we have put a drawing sheet here. So, a paper which would not shrink with the change in the climatic conditions we put a paper like that here and we use that paper for plotting on the plane table. Now, we will see the next instrument used in the plane table. The next category of the instrument which we use in the plane table is alidade. We have 2 types of alidades; one is simple and the other is telescopic we will see these 2 alidades now over here with us is the simple alidade.

As you can see in the simple alidade we have 2 vanes and I can erect these 2 vanes one has a very thin wire here while on the other side we have a slit. So, what we do keeping this slit towards me and the wire away I can keep this alidade like this we keep this alidade on the drawing seat or on the plane table. I can pivot this alidade about a point we will see all these things how these are useful. If I pivot the alidade about a point let us say that is the pivoting over here it is pivoted I can rotate the alidade also. The main purpose of the alidade is using this alidade I can sight an object for example, I can sight a tree and I draw a line here. So, from a point in the plane table I have a line towards the tree.

If I got some building corner I rotate this alidade about that pivot it is rotated and looking through the vanes the slit and the wire. It is possible now to see the corner of the building there if I am seeing the corner of the building again I will draw a line. So, what we are doing basically here using the alidade we are. In fact, measuring the horizontal angles because this table is now horizontal we have made it horizontal using the level. So, on this horizontal plane we are basically measuring or other drafting graphically we are drawing the angle between those 2 points in this horizontal plane. There may be some objects which are you know higher. So that I cannot see within the available line of sight here it may be possible or there may be something which is down there in order to help.

In that case what we do? We will have one additional thread which will start from top of this vane and will reach the top of this vane here. Now, using this extra thread what I can do if I am looking downward the thread here. And the wire here I can bisect the things which are in angle of depression as well as using this thread everywhere and looking from the vane here I can see in inclination angle or inclined sight line of sight. So, I can bisect objects lower as well as higher and as well as in the horizontal plane and all these objects can be we can draw the lines which we say resector to those objects. So, the angles between horizontal angles between all these can be met here in the drawing sheet.

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The other alidade, because this alidade is simple alidade and this one is telescopic alidade. The idea is over here we have a telescope as we have already seen the telescope. In addition we have the straight edge as in the case of the simple alidade the straight edge plus using this telescopic alidade I can also measure the vertical angle in which direction I am looking at. The concept is same using this telescope we use it for accuracy we use it if the things are or the objects are very far from us we cannot see them correctly by naked eyes. So, we make use of the telescope and whatever the angle of the object we can bisect that once the object is bisected we draw the resector from a point. And similarly for one point for the second for the third again we are mapping the horizontal angles between these features which are there in the ground. The next instrument which we will make use of is trough compass and of course, the level. Now, let us see what the trough compass is.

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In the case of the trough compass as you can see here we have a magnetic needle and that is encased with in a box and it is free to rotate about the point here. So, if this trough compass is oriented in the magnetic north direction this needle will be in the centre otherwise it will not be in centre. We will make use of this in order to orient our plane table in a moment. So, we keep this over the plane table and then we use it this is the simple expert level. We have seen the concept of it you know a tube which is a part of a big circular tube filled with less viscosity liquid here. So, we have a bubble tube here and using this bubble tube we will level the plane table.

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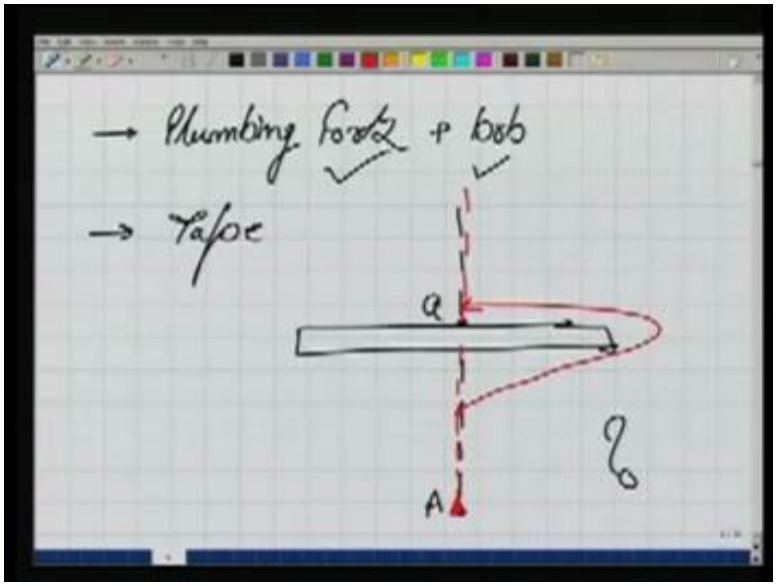

Well the next instrument which we use here is plumbing fork and the plumb bob. Now, what is the principle of plumbing fork and plumb bob? The idea is if this is my plane table on top of this there is a point I want to centre it. The meaning of centering is if this point is a and the corresponding point on the in on the ground is capital A. I want to put this plane table in such a way that this small a is exactly on top of capital A the point in the ground. Now, how to do that, how to realize this? This is realised by plumbing fork in case of the plumbing fork what we have we have a instrument like this which we will see in a moment and from here we have a plumb bob suspended. And the idea of the instrument is that these 2 points of the instrument are along a along the same line. Well this is the plumbing fork here.

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How we use it? We put the plumbing fork like this now wherever the plumb bob is pointing now there in the ground the same point I can locate here now. So, it is a way of transferring that point on the ground over here and the other way around also A point which is here you know a point which is here where is that point on the ground. You know just accurately if you want to do it a point which is here that point is there in the ground so, kind of note transferring the point up and down.

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The last instrument which we will be making use of in case of plane tabling is the tape because we will very often measure the distances here. So, we will also make use of tape. So, if you are going to do plane tabling in the field you should have all these instruments ready with you. Now, having seen these instruments we will see in a moment the methods how we do the plane tabling in the field, but we have understood. So, far in case of the plane tabling, we basically make the map there in the field itself now what are the advantages of this method? Number one advantage as we have been before also you know the ground is in front of us whatever is there we can plot that. So, this plotting is of course, we are carrying out the measurements is a measured sketch is sketching the ground, but with proper geometry. We do not need to keep any field record there are chances that the records may be lost. So, that is the main advantage of plane tabling method.

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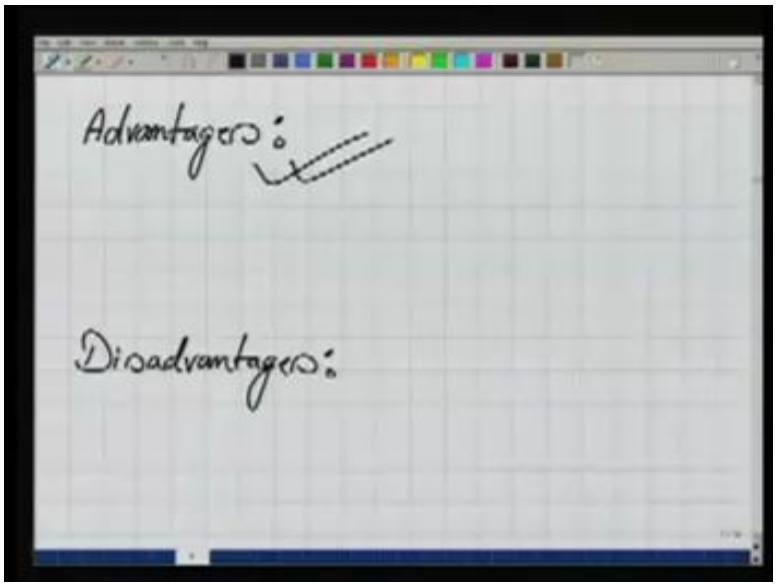

Now, disadvantage; disadvantage could be, because we are not keeping any record with us it might happen that once you are back in the laboratory something goes wrong with our sheet we do not have a way in order to regenerate that because we do not have any records with us. Another problem when we are working in the field if the weather conditions are not good, because here we are using a sheet you know a paper sheet. And if it starts raining we cannot work there. What about the drawing which we have made or the map which we have plotted the inks they will all be washed out.

Another problem when we work with the plane table you will observe that once you go to the field and work with the plane table. Because the paper which is pasted on the plane table the drawing sheet or the mapping paper that is white in colour, because it is white in colour. So, lot of sun light will reflect. So, it becomes very difficult to work there in the field. So, all these are the limitations with this method, but still this method is very good in order to fill details at small scale maps. Now, you will see some of those methods how we do it. Let us look at now that how we work with the plane table, what are the steps?

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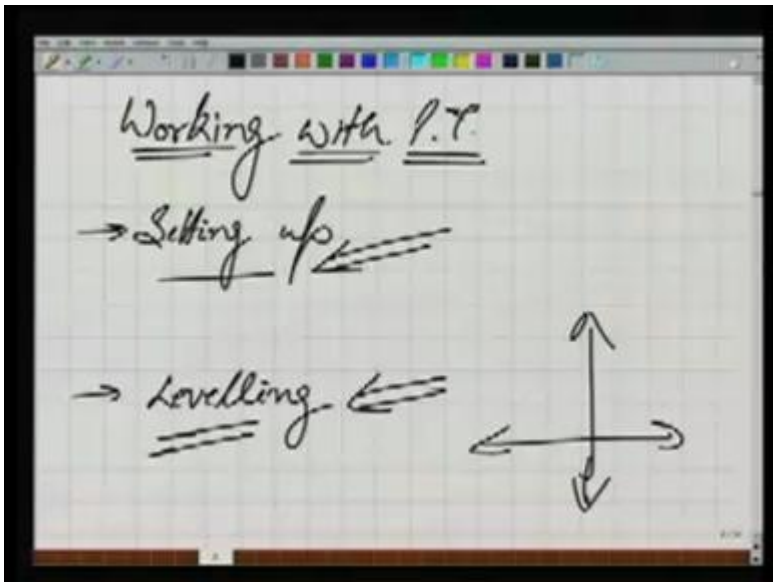

Number one as we have already discussed is setting up. Setting up means we bring the plane table at the point where we want to keep it you put it on the tripod and we clamp it. The second one is levelling and we have seen that we will be making use of the spirit level. And we know the principle of spirit level we keep the spirit level in 2 perpendicular directions and we ensure that the levelling is done in both the directions once it is. So, the table will be levelled in all the directions. So, another one the third one is the centering.

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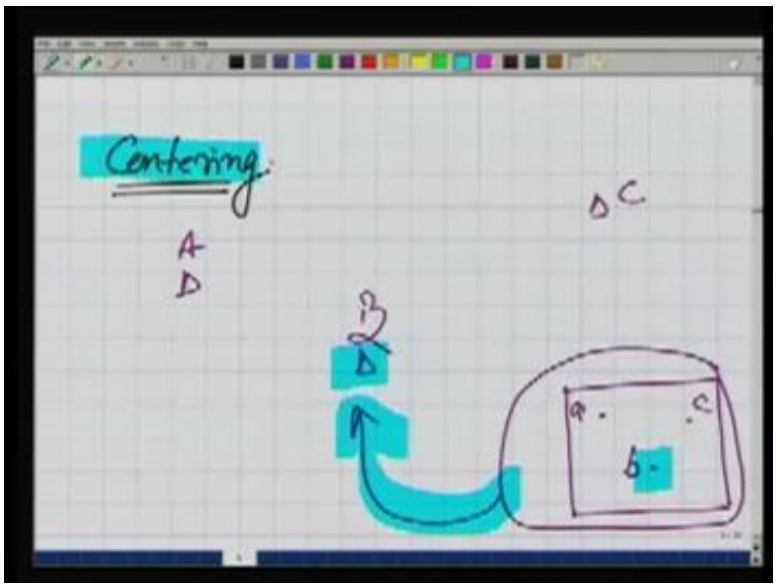

What is the meaning of centering? The meaning of centering is let us say there in the ground we have 3 points A B and C these are the points which are there in ground. If I have plotted these points also on a plane table by some method my a is here b is here and c is here. I have plotted these by some method. Now, I want to carry this plane table to the point B the meaning of centering is when I carry this plane table to the point B. This point if I highlight that the point small b should be exactly over capital B. If we can ensure that once this table is brought over here on top of the B and small b is over capital B that point on the ground we say the centering has been done. Well another way.

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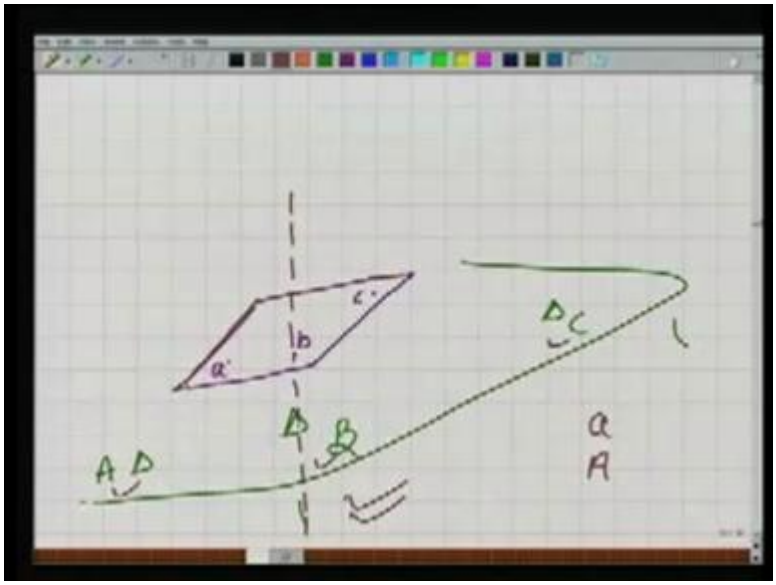

What is the meaning of this? The meaning is the same A B and C three points on the ground, which are plotted on a plane table. All the points you see plotted on the plane table we saw them by small letters while those points on the ground represent them by capital letters. If this table is centered the meaning is this point b is exactly over the point there in the ground capital B. So, the centering has been achieved.

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The third step in working is orientation what is the meaning of orientation. Orientation means you know if already some details are plotted on the plane table we are going to the field. We occupy the field besides setting up levelling, we need to orient it also orientation means the weather details are plotted in the sheet. I keep the sheet in such a way that the sheet is oriented meaning the lines joining any 2 point on the sheet should be parallel to the line which is joining corresponding points there on the ground. We will see this by an example.

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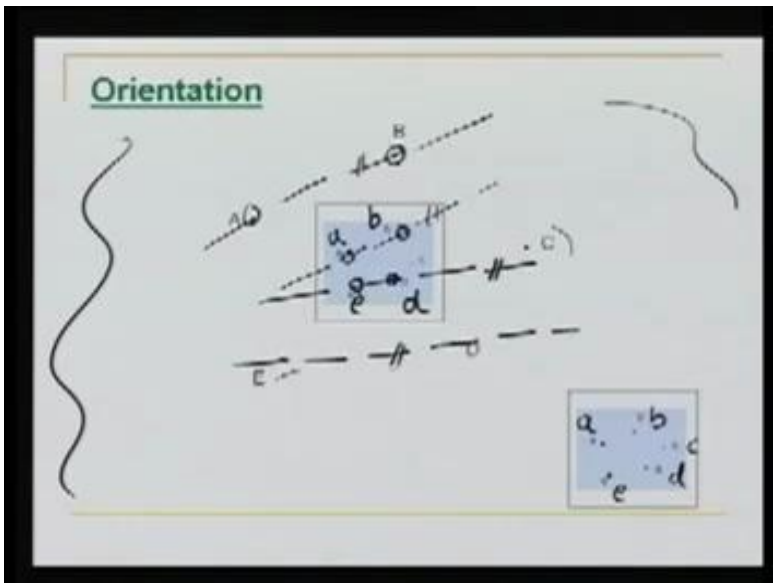

Well here is an example of the orientation. If you look here let us say there in the ground we have A B C D and E. These are the features there in the ground and this entire thing is our ground here and these are the features. Well, we have already plotted this ground all these points by some method. So, in this field this point is A this is B C no these are the points and D and E this is A here and similarly b c d and e. Now, this particular map has been done by some method it may be done by the plane table or by some other method. Or maybe these are the controls which are done by triangulation total station. Or whatever the meaning of orientation is if I take this sheet to some point here you know in between anywhere now in any of these positions this sheet is not oriented.

For example if I say here if the sheet is in this position or in this position or in this position the sheet is not oriented. The sheet is oriented only in this position why, because right now if I join the line on the sheet joining point a and b. This is a and this is small b and corresponding to these the points on the grounds are A and B. So, if these 2 lines are parallel. Similarly, we can also see it for point e and point d. So, the point e is plotted here point d is plotted here if I join these by a line. Similarly, I join the points on the ground by a line again these 2 lines are parallel So, if we are able to put our plane table in such a position that the lines on the sheet are parallel to the lines on the ground we say our plane table is oriented. Now, how we do this orientation, what are the methods?

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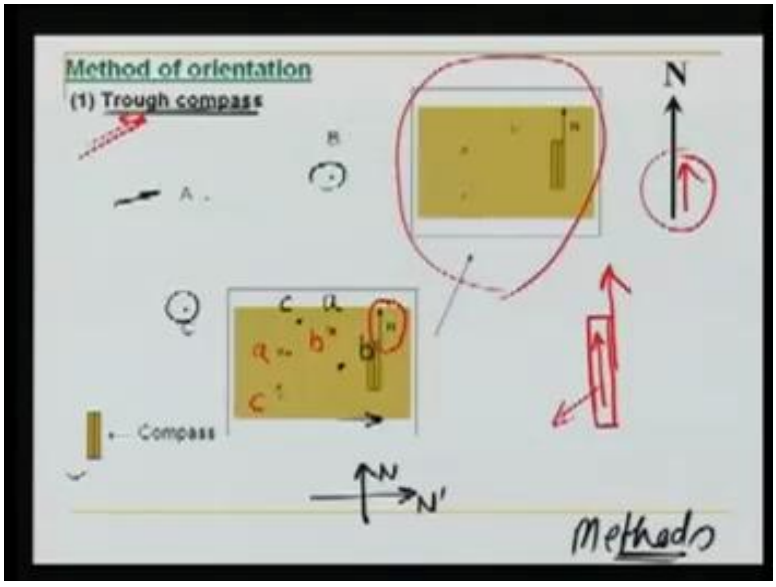

How to achieve that, how to realise that? The very first method is based on trough compass. We know the trough compass in the case of the trough compass we have a magnetic needle and we keep rotating the trough compass. Once the magnetic inductance centre it points to the north we are making use of the same principle here. Now, here in this case let us say this is the compass 3 points A B and C are there in the ground. This is the direction of north here Let us say these 3 points are already plotted on a sheet. This is our plane table on this plane table the c is plotted here a is plotted here and b is plotted here. I am again doing it. So, that I still let you A b c are plotted like this.

Once we are doing this plot at the same time what we did? We also plotted the direction of north on the sheet. So, this direction of north is plotted here on the sheet. Now, if I keep the sheet like this what we observe the direction of north here is not the right direction. The right direction of north is this, but the sheet on my sheet the north has been shown like this while the actual direction of north is this. So, we can you know understand or rather we can conclude that my sheet is not oriented in order to orient this sheet what we would like to do. We would like to rotate the sheet if we rotate the sheet like this now the new points have shifted I will show them by a different colour now The point a is here now and this is point c and over here is point b.

And now the north of sheet is this and if the north of the sheet is in the direction of the ground north and what we have done along the north which is plotted on the sheet we have put our trough compass. So, there inside is the magnetic needle. So, right at this moment in this case once this north of the sheet is pointing in the direction of north of the ground the magnetic needle will be in centre. So, our sheet is oriented. So, from a non oriented position the sheet is oriented now. So, this is the method of trough compass. Of course it is not very accurate because this trough compass or the magnetic needle may be affected by not only the magnetic field of the earth rather it may be affected by some other things.

You know a key ring in your pocket or some other influences or magnetic forces which are there in our surrounding. So, it is not a very accurate method, but still for our first approximation we can use this method of orientation by trough compass. Now, what is the second method? In the case of the second method of course, now if we have moved the sheet to a second point as shown here again we will have to rotate the sheet and then

only the sheet is oriented. Next method of orientation is orientation by back sighting. Now, how we do that?

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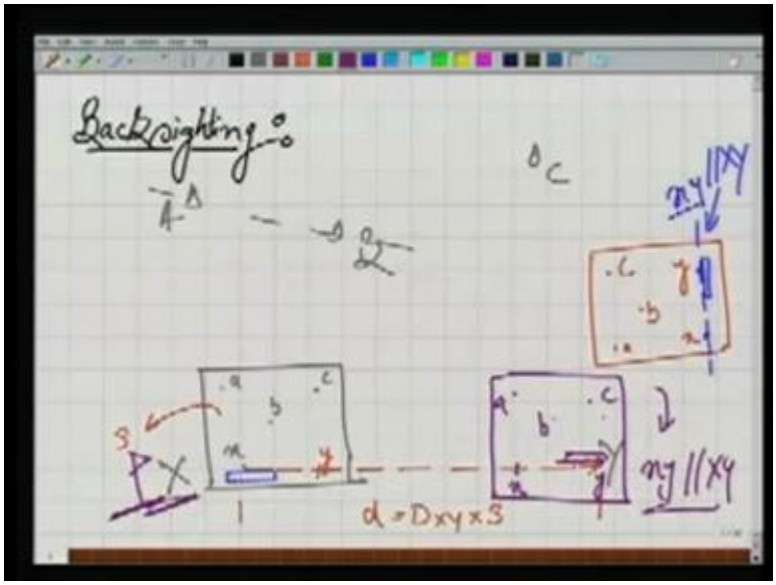

Let us say in this case we have some 3 offsets A B and C they are on the ground some three features any we have a sheet or the plane table here. Now, these 3 points are plotted by any method we are not talking about that these things will be clear in a moment. In addition where we are see we are also standing on a point on the ground. Let us say that point is X. So, that point X on the sheet is small x. And right now for example, this sheet is oriented right now the sheet is oriented, because the lines which are there in the ground are parallel to their corresponding lines on the sheet. Our job is we want to take this plane table from this point X to a other point Y. And once we take it to the Y it will be required when we are doing the mapping we will need to do this.

So, after taking this sheet which is oriented at X to the point Y. Again we want to orient it at Y we can do it by trough compass, but the more accurate method will be by back sighting. How do we do that? Well, let us say the Y which you want to occupy is here on the ground from X we by keeping our alidade. So, I keep my alidade on the sheet at small x this point. If I show you the alidade that is that is the alidade now looking through the alidade. We can see this Y and we draw a line or resector this line or this is called resector. Well I can measure the distance between these 2 on the ground multiply

that by this scale at which this plotting has been done. And you will whatever this small distance d comes out to be I can plot the Y on my sheet as small y.

So, right now what I know? Right now I know on my sheet a direction small x small y as well as the location of Y. Next we are taking this plane table to the point Y if I take it to the point Y over here. Let us see initially my plane table is not oriented I keep my plane table a b and c a b and c and the small x is here and small y is here. If I keep my plane table this way over this Y its not oriented we want to orient it So, what we do? We keep our alidade at the point y and we ensure that alidade is kept in such a way that the alidade also passes through small x. So, on my sheet the alidade is kept at y point and it is oriented in such a way the alidade that it passes through small x. Now, there on the ground where this line is that line is corresponding line is capital X and Y.

So, what I will like to do? I would like to rotate now this plane table. So, that this line small x y becomes parallel to capital X Y. So, this is what we are doing at the point here? If I find some space here for the plane table well let us keep the plane table here. So, the plane table is in the new position this is small this becomes a small y now on the plane table. Small x was already plotted. We have kept our alidade at Y. So, that the line of sight passes through small x and we rotate this plane table till the capital X, because this capital X we can have a ranging rod now. So, we keep rotating now a plane table. So, that capital X is or the point x there in the ground is bisected. Once we have achieved this our small x y line is parallel to capital X Y and our table is oriented. So, our a b and c will be in the right position. So, what we did? We made use of back sighting in order to orient our plane table having seen these 2 methods of orientation.

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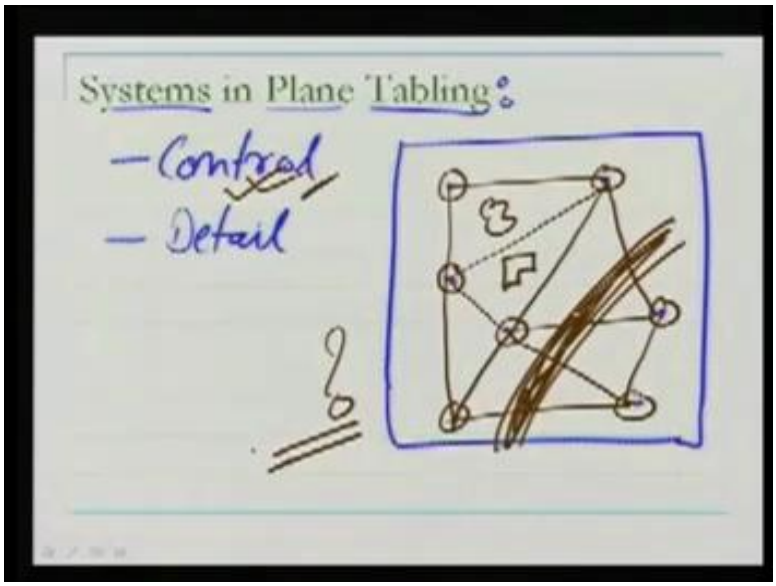

Now, let us get into systems in plane tabling, what is the meaning of this? The meaning is how do we plot details in plane tabling. What do we do in the field? What do we do? You know when we want to plot the details. In case of other methods you know the corresponding methods we have seen you know from 2 theodolites. We can intersect find the angles or total station method or may be offset method we use those methods for plotting the details. Now, here in the plane table we want to plot the details. One more thing that we should understand here in plane table, as we know in any plotting there are 2 things. One is control the horizontal control or the vertical control the second is details. We want to fill the details now, what is the meaning of thi?

If we have a plane table the control has been generated by some other method of survey let us say that method of survey is triangulation. So, what we did? We observed all these triangles and basically we know now the coordinates of all these points. This is how these points have been plotted on the plane table. So, our control is available to us. So, whenever generally we go to the field in order to do the plane table the control is already available to us. The meaning of this is on your sheet you have the points which are plotted these points are already plotted as well as we can locate these points there on the ground. Now, what we have to do by making use of these control points we want to fill the details. How to fill the details? Detailing means we want to plot the tree here we want to plot the building here or if there was a road we want to plot the road here. Now, how

to do that this detailing? This process we are going to look into first method of detailing is by radiation.

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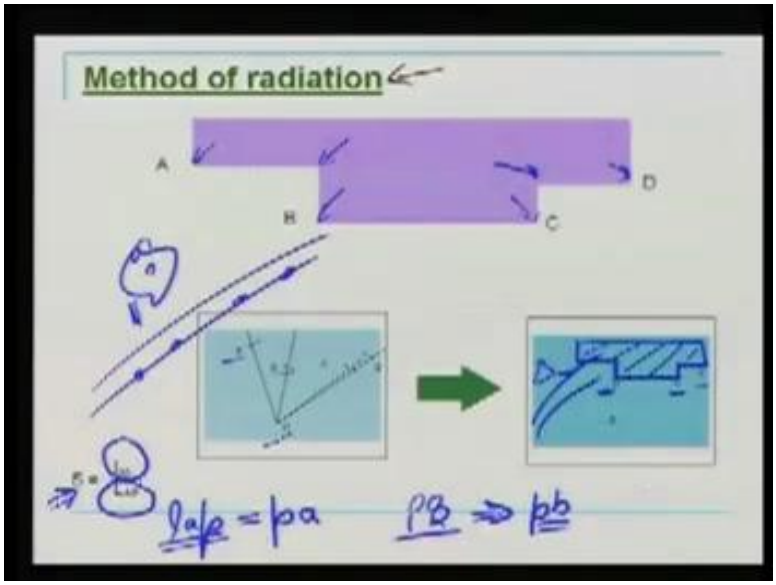

Now, in this radiation what we will do as we can see here. Let us say there is some object a building and these are the 4 corners of the object A B C and D. And we want to plot the outline of this building of course, there are more corners we can also locate these. We want to plot the outline of this building, what we do? We occupy a point there in the ground which is P this point P is the one where we are keeping our plane table. Right now on our plane table nothing is plotted let us take it like that our sheet is blank nothing is there on the sheet. In order to plot this big building, because this big building has to be accommodated in my plane table finally the big building will come like that. If I am standing somewhere here I am standing somewhere here the point P where on the sheet I should be I should be somewhere here. What we are seeing? The entire slide here the full frame of your video is the ground while this little frame here is the plane table or the drawing sheet.

So, if we compare the geometry of this building and this point. So, over here the building and the point should be somewhere here. So, once we bring our plane table at a point P we know where exact where approximately we are. So, that is our starting point. So, what we do on our drawing sheet? The drawing sheet initially was blank I mark a point small p. We are standing at the small p point well this is what we have done. By putting

it we have marked the small p this is small p. Yes we are here nce we have done that what we do on this small p the point which is on the plane table I keep the alidade I rotate this alidade. So, that I am bisecting one of the corners of the building. So, now I am looking in the direction of the, that corner. Once we have done that we draw a resector on the planes table.

Now, this is what we are doing here in the slide. We have drawn a resector to a point capital A in addition to this as we discussed that we will also have a tape with us in this method of radiation. We physically measure the distance between the capital P point means where we are standing and the corner of the building A. So, this distance is measured having measured this distance what we will do next. We will convert this distance on to the scale on to the scale means how we do that? If s is the scale of the plot for this map we have decided s is the scale. So, using this distance which is measured on the ground I can determine the corresponding distance l a p; that means, the length on the map sheet. Once we I have found it this is equal to small p and a we mark the point A here the point A is marked here.

Now, after we have marked the point A we would like to repeat the same procedure for other points. Well the point A is now known to us. So, similarly we draw a resector to point B, we measure the distance between capital P and B and determine the corresponding P B the map distance and again we mark the point B. So, A is marked here point B is marked here on the sheet similarly, for C and for D. So, what we have done here basically by taking all these resectors and by measuring the distances physically on the ground converting them to the scale we are able to mark those distanced distances on our sheet. So, on my sheet now I have got these 4 points located joining those four points I can have the outline of the building.

So, here is a small a a small b a small c a small d and the outline of the building has been plotted. So, similarly, if we can take more number of points in this building and the entire building can be plotted. If we had some tree some of the feature a road. So, I can take some points on the road. So, roads trees and other things can be also plotted by that map. So, this is the method of radiation the next method is method of intersection. Now, let us think about it in method of radiation, what were the problems? The problems were we had to measure each and every distance. And that is very difficult you know the

ground many times you may not able to walk to that particular point in between as we can see here.

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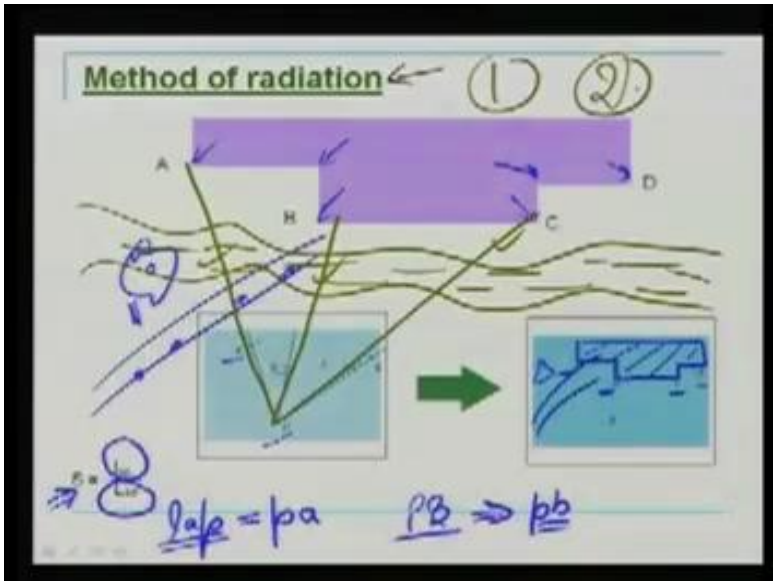

In between this building and our sheet if we cannot go there let us say there is a river a water pond. If that is the case I cannot measure the distances as we were doing so far. So, if distances are we cannot measure them number 1. And number 2 why should we measure so many distances more number of distances we measure more are the chances of the error. Can you do something? So, that we can eliminate this distance measurement that is the question. Now, the answer lies in method of intersection.

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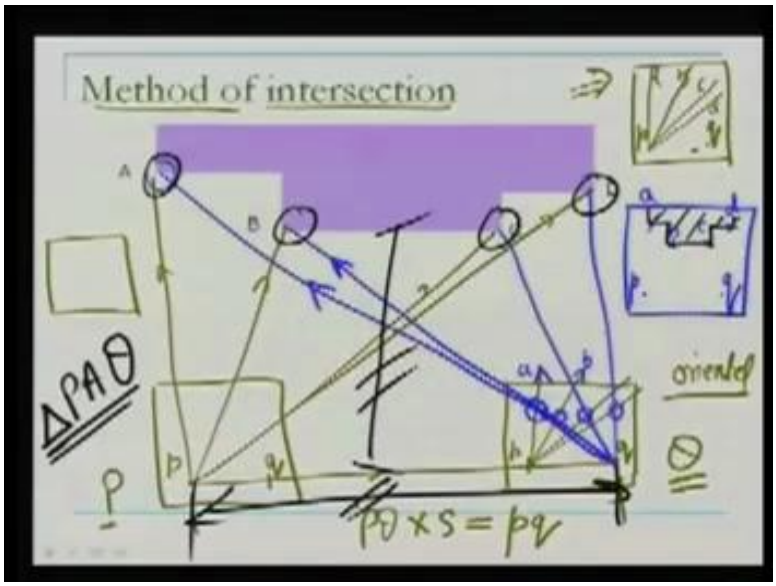

In this method we will not measure all the distances, but only one or a few. How we do that? The same our building A B C D is there again initially let us say my plane table is just blank we do not have anything on the plane table. And I keep this plane table for example, at a point capital P. So, this point is capital P which I am recording as small p on the sheet. What I do from here? By keeping my alidade at a small p I can draw resectors to A to B to C and then finally, to D. So, all these are the resectors which have been drawn the rage right now I am not plotting it. In the method of radiation we had measured the distances also and then we also plotted those points.

In this case we are not plotting them right now. Well what we do next? We locate another point Q there on the ground and towards Q also we take a resector like resector to the Q. We measure the distance PQ if we have decided a scale as S we find the corresponding small pq the distance on the map using this small pq I can locate the point q here. So, what we did? We measured only a single distance right now once we have done it right now on my sheet what we have I am drawing this sheet again. On my sheet I have a point p I have a point q and then I have some resectors to A to B to C and to D. This is how my sheet will look like at this moment. Well we bring the sheet does it a sheet look like to the point Q we centre it. So, that small q is on top of capital Q we level it and then we orient it also.

Now, which method of orientation will you we will use the method of back sighting, because we already have the things. And using those we can easily back sight our, you know orient our table by the back sighting. Well what we do? We bring this sheet over here lastly this is the table the point small p small q. And then the resectors from Q from the P 1 to A to B to C and to D and while we are doing it we have already mentioned here that these are the resectors to A B C and D. Well our table is oriented we know the method of orientation and we have oriented our table here. Next what we do the procedure is same keeping my alidade on small q I sight the point A.

So, basically if I keep my alidade on this small q and sight capital A we draw a resector that is is this is the resector. Similarly, to B that is the resector to C that is the resector and finally to D. What we have observed? We observe that a resector towards A intersects the corresponding resector at a point over here. Similarly, the resector towards B intersects the corresponding resector which was towards B from P at a point here then towards C towards D. So, what we have? At this stage we will have our sheet on the sheet we have small p small q as well as the intersections intersection of the points. This is the intersection corresponding to small a small b small c and small d.

So, finally, we simply join these well I join these and that is the outline of our building. So, in this method how did you do it? We drew the resectors from both the points. First from point P and on our drawing sheet right now only the resectors are there. Then we measure one distance PQ and we plot the point small q on the sheet. We go back to Q and then at Q we orient our sheet by back sighting again draw the resectors to A B C D. Now, wherever the resectors are intersecting the corresponding resectors those are the points which are the on the sheet. And. So, by this without measuring these distances distances means the distance from P to A B C D as well as from Q to A B C D they are not measuring these distances. But still we can plot a small a small b small c and a small d and our map is ready. This is a very good method during this method we can make the map or other we can plot the details.

The only thing that we should keep in mind, just think of you know the triangle here think of the triangle P A and Q. We have already seen you know once graphically we have seen it methodically also we have seen it. If 2 arcs they are intersecting at ninety degree the uncertainty is very less while these 2 arcs they are intersecting at very large angle or very small angle the uncertainty is more. So, the same thing applies here also

our triangles for example, like triangle PAQ or PBQ or PCQ any of these triangle they should be well conditioned. If the triangle is not well conditioned we will be locating these points, but error will be more. So, this is something which you know we have to take into account we have to consider when we are forming this triangle. So, our distance from the feature length of the base line how much the base line is all these will control what kind of triangles we are forming?

So, this is an important consideration which we should keep in mind. So, what we have seen today? We saw what is the plane table know the equipments of plane tabling. We saw also the concepts; why we use the plane tabling you know to fill the details, because the other methods are there. But they are costly though they are more accurate. Many times we would like to make the maps at a very small scale at a very you know without putting much money into that. So, plane tabling is a very good solution. Also for some large scale not very accurate maps we can use the plane table. Then we saw the advantages of it disadvantages of it. Then finally, we looked into you know how we work with that, what is the system, how to plot the details by radiation by intersection. There are some more methods in this and we will see those and some other things in our next lecture.

Thank you.