Surveying
Prof. Bharat Lohani
Department of Civil Engineering
Indian Institute of Technology, Kanpur

Module - 11
Lecture No. # 01

Project surveys

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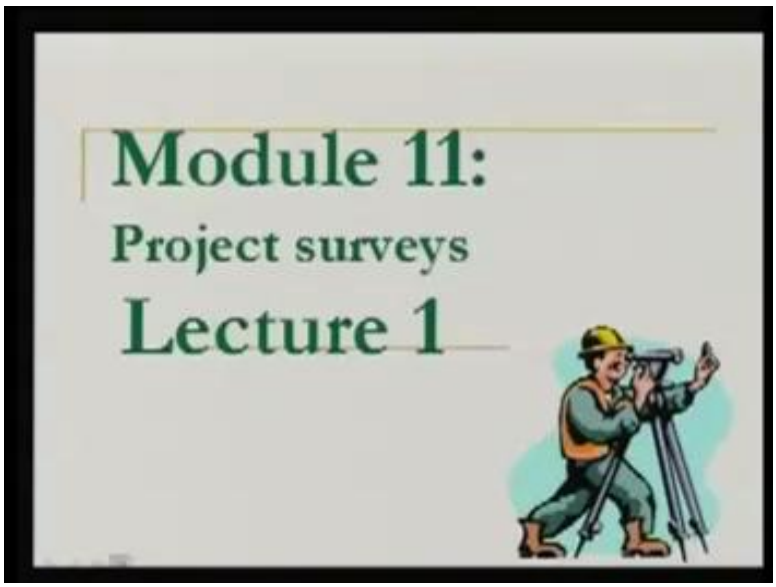

Welcome to this video lecture, series on basic surveying. And today, we are in module 11, is a new module, which we are starting today. And this is about project surveys, today we will start with lecture number 1 in that. This is the overall program of our entire video series lectures.

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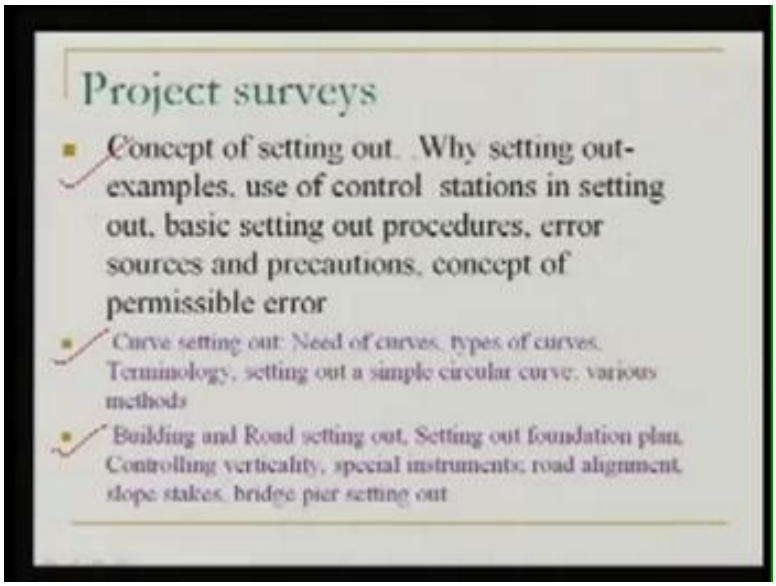

What we will cover in the project surveys? Is written over here, this is index number 1, lecture number 2, and lecture number 3. So, first of all we will be talking about the concept of setting out, why we need to set out? We will see one example, then we will see the use of control stations in setting out. And what are the basic procedures for setting out? Later on we will see the error sources and what precautions we need to take? And finally, what is the tolerance level? You know permissible error, which is there and how to take into account that thing?

In addition to this, in our next 2 lectures we will be talking about some particular projects. For example, in the second lecture, we will talk about the curve, if there is a curve and we want to set out the curve in the field. What is the procedure for that? Then later on, we will be talking about the road and the building. How to set out those in the field? Well we will start with, why we need to set out? That is the basic question you know, why we need to set out.

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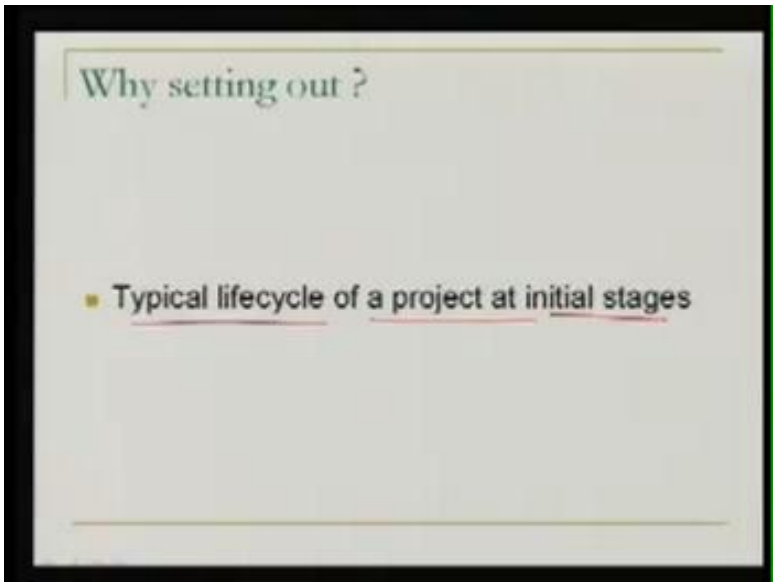

Before we get into that, what we will try to do? We will try to see a typical life cycle of a project, at initial stages, when I say project I mean, I mean civil engineering project. It may be a bridge, it may be a building, it may be a road, it may be a dam any civil engineering project. What is the life cycle in initial stages? So, we will see that by 1 example, the example here is we want to have a road and a bridge in the area.

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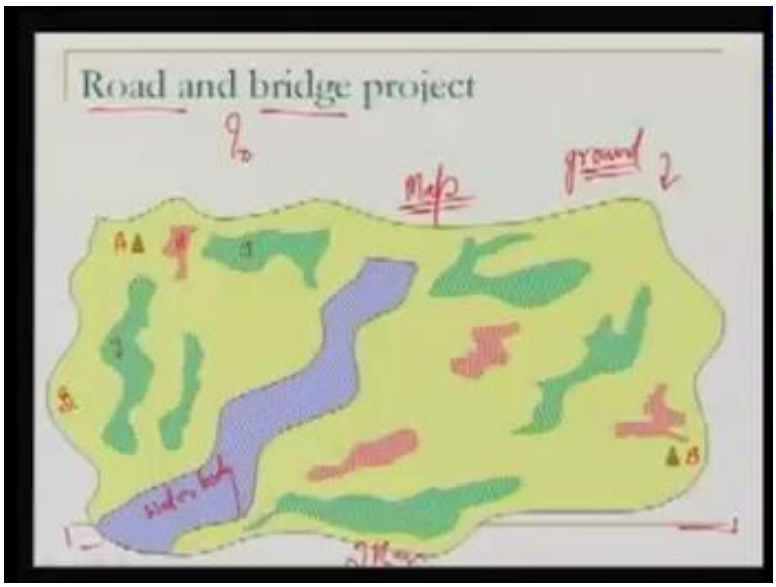

Well over here in the screen, I am showing you the ground, this is ground. So, right now, we are seeing the ground and the ground is very large here. For example, let us say this

entire length is of order of 2 kilometre and as well as the width is around 750 meter. So, it is a huge area. What is desired here? Starting from a point A, we want to go to point B while there are jungles in that area as well as some habitations. So, this red is the symbol for habitations and these are the symbols for the jungles. And rest of the area is you know barren fields, while this particular feature here is a water body. Well we want to have a road and a bridge, which will join these 2 places. For some example, you know road in base we have some questions? Which, we are going to raise now.

So, if this is the project, we want to join these 2 places A and B, what should we do? You know you just think yourself, you know you are standing on that ground right now. I have brought that ground on to my video screen, on your television screen, but think that you are standing on that ground. And while you are standing, you want to have a road between 2 points A and B which are around 2.5 kilometres apart. Now, how to do that? Should we start from place and start going in to the other no that is not the way, we have discussed the principle of surveying also, which is very important principle and anything we say whole to part. First we should know about the whole thing? We should do the recognition; we should come out with the best possible project.

But how can we do that? In order to come out with the best possible route, between these 2 points what should we do? We should be able to do something. So, that we can see the area synoptically, you know the entire area in one go. We can see all the features, which are there in the area all the land forms, all the obstructions, all the habitations, all the forest tribes and all the query sides we should be able to see them access them and then accordingly we will decide about the route. Now, how do we do that; obviously, we know that we would like to make a map. So, we would like to map this area, that particular entire area we would like to make a map of that. Now, we want to make a map of this area.

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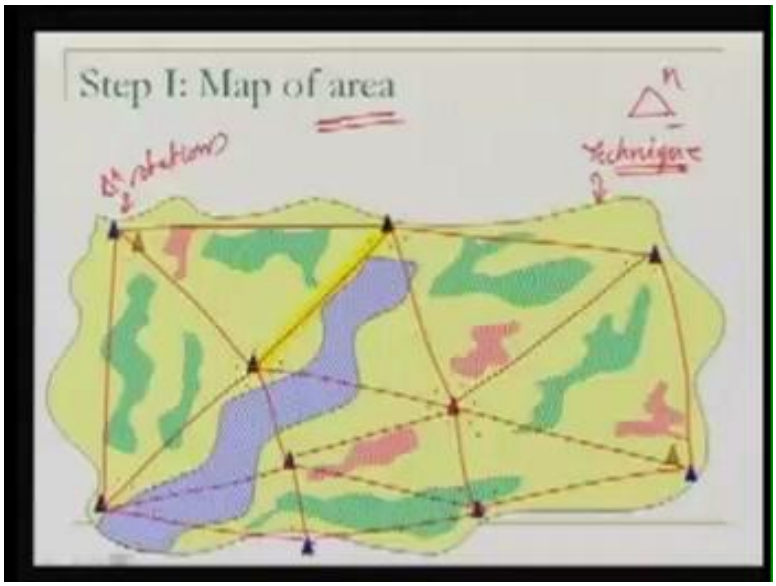

Now, in order to make a map of this area, as you can see we have to decide about 1 technique, what is the technique? That we are going to use for making a map. We have to decide about the instruments, let us say about the techniques. In techniques, if you observe this area and we have decided then we are going for triangulation. So, first of all as you know, we would like to do the recognition, in order to locate those points which conserve as the triangulation stations. And there are some requirements, we know once we are talking about the triangulation, we discussed. What are the points? Which, we should keep in mind, in order to locate the triangulation stations or the survey stations.

Well keeping those points in mind, let us say we decide that these are the locations, you can see these locations here now, in blue. So, these are the triangulations stations well if these are the triangulation stations. What we will do? We know the procedure of triangulation; we will measure the angles, all the angles which are possible. There we will measure one length, out of all these lengths, which is possible to be measured easily. So, over here, what we are doing right now? We are forming the triangulation right here. We are assuming that the inter visibility is possible, that is why we have taken the line of sight through jungle, similarly, here also.

So, that is our triangulation network, one of the line for example, this line can be measured easily. So, I am drawing this line now, I am rather highlighting this line. So, that is our base line and then we measure rest of the angles, all the angles are measured.

So, we know now, the triangulation can be done and we can compute the coordinates of all the points, which form our triangulation network. Well having done the triangulation, what is next step? Triangulation means, we are collecting the skeleton of the area. So, in our drawing sheet now, where we are going to make the map, our skeleton is plotted, because we know the control points. The rest we plot the details, we are seeing that details can be plotted by plane tabling or may be in this case let us say we are doing plane tabling or intersection by the theodolite or may be by taking the offsets. So, what are the methods? We are plotting the details. So, by this method we generate the map.

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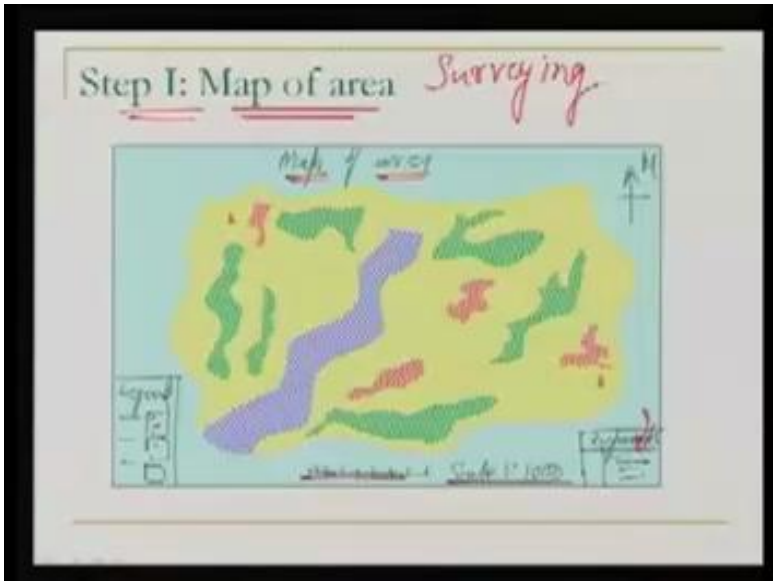

So, here it is map of area and other details, you know the graphical scale the scale written as rf. Representing deflection the details who prepared it and as well as ((refer time: 08:06)) and other thing. This is plotted in the map; well we have the map what next? The map gives you a facility to look at your area in a synoptic way, the entire area all the habitations, all the forest everything is possible that you can see in one go. So, maps they make it possible to plan your project well. So, after completing this step number 1 in the life cycle of the project, which was surveying, I am saying here making the map or we can say surveying in general. So, we are doing the surveying as the first step.

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The second step is on the surveyed thing we are doing the project planning. So, this is the second step. So, what is the meaning of that? Well project planning means, on this map now, it is map and I can work on this map, I can come out with various routes. For example, I decide to choose a route like this in order to join these two points, well someone else he says no this route is not good. Rather we should go for some other route and he chooses a route like this, where there in between will be a bridge. And someone says no even he wants to take, because of some reason the reasons may be different and his route is, may be something like this and the bridge is here.

So, while we are doing the planning using the map, it is possible that we can come out with various routes. And then we go for the optimum 1 optimum or the best 1 the best route which is possible under the circumstances. If the decision is taken and we say well this is the best possible route so, other routes are not taken into account. So, this route along with the bridge is marked on our map. What is the next step? Now, the route means the road and the bridge, they are on the map what we should do next? The third step, the third step in.

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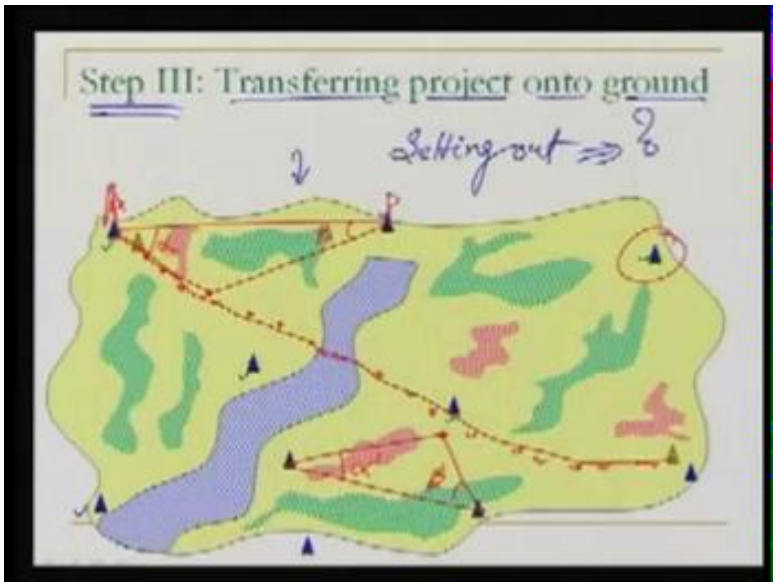

Life cycle of the project is transferring the project, on to the ground. So, the road and the bridge which are there on the map sheet are, because I am giving the map sheet. As an example, it may be you know you know computer also, because we can do the planning on the computer our map is staying in the computer. So, from that planning stage we want to take that project onto the ground now. How to do that? That is the question and this procedure of taking the project from map sheet or from our drawing board to the ground is called setting out. Well how do we do setting out? Now in this case, if I go to the ground let us say we visit the ground now. We have a map sheet with us and on the map sheet we have the road and as well as the bridge location plotted.

Now, we are visiting the ground, if we visit the ground still there on the ground there is nothing, you know the ground will look like. Yes I am showing you here the ground will have only our control stations, which we have marked earlier. And these control stations when we fix these we fix them in such a way that they will stay there for longer periods. So, after 2 months of surveying, when we visited this area still the control stations are there. So, these are the control stations and as well as the other detail the rest of the ground. And what we have to do? Now I have to see that how my road and my bridge will come? And where exactly it will come? We do not know right now. Whether it will be whether it is here, whether it is here, whether it is here and there is a question, there on my map its location is only one location as you can see in the map.

So, what we need to do now? This is important the way the project has been planned on my drawing board, on my drawing sheet, on my map sheet we need to transfer it in exact details onto the ground. So, we need to transfer the project exactly onto the ground, as it had been planned exactly means, you know it is the relationship of the project with the landscape. The geometric integrity of the project that should be also transferred on to the ground. So, the project the way it has been designed in a relative sense, in itself the project itself, as well as the project the weight has been laid out on the map sheet, in relation to the landscape that has to be transferred onto the ground exactly.

So, this is the procedure of setting out, now how to do that? So, over here in the ground as we discussed we only have our control points. So, what we would like to do? We will like to make use of these control points, which are also there in the map. So, what we will do here? There on the map with respect to these control points. We will try to find where our project is, for example, if there are some points on my line. Let us say the road which was planned is, that was the road which was planned finally, along with the bridge and we want to now, look at some of the points of the road there on the ground.

So, what can I do over here? Let us say in order to locate this particular point. I think measure its angle and as well as this angle. So, 2 angles alpha and beta, if they can be measured on the drawing sheet with respect to station A and B. So, what I can do? I can go to the field set up this line by having the running rods here. And putting the theodolite over here I can measure the angle as where they alpha and beta angles, because we have alpha and beta angles. So, same what we will do? We will set out alpha angle and beta angle there in the field. And where will they intersect? That is the point which is located now.

So, what we are ensured here? We ensured that the point has been located, where should be as it was there in the map. Similarly, any other point a point for example, here on the road this point can be also located using some other control points. I am just making use of 2 angles alpha 2. So, alpha dash and beta dash, so, a point here can be located by if you go to the same set of stations so, from these 2 alpha dash and beta dash. So, this point is also located similarly, we can locate various points of our project along with the bridge. And the entire project will be located there on the ground.

So, what would we do we made use of the control points. This is important, what we did? We went to the ground, we had the control points, already there we made use of the control points. In order to find the coordinates of the project on the map sheet as well as then transferring those with respect to the control points. Which are there on the ground. So, by doing that we are able to set out the project there on the field. So, in this, what we observe?

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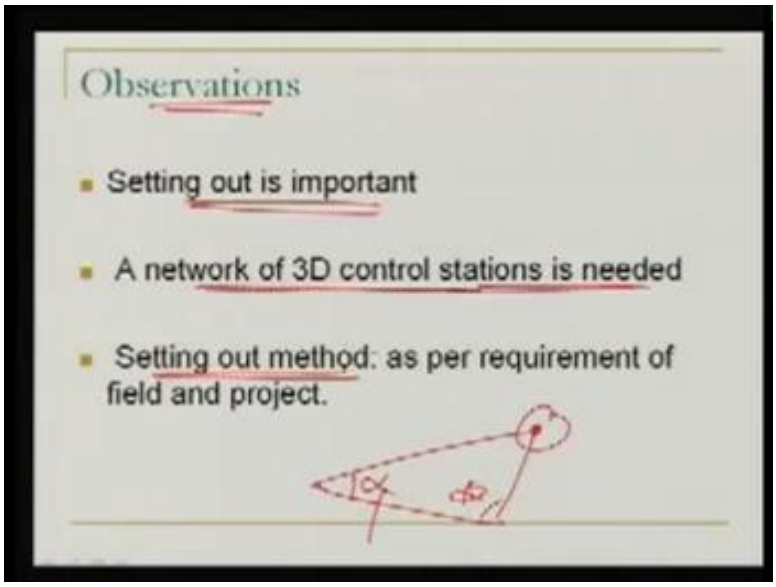

Our observations are well, we of course, setting out is a very important activity. And for setting out we need a network of 3D control stations, this is required. Then how about setting out method? I just discussed 1 case where we were measuring 2 angles alpha and beta to locate the point of intersection. And these 2 angles alpha and beta were same as these were there in the map not always this is possible. So, sometimes we have to go for some other method also. So, the method which we will use in the field, will depend upon the field conditions, and the project requirement. Each project will have a different requirement, whatever we are going to set out? Will have a different requirement, our method will depend on that only. Well what we will do now? We will talk about the various things, which come in this procedure of setting out; we will start with control stations.

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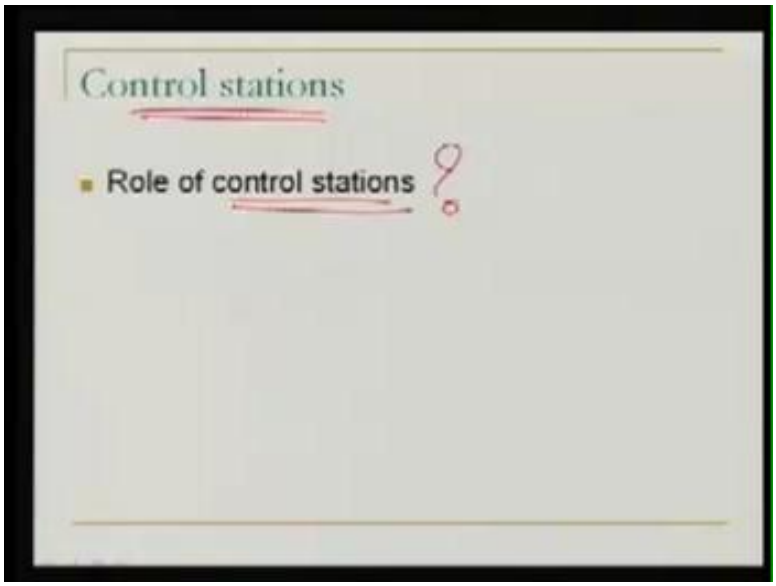

What is the role of control stations? We know, it control stations means, they are established in the field as well as in the map they help in making the map, as well as they help later. On in finding the relative position of project on the map sheet, and then we take that relative position to the ground. So, control points are very important we know about that.

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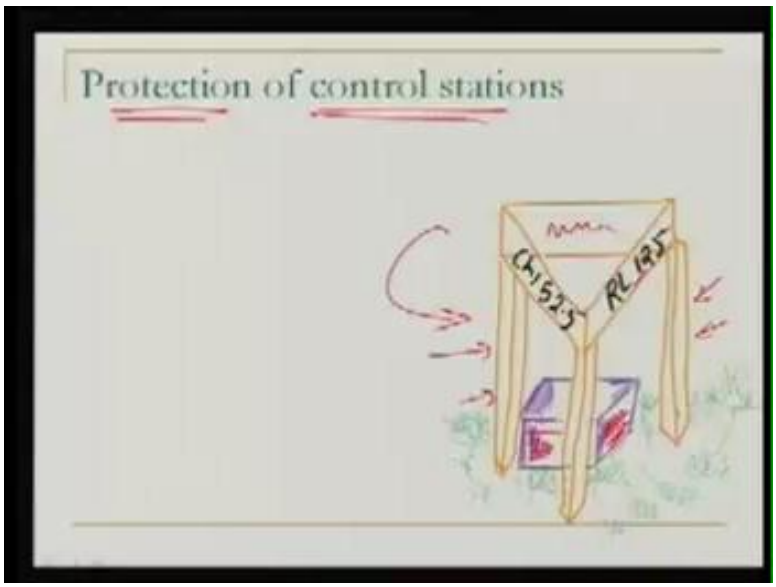

Next it is important you know, because from the duration you know the duration between the very first survey in the field. When we are making the map, from that point to the

point when we actually, transferring the project onto the ground could be a long duration many times. It might take you know 1 year when we did the survey? And later on when we actually, transferred the project onto the ground. The planning stage or the designing stage took around 8 or 9 months it is possible, or sometimes it may be less also. But in any case, whether it is more or less whatever? We need those control points there on the ground? Those control points which we used for surveying, should stay there, because they help in the process of setting out.

Now, in order to ensure, that they are there, we need to protect them, how to protect them? There are various methods. For example, you can make very big concrete blocks and insert them into the ground, you know like the stations. We discussed some when we were talking about triangulation, we discussed what is the, you know? The standard method of making a station make proper stations. Which are embedded there on the ground? So, they will stay there. In addition, sometimes it is possible you know if you are working in a very busy construction site it may possible, that one of the stations they get damaged, some excavation is going on there.

So, that station may be damaged. So, what we need to do? We need to protect our stations properly, there could be varieties of methods of protecting it. just 1 example here, 1 example here is this is a concrete block, which is embedded there on the ground and as well as what we have done? We have protected these stations by these wooden planks. And as well as we have written over here about the station well what is the RL of this what is the ((refer time: 20:07)) of this or something like that. So, the method may vary, but the important thing is, we should protect the station. Not only protection many times you know, even if you have protected the station. But it is possible that in that bridge side someone came with heavy digger and he dug that entire area. So, that station has gone away, that was a very important station, but it has been dug out. Now, it is no more there. So, in this kind of situation what we need to do? We need to go for,

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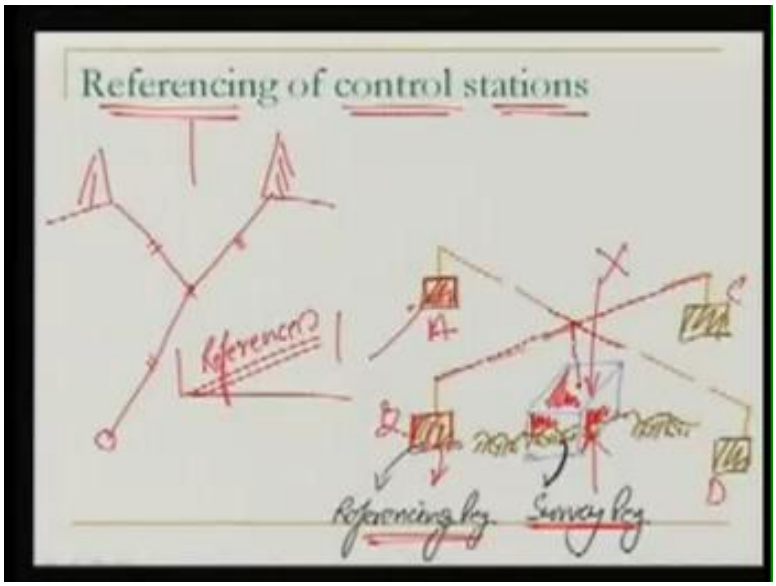

Referencing of station also so, not only we establish the control stations in the field, rather we also take their references. Now, what is the meaning of references? Even if this station is not there, we should be able to locate the station. How can we do that? When we are establishing a station, for example, here over here a station is established this is a concrete block. And this concrete block is embedded there on the ground, and when this concrete block was established? That is the point of the station, along with this we establish some more stations or rather be some more concrete blocks. What this serve? If I stretch some thread between these 2 points, it intersects exactly over the stations. So, when you this station is damaged, This station is damaged, by using these A, B, C and D stations it is possible that we can locate its location further.

So, over here this is our survey pack, survey pack means, our survey stations. While these are our referencing packs, referencing pack means, which we are using for the referencing. Many times if there is a survey stations, we would like to reference it with respect to some permanent objects. Let us say, there are 1 electric pole and 2 buildings, and I measure the distance of my station from these 3. So, these distances are known. So, by using these also we have generated some references, and even if, this station is damaged later on. It is possible that, because we know the distance we can further locate it after some time. So, this is why, we need to generate these references. Now we will go for the basic procedures, which we need to follow in setting out.

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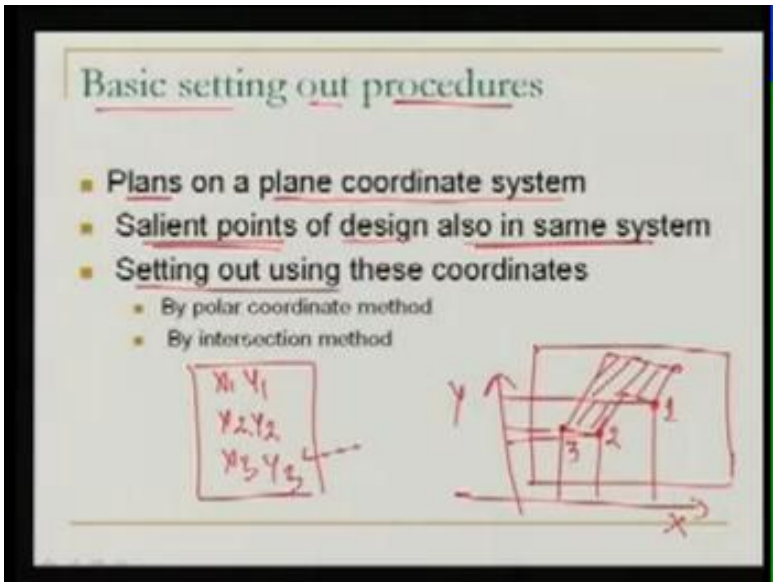

So, basic setting out procedures, we will talk about these one by one in detail, but overall over all what we can say the plans or our maps are always on a plane coordinate system. You know if you have a map, a map has a coordinate system with it. Always we can assume x and y that is the coordinate system along with the map. Now, on that map we have designed a particular building for example, this is the building let us say. So, salient points of design are also in the same system, well salient points means, those points which I can make use of in order to locate this building. So, these are the salient points for example,. So, these points point number 1, 2, 3. I can find their coordinates x 1 y 1, x 2 y 2 and x 3 y 3 also in the same system. Now, once we have this information we use this information for setting out.

Now, this setting out is done basically, by 2 methods 1 we say polar coordinate method and intersection method and you know we are not limited always, to these methods. This is important what I am giving you here? Is only know only just idea about some methods. But actually, when you work in the project, actually when you are working in the field, you have to come out with a method, which may have a bearing on these concepts. So, these methods or these terms or these procedure, which we are discussing here are only the conceptual things. There in the field when we are working in the field, we have to place our final solution on these concepts. Whatever final solution may be entirely different. So, what we will do now? We will talk about these methods 1 by 1.

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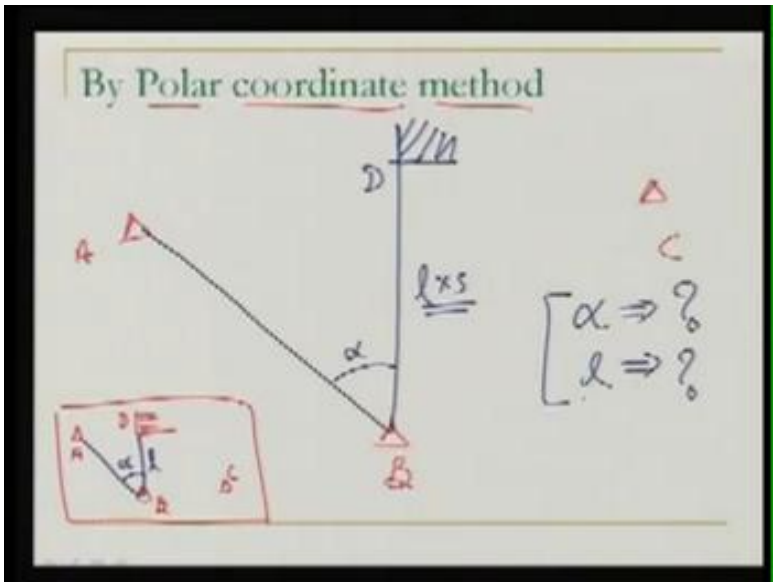

Well, we start with this polar coordinate method. Now, what is the polar coordinate method? In polar coordinate method if we have the controls A, B and C and here we had the map, on that map A, B and C are there. There on the map, there was a building corner let us say this is the building corner D. And this building corner needs to be established there on the ground. So, what we can do? I can have a reference line, and from this reference line, I can observe the angle, I can measure this angle alpha and also I can measure the distance l.

So, this is the polar coordinate system over here, and what I do now? In the field I go to that reference line BA and from that reference line we will set out angle equal to alpha and then on that line alpha we will set out the distance l. Of course, this l will be multiplied by the scale, because we are working in the field the scale of the map. So, this is the point D, and this is the first corner of our building, which had been set out now. So, this is the method which we say polar coordinate method. What we observe here in this case we had to set out angle and as well as length. So, the question comes now. How to set out angle and how to set out the length? What should we do? What are the methods for this?

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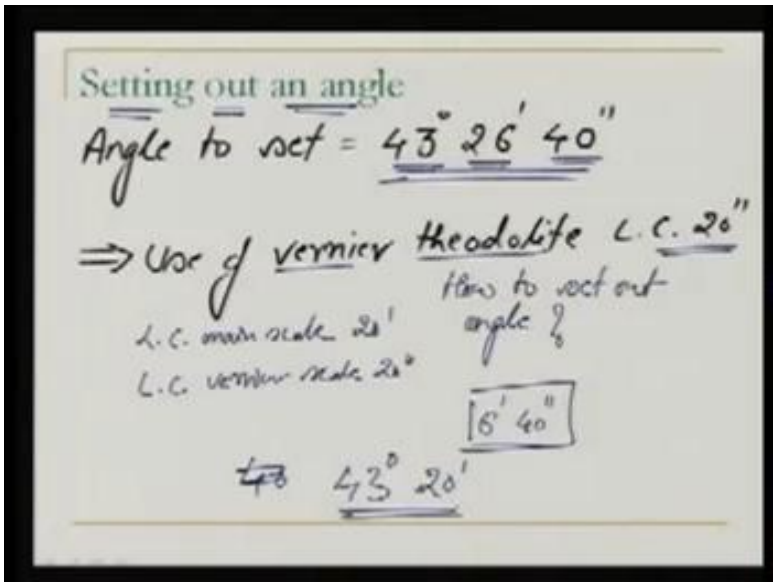

We are going to now, discuss about the setting out of angle. I give you one example, let us say the angle to the set is f 43 degrees 26 minutes and 40 seconds. And we have a vernier theodolite, which has a least count of 20 second. How to set out this angle? Well, if you remember, when we discussed the vernier theodolite in case of vernier theodolite there was 2 scales the main scale which was there in the bottom. And the vernier scale in vernier we had vernier A and vernier B and that is the main scale, which is graduated from 0 to 360. When we rotate this vernier, along with this vernier telescope also rotates, and the angle value changes.

Now, the vernier is used to read in sections of or rather in with the least count of 20 second. In the main scale if you remember in the main scale we can read upto 20 minutes, the least count of the minute scale is 20 minute. So, keep that in mind, the least count of main scale is 20 minute, least count of vernier scale is 20 second and this is the angle which we need to set out. So, the procedure for this is first of all in our vernier, we look through the eye piece, and in our vernier we will set out an angle of 6 minutes and 40 seconds. So, this is the angle which is set out in the vernier. Initially for example, in this problem itself initially, when we are looking in this direction the reading is 0, 0, 0 that is the reading.

And now, we set out in our vernier 6 minutes and 40 seconds now, what we do? Next rest angle that is 43 degrees and 20 minutes. This we change or this we read or rather we

rotate now, our telescope, because you already the 6 minutes and 40 seconds angle is already rotated. So, now, we rotate our telescope. So, that the angle on the minute scale is 43 and 20. So, the total angle that will be set out is 43, 26 and 40. But this is an you know not very difficult thing to do, but there may be a rather little difficult, situation.

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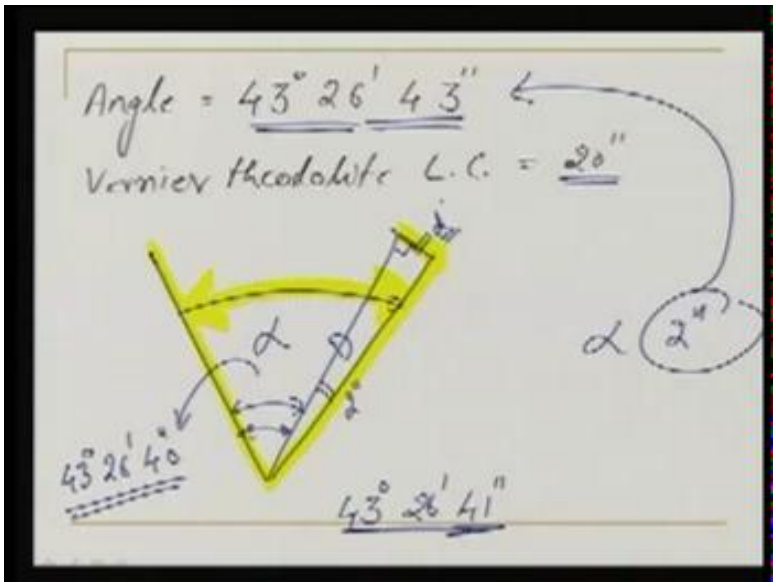

When the angle that we have to set out is, not in multiples of least count over here the angle is 43 degree 20 minutes and 43 seconds. When it was 40 it was fine, because the least count of vernier is 20 seconds. But now it is 43, we cannot set out 3 seconds with this instrument, because its least count is 20 seconds. So, what we do? Well that is our reference line, from this reference line first we set out the angle as we just discussed, which is 43 degree 26 minutes and 40 seconds. That is the angle, which we set out and it is possible to set out this angle.

Next what we do? We again, observe this angle by repetition method, though we have set it out, but naturally there will be some error. So, what we do? We observe this angle again by repetition method and let us say by repetition method. This angle comes out to be 26 and 41 seconds it is possible. Though we had set out 40, but it is possible that by repetition method the exact angle, which is there is 40. So, this is the angle this is the angle 43, 26, 41. So, our angle alpha here is less by 2 seconds from our desired angle. So, what should we do? Because we cannot set out 2 seconds, well for this length if I draw a perpendicular here.

And I know this angle D, you can compute what should be this distance d small d, because we know this angle is 2 seconds. So, if it is so, I can compute the distance d, and what we can do? We can set out the angle now in such a way, that our actual angle becomes the angle between this line. And after setting out this distance we get a point and we get this line. So, our actual angle, which we wanted to set out is, this angle. Again if you want to be more accurate, we can further measure this angle by repetition method in order to know, whether it is within the permissible limit or not.

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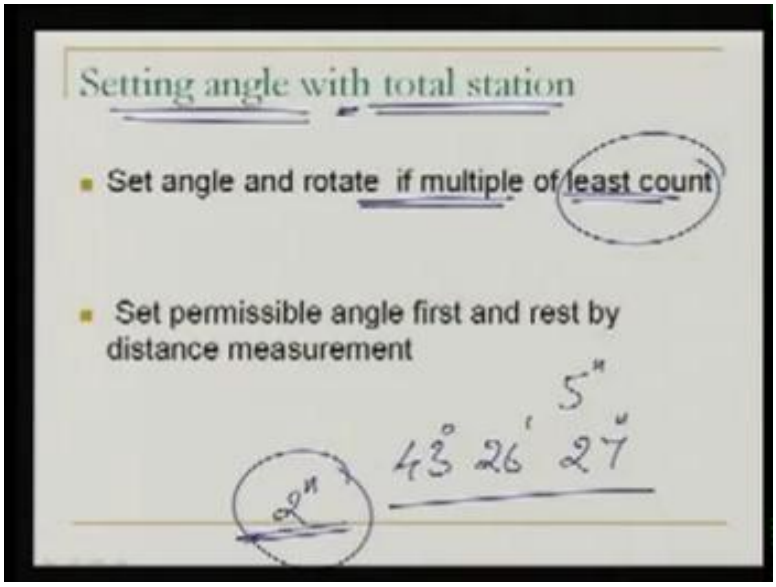

Well in case of total station, what will happen? Total station does provide more facility for reading and setting out the angle, automatically. So, if the angle is in multiple of least count, we can set the angle in the total station and the total station will automatically take that much rotation. So, we can set out the angles that way, in case of the total station. However, here also if the angle to be set out is smaller or rather I should not say smaller, rather the procedure of the angle is not or rather the angle is not the multiple of the least count. The better way of saying it, the angle that we want to set is not multiple of the least count. The least count is for example, 5 second for a total station, but the angle to be set out is 43, 26, and 27, that is the angle which is to be set out. So, we have set to do something in order to set out this extra 2 seconds. So, what we will do? Again we will go by this particular method and that particular angle can be set out. So, this is about the angles now, we will see how can we set out the distances?

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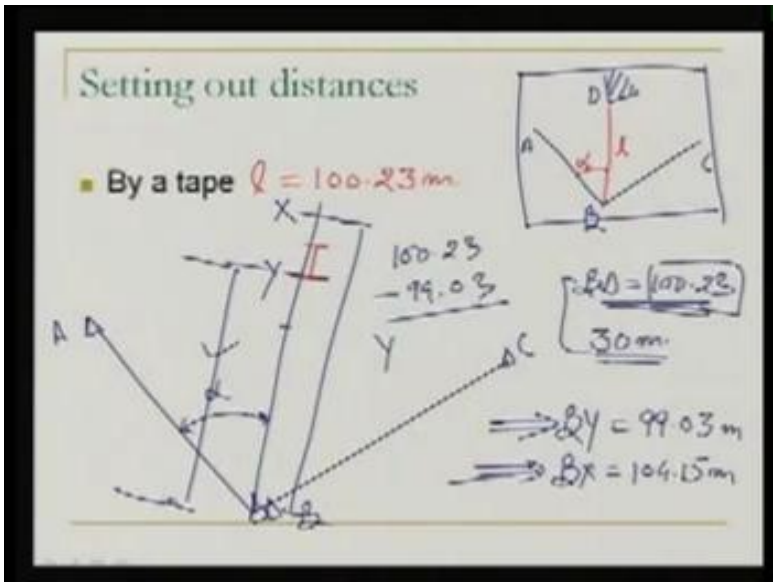

Because if in a map, we are setting out this building corner, this is D with reference to A B and C control points. And how we are doing it? We are doing it by polar coordinate method, where we are observing this angle alpha and the distance l. So, this distance which we have to set out is 100 point 2 3 meter now here, on the ground let us draw the ground here. Now, well there on the ground this is A and B and C are there this is the point, where the B is and we have already set out our angle alpha.

So, the alpha angle is somewhere, in this direction. Now, what we need to do? We need to fix a points here, somewhere we do not know where? So, that the distance BD is 100.23. Now, how to do it? We have a tape of 30 meter length now, with a tape of 30 meter length setting out this distance. What we can do? I can observe 30 meter, 30 meter, 30 meter and then I can ((refer time: 35:32)) tape and further I can measure the rest of the distance that is 10.23. So, 30 meter plus, 30 meter plus, 30 meter plus 10.23, because I cannot set out this full distance in one go I have to do it in these little parts.

Well the better method of doing this, how we do it? Actually, the better way of doing this, we can make a guess, well my distance, my point D, should be somewhere between these 2 points. And we say let us, say these 2 points are x and y the our point D, should be somewhere in between these 2 points. This is you know, we are making a guess and a server has to be always good in making these guesses. It is these are required in the field after making this guess, what we do? Measure we measure the distance By and Bx. let us

say the By distance is 99.03 meter and the Bx distance is also measured. And it is 104 point 1 5 meter, these are the distances which are measured.

So, what we can do now? Because when we are using the tape, chain in any case we have to apply the corrections also. So, we can apply now, our correction in this entire length of By as well in this entire length Bx, and we can have their corrected value. What is the corrected value? Of this length as well as of this length, once we have done is I know, the length upto this is a certain value. So, my problem is reduced now, to set out only a little distance this is 100.23 minus 99.03 from the point y. So, from the point y I will set out only a small distance.

So, if at all there is any trial and error all those problems, they are fully small distance and we can avoid also applying correction for the small distance. So, our rest of the distance has all the corrections properly, applied and this distance is then finally, measured. So, what we have done? Our distance which was large distance of 100.23 meter order has been now, reduced to the measurement of a distance which is of 2 3 or 5 meter that kind of order and, because it is easier to do any trial and error, any putting on the tape. You know all those things for a smaller distance, then for a larger one. Now, in case of EDMI.

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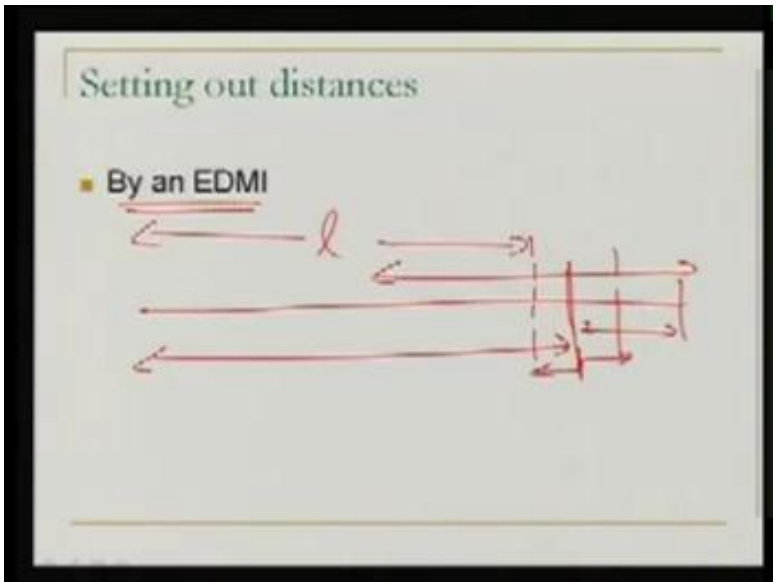

Generally, there will be facility, because we have seen the EDMI in EDMI. I have got EDMI or in my total station as the target moves. So, when the target is moving the EDMI

continuously shows us the distance. So, again here also we have to make a guess starting from a point, we have to set out a distance naturally, what we would like to do? we would like first to observe the distance. Whatever is the diatnce, we would we would not like trial and error in the entire stretch rather, we will limit the trial and error for this. And once we have observed this, distance we know we need to move in this direction or in this direction and then accordingly that point will exist at the distance l as desired.

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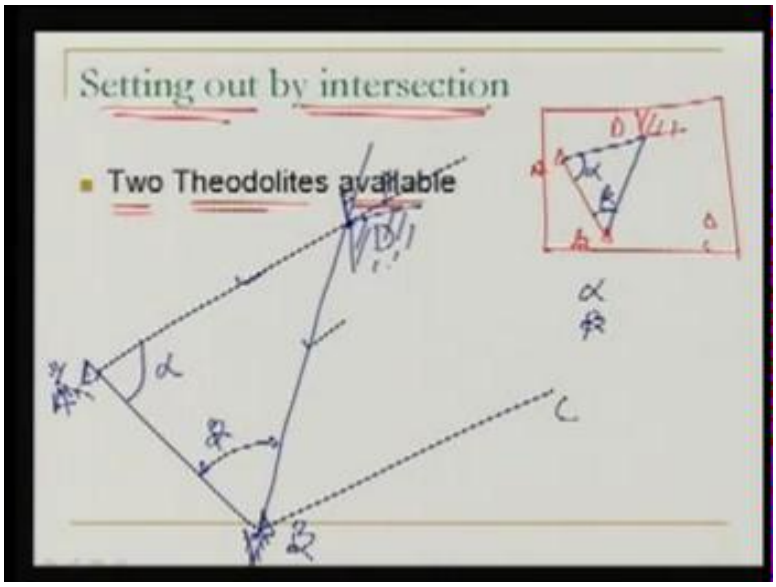

Another procedure of setting out, because the first method, which we discussed was by polar coordinate. And the second method, which we discussed, is now, by intersection, now in the case of intersection. What we are doing? If we have 2 theodolites well again that is our map in the map the point D, and these are our control points A B and C. Let us, say that is the base line, which we choose and from this base line, we find the angles for this point. So, what we are doing now? Intersection means, we are setting out by 2 angles not by one angle and one distance rather we are setting out by alpha and beta alpha and beta. So, this is why we say this as method of intersection.

Now, if you have 2 theodolites available in the field this, becomes a very straight forward process A, B and C we keep our theodolite at A and at B both. And then at A we set out from B A and angle equal to alpha. So, this angle is set out as alpha and now, this theodolite is looking in this direction. While at B we set out the angle beta from line BA and we are looking in this direction. Now, someone here moves with a ranging rod and

the movement this ranging rod is bisected by both of these theodolites or the line of sight is there. Because someone is looking from these 2 theodolites and once this ranging rod is bisected by both of them. So, that is the point which is the point of intersection or our point D which we wanted to set out. So, this is the method of if we have the 2 theodolites.

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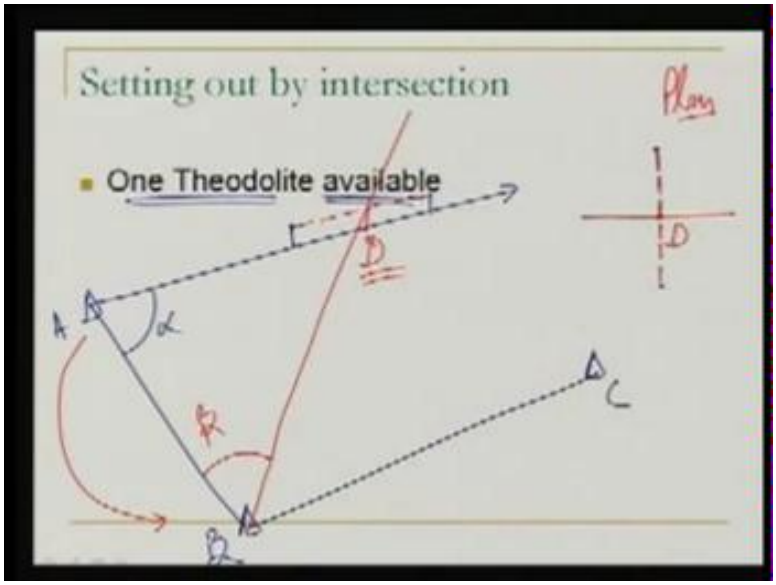

Well if we have only 1 theodolite then in that case, what to do? In that case and that is again this is A, B and C our control stations, and we want to set out a D which is somewhere in this area. This, what we want to do? Well from A let us say we have only one set theodolite. So, first what we will do? From A we will set out the angle alpha. So, the alpha angle is set out and this is line of sight. Now, in this line of sight again, we can make a guess that my D, point is somewhere, in between this point and this point. So, what we do? We put 2 packs here, and then on top of these 2 packs we have a thread stretched. So, over here we have a thread stretched, if I show this thread by red colour, this is the thread which is stretched.

And here also let us, say between these 2 points this is the thread, I am showing this in plan here. Then we move our theodolite to second station and from there, we set out the angle beta. So, our setting out, this angle beta, that is the line of sight. So, where this line of sight intersects, the thread the corresponding point on the ground can be found. So, this is the line of sight and this is the point D. So, that is the point D, which can be

located now, on the ground. So, basically what we are seeing here? You know depending the field condition, depending the availability of the instrument; we have to change our method. Next one more approach we will see, and this is the approach which say in, which you are making use of the grids. We will see the concept of the grid, and how we can make? Use of the grids.

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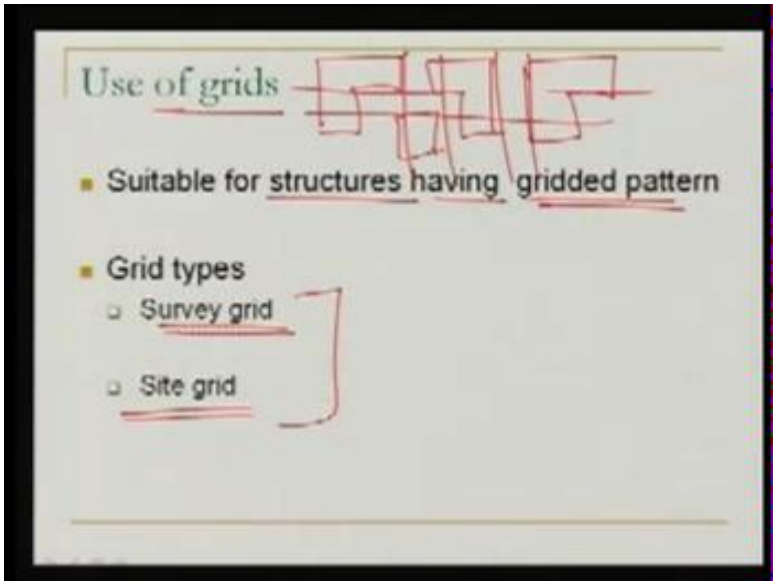

And these grids are suitable for structures, which are having gridded pattern. You know may be a building, which are the gridded pattern, which can be set out easily by the making by making use of the grid. Because this, appears as if there is a gridded pattern here, in the building or its walls or its structural elements of the building. We have 2 types of grids, which are used for setting out they are survey grid and site grid. Now, what these are and how do we make use of this?

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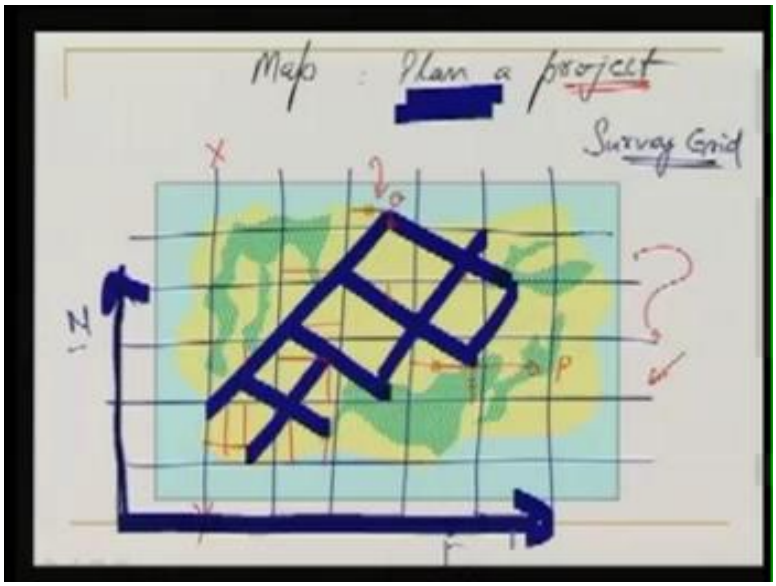

Let us say again we have a ground here, and on this ground our project is planned. So, naturally, if the product is planned here the project that is planned is we want to have a town over here; a town is to be set out. So, first of all the very first step is that we would like to make a map of this entire area. Now, we have the map of the area ready, with us and on this map we would like to plan our town, let us say a decision has been taken. So, that the main roads of the area or the town, are like this is how the town is being planned and so on. Similarly, the other facilities in the town will be also planned here; once this town has been planned, we would like to take this town there on the ground.

So, right now, we are seeing how we can make use of survey grid? Survey grid means, a grid which we can lay on the map. And which is also parallel to the main coordinate system of the map. For example, this is our map here, I can put a grid on my map sheet a grid like this, so, the grid which is parallel to the easting, and northing in case of this map is the survey grid. Now, this particular project can be referenced, with reference to the survey grid the various points of the project can be measured or can be located with reference to this survey grid. So, next in the field what we do?

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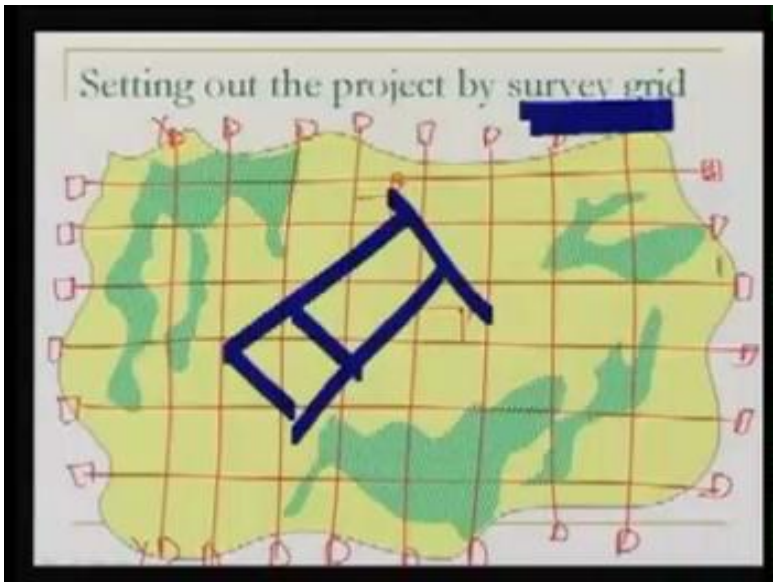

First of all, the job will be to transfer this survey grid, the very first element of survey grid. let us say this line is X and Y and first of all, we would like to establish this line X and Y there on the ground, and then complete rest of the grid. So, there on the ground the rest of the grid is being completed similarly in this direction. So, basically what we have done? The survey grid which was formed there on the map has been now transferred onto the ground. And when I say it has been transferred on the ground the meaning, is we have some control points on the sides of these lines we do not have lines there on the ground. Because these lines are not possible putting lines like this on the ground, rather we have some stations and joining these stations, we can complete our grid. And similarly, on this side you can just think that as if this ranging rods are put on these points. So, the survey grid has been laid now. Now, our project this our project which we can map, its offsets from the survey grid.

A various important or the salient points in the design in the project, we can find their locations with reference to the survey grid. So, now, we have to set out only these 2 little distances in the corresponding grid. So, in the corresponding grid I set out these 2 distances, so, I have the point x or the point let us say this is the point P, on my design on my road network. And this point P is set out here, similarly, any other point for example, let us say a point is here and this point is Q, and this is in this particular grid. So, by knowing these 2 offsets this point can also be plotted here Q. So, similarly we can set out the entire project in this area. So, what we did? We made use of a grid, which is parallel

to the easting and northing directions as in the map. So, this is why we say this as survey grid.

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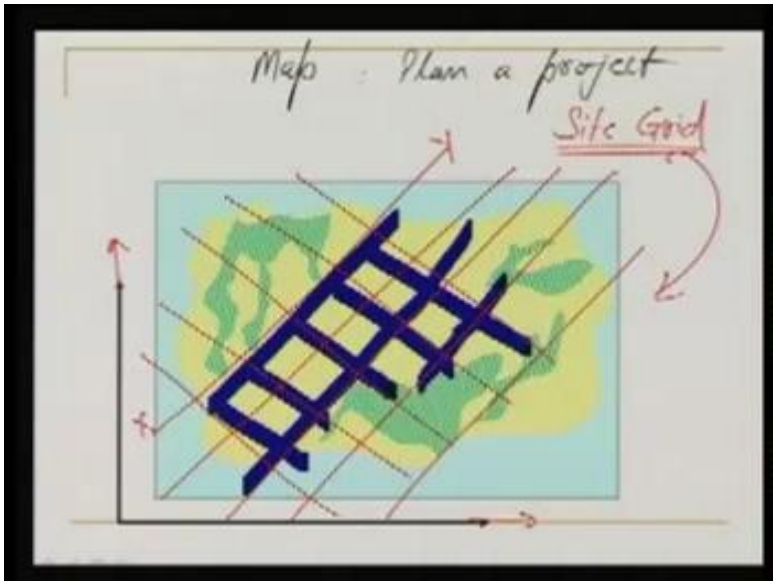

With a second, we would like to make use of now, site grid. What is site grid? Well the project which was planned here, is this is the project, which was planned it was decide to have the road network like this and now, we want to set it out. Let us say this is the project which have been planned. So, what we can do? Instead of having a grid which is parallel to the easting and northing, you can have a grid which is parallel to the project because the project has some cardinal directions. For example, this direction I had my X and Y here and then I develop a grid system parallel to the, if this is the grid pattern. So, now, we have a new grid system at this grid is a site grid, site grid means, a grid which follows the principle directions in the project, because in my project these are the principle directions. So, we have developed a grid on my map which follows the principle directions of the project. So, now what we do? Next these principle directions of the project.

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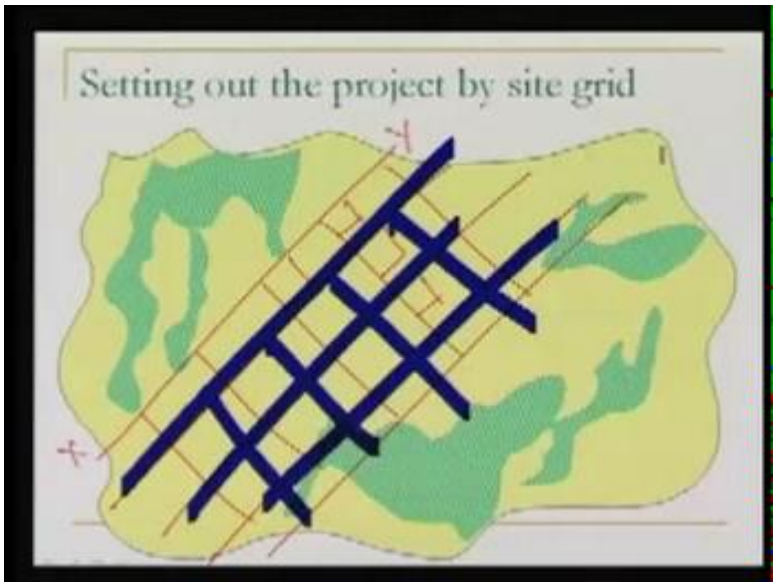

We first transfer onto the ground. So, very first X and Y which are here X and Y these are transferred on to the ground, and then we complete the grid. So, the grid is completed, well this project is also observed rather no, we can set out the various salient features of this project with respect to this grid, and this is now easier. And similarly, by mapping these various offsets, we can then set out our project here. So, basically in this case the advantage of this site grid is, because it follows the cardinal direction or the main you know principle directions of the project. So, measurement of the distance is, it is becoming easier now, because we are measuring in the direction of the project. So, this is the other method of setting out a project, mostly these method, the grid method will be used when the project is of gridded pattern. You know I gave you one example of a road network, it could be an example, of a building a building which is gridded.

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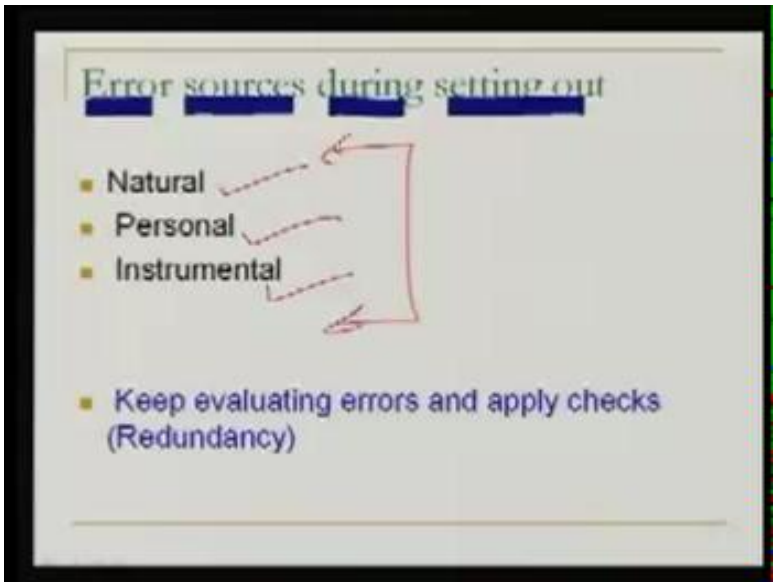

Well having seen this, now, we would like to see some error, the error sources in setting out. He error sources are same what we have been talking? Earlier also, the error could be natural, you know when we discussed about the surveying. We talked about the various errors, errors which may occur, because of the weather. Which may occur, because of the, you know there is rainfall or the temperature is too low or too high. So, there are errors which are coming because of nature. Then second is personal, the person who is doing? The setting out, he also influences the accuracy, third is instrument.

What instrument? You are using is it adjusted, is it levelled you are using the theodolite to observe the angle, but that is that theodolite properly set or adjusted. And if you are observing the angle only in one face, that is not right we should observe. Or we should set out the angles using both the faces, because we know the utility of both face measurement. So, these are the things, which we should keep in mind and always at average step we should keep applying the checks. We know the very first lecture or the second lecture we discuss about the principles of surveying. So, similarly, here also we need to apply the checks and the redundancy.

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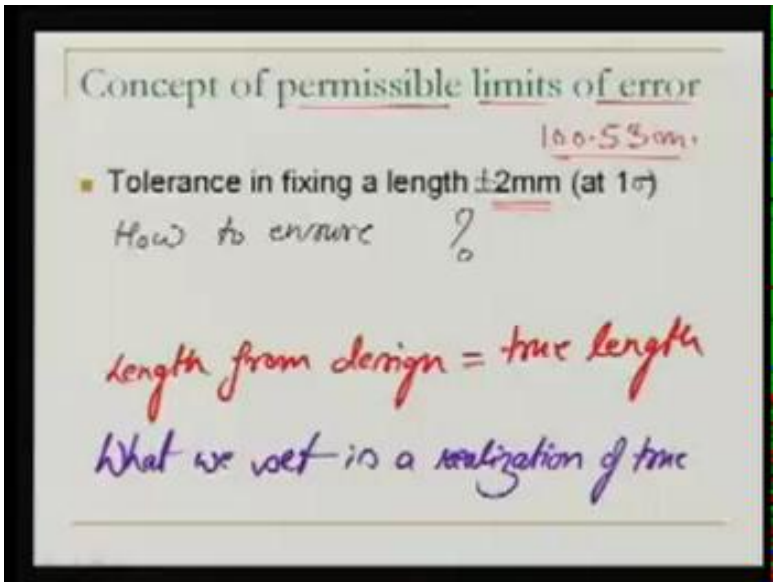

Finally, we would like to see always in a project, you know something which we observe from the drawing sheet. In our drawing sheet, in our drawing board the project is planned or rather it is in the computer you know, within the micro station within the auto CAD or any other system the project has been planned there. I take a distance from there, 100.53 that is a true value, which is coming from the drawing sheet, which is coming from the computer.

And now I want to set the distance there on the ground, well I cannot set the distance exactly, because that distance for example, is 100.53 meter. Can I set exactly 100.53 meter no, because while we are doing the setting out, we will introduce some errors. So, always there is some tolerance, you know when we are setting out, we should know what is the permissible error? In this case and depending the permissible error if the permissible error is 2 milli meter at 1 sigma, then what we will do? We will.

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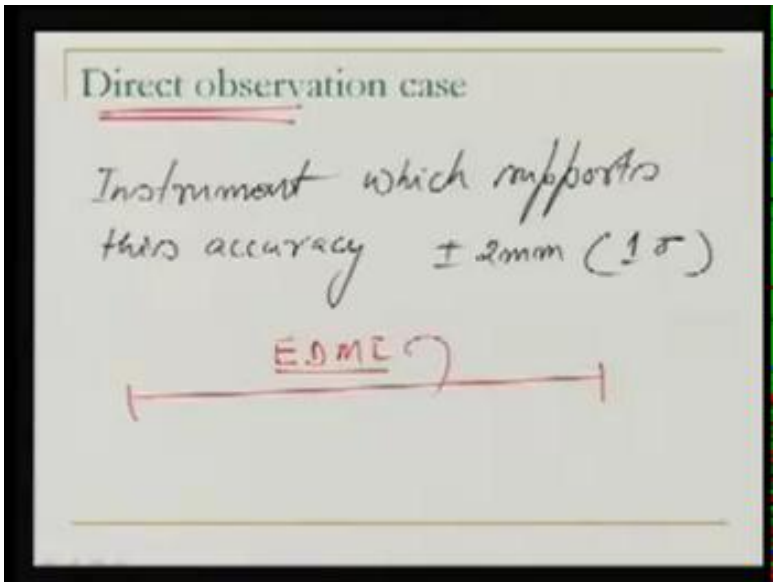

If we are taking the direct observation, you know for example, we are measuring a distance using an EDMI. It is a direct observation, if you are doing a direct observation we should go for an EDMI. which supports this accuracy, if you are doing the indirect observation.

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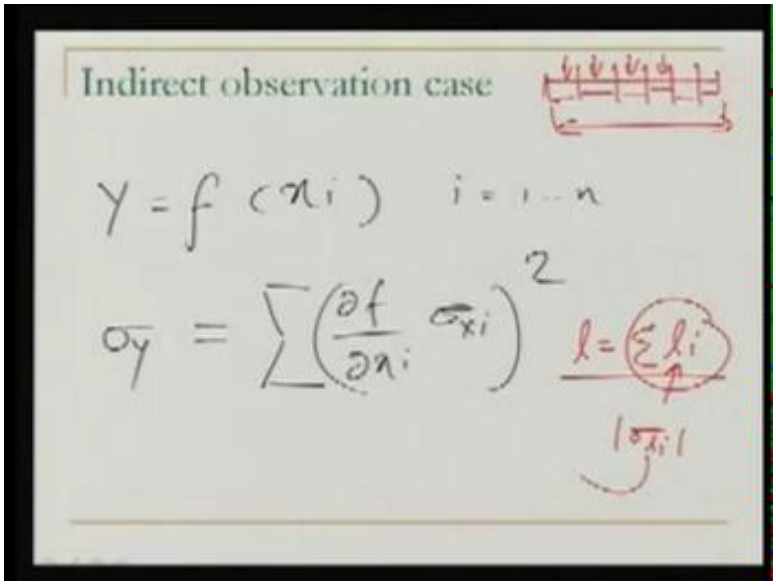

Indirect observation means, in order to determine a length we are measuring the various parts of it, and then we are finally, summing it out. So, what is happening? The error here, the error here, the error here, the error here all these errors, errors in included here.

They will finally, propagate, because our final distance l is sum of all these individual components sum of all this distances. So, there will be error in each component. So, when we sum all these distances the error will propagate. And we will be there finally, in l and we know if we have a case of indirect observation, how the error will propagate? We know this relationship. So, there may be cases when we are doing setting out by indirect observations.

So, what all instruments we are using? And what is the accuracy that these instruments can give, and then finally, how all these observations which are carrying out? Are being utilised you know function I am writing y is a function of x. What is this function? Then accordingly the error will propagate, so, we can do the computation. So, by doing this computation we will know, whether we are working within the permissible limit or not. So, this is important. So, what we saw today? We saw the basic concepts of the setting out, one important thing whatever we have discussed here, some of the methods they are just conceptual things. there in the field the solution will be entirely different, but yes these concepts are important.

Thank you.