Digital Land Surveying and Mapping (DLS&M)
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Lecture - 37
Detailing of Digital Land Surveying

Welcome students. This is the 37 class on Digital Land Surveying and Mapping. In today's class I am going to discuss on how to collect detailed objects of features on the surface of the earth for digital land surveying work. Now as you know that digital land surveying all the detailing we do collect by making use of a total station and total station using reflector or without reflector can be used for collecting the different details like objects or heights, spot heights that we will like to get information to be mapped in our topographic map.

As, I have already discussed that in case of reflector less total station, the distance of the objects will be limited. So, if we want to go for objects which are near the total station then we can go for reflector less mode, but if the objects which are far off then we can we have to go with reflector. Another thing to use reflector or reflector less the visibility between the station and the object should be free; that means, there should not be any obstruction in between and using total station both accessible as well as inaccessible objects can be mapped or detaining of accessible and inaccessible objects may be obtained by using total station.

Now, you obtain the total detail about the objects of features present on the surface of the earth. We easily make use of two methods one is called method of radiation, another is called method of resection, so I will start with the method of radiation.

Now, we know that suppose I have an object here which is a tree, now I want to look at that object. So, what it is required minimum two station points which we are in need to help, so that we can get a baseline or line horizontal line between these stations A and B and we need to know the direction of this; that means, bearing or azimuth of this line.

So, for any detailing work we need to have the location of at least two stations or control points or known points and as I have discussed already in the last class that establishment of control point. So, using GPS we can get the location of these points as well as we can get the; this line length and its azimuth length and azimuth we can get from our GPS observation. So, from that now if I want to know where these object is this tree then we will be need to have the distance of this object and the direction of this object.

So, distance and directions are the two parameters which are required to locate the object at A, at P and also if we want to know what is the height of the point P then also or the RL of P RL of P we can also find out if we know the height of the instrument and height of the reflector that has been placed on it. Vertical angle measurement and height of the instrument and height of the reflector we can also get the height of the point P.

Now, suppose this is the line this is the point where we have set up our instrument and this is the point P, where we have set up the reflector height of that point A known then height of the point P we want to find out. So, that can be done this is the slope distance between these two and this is the vertical angle beta. So, if we know the height of P will

be able to get it from height of A plus height of the instrument plus that vertical distance l sine beta. So, I got this up to this much than minus h of the height of the reflector, so from in this way height of the point P can also be determinate. The coordinate of the point X and Y can be r cosine of theta and r sine theta, so this is our X, this is our Y.

Now, if this is north direction and perpendicular to this is east direction then this X and y can be converted to our north and east also. So, these can be converted to north of the point P and east of the point P, so this is the fundamentals behind how we can get the location of the point P from the coordinate of the point A and B. Now here you can see that we have to measure the vertical angle, we have to measure the slope distance and the the base of this slope distance l cosine of beta is nothing, but our r. So, r from this we can get and theta is the horizontal angle, this is the horizontal angle, so horizontal angle vertical angle slope distance. If we can measure these three, from these three we can get the coordinate of the point P north, east and height.

And already we know that we using total station we can measure this parameter, so and this parameters if we after measuring the total station is having the software which will automatically convert it to the coordinates. So, now we can get the; we can obtain the location of any objects or points a digital format using total station, so total station will be used in our digital land surveying and mapping.

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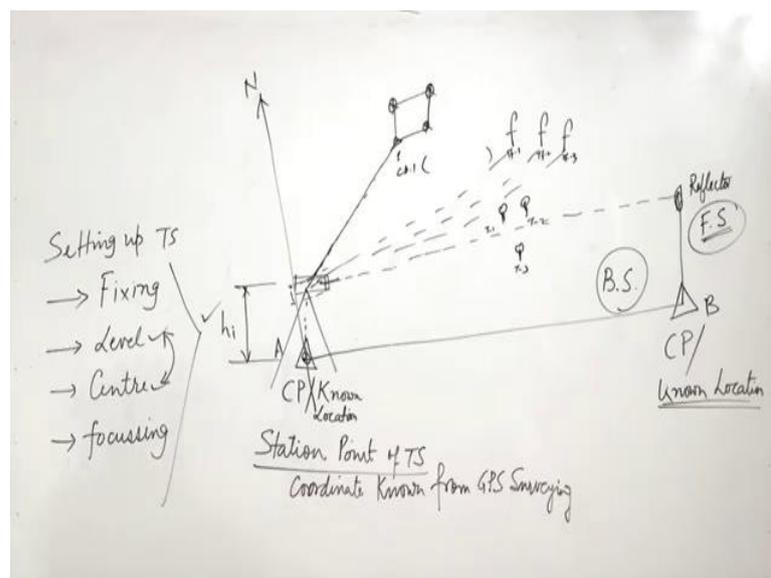
We have to have the two control points whose patience are known and the control point should be intervisible this is the first requirement; two control points control point or known location A and B, another control point or known location B. So, these A and B we can get from our GPS observation, so from the GPS we will establish these points A and B which are intervisible.

Now, what we will do? We will set up our total station on this point A and now already we have learnt that the setting up of total station consists of fixing the instrument on the tripod stand and then we have to level it, then centre it and then we should focusing the object. So, these are the four operations which involved in setting up of the total station, now the point levelling and centering are very important and they are done generally iteratively. Now once these instrument has been set up on the station whose coordinate is known then we have to fed that location to the total station; as the location of the station point, so station point of total station coordinate known from GPS surveying.

So, once the instrument is set up for first then we will also note down the height of instrument. So, we should note down the height of the instrument there is a notch on the side of the instrument and along the notch what is the height from the (Refer Time: 11:53) instrument station location that we have to note down. Then we will take the reflector on a (Refer Time: 12:03) and the height of the center of the reflector from the pole point, we should know what is the height of the reflector.

So, these height of the instrument and height of the reflector we should note down and record in the total station because there are appropriate places where you have to record it. Next class I will demonstrate this working of this total station in finding out the in detailing the object there I will show you all these thing or we should focus the instrument to bisect the reflector.

Now, this is called back sighting, so the back sight who has to be taken on a point whose location is known. So, and once the instrument will bisect the reflector then it will ask for the coordinate of the back sight point, so in that we have to fed the known location. So, this is the first thing we need to do for starting the work with total station for carrying out for that detailing. Now once this is done then the software inside the total station will do necessary computation to find out the azimuth of the line A, B and by finding the azimuth of the line A, B means it will automatically decide the north direction.

So, now these we can use for finding out the location of any object or detailing like I have this telephone lines then some trees are there then a closed area. So, for each of these, what we have to do; we have to take the reflector at this point first I will place it and then we can bisect the object and we should give some name of the feature like corner of the building C D 1 and then we can write in the software in the data collected itself that it is the corner of the building, then we can take the corner of these, these, these by placing the reflector at this points.

So, once it is done then we can go to our telephone lines, so we can say as t f 1, t f 2, t f 3 like that and we can go on bisecting these like this we can bisect these.

Similarly, we can go for t t 1, t 2, t 3, so we can go on bisecting this. So, in case of total station whenever generally we collect the data throw the data collector, so the records of the data has been placed in the inside the computer, inside the data collector automatically. Now in such cases generally we should prefer to collect the similar type of data in a single go that will help in future for the mapping work. So, in that way now we can go on taking the reading or go on taking the data for all the details that we will like to have from the field.

Now, once we are satisfied that the data has been taken is ok then we should shift our instrument to some other location then before shifting the instrument to other location, we should again take the foresight, we should take the foresight on the point where back sight was taken. So, this is one thing we do generally observe in the field to get or to know if there is an error in carrying out our work or not and some check in future we will be able to do.

So, in that way this is called the method of radiation; that means, for every time we are sending a ray of light through bisect or from the reflector to come back or to reflector and to find to get the object location. So, it is called the method of radiation and the fundamental behind how method of radiation is useful for locating the object you know in planimetric position or its completing the height already it has been discussed. So, we can do the work in this way; idea about how we go for delineating the object inaccessible area.
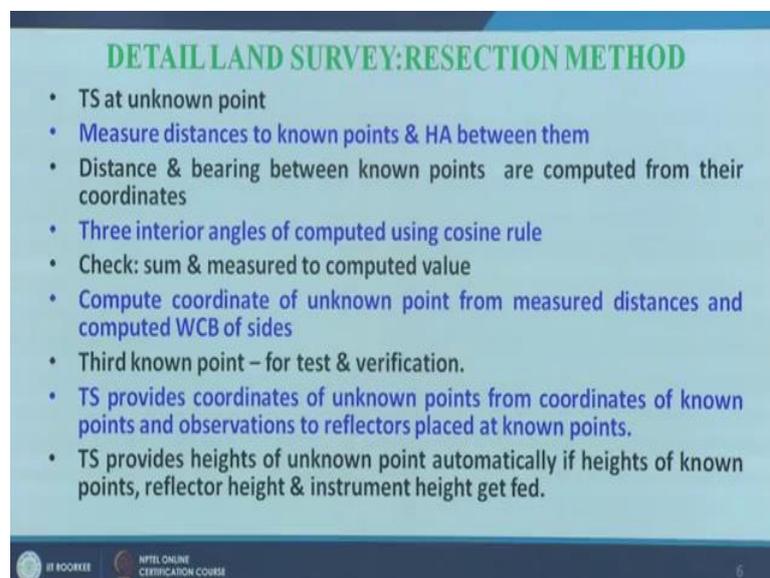
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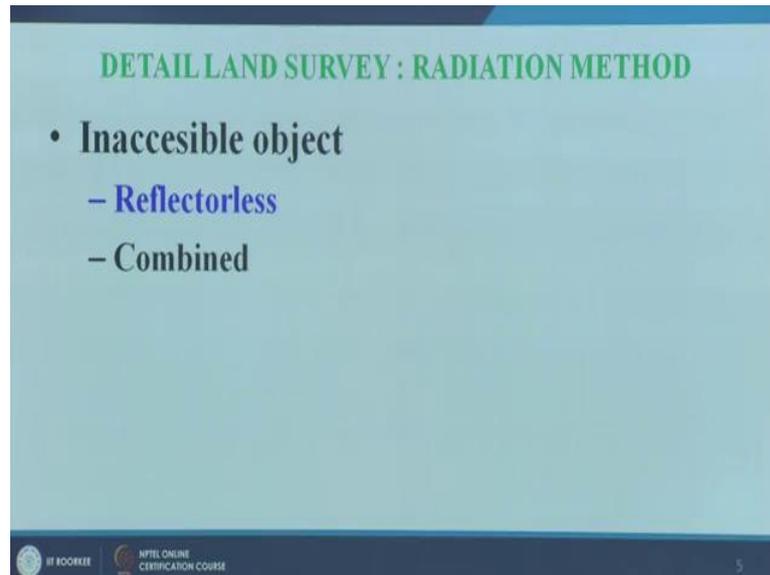
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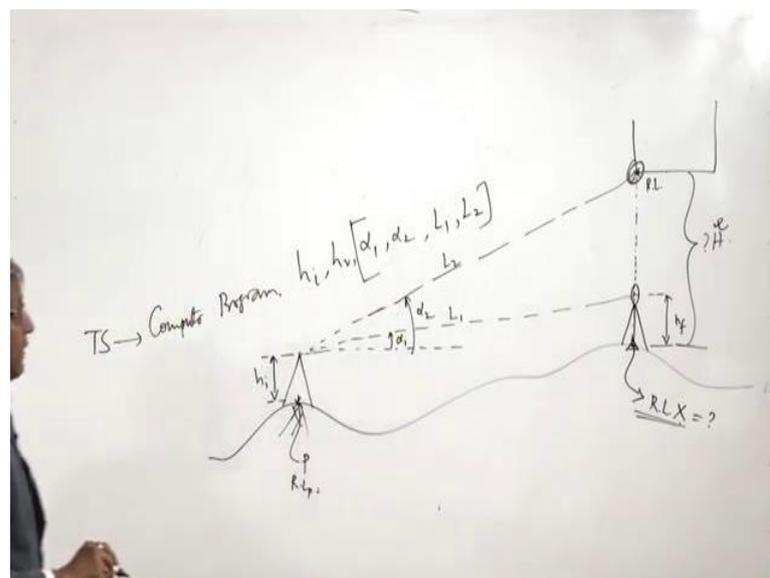
Now, suppose there is a beach (Refer Time: 18:09) is there, so and this is the terrain, so how to find out the height of this. What we have to do? We have to set up our instrument somewhere here and we should try to place our reflector exactly over it and then first we should hold our instrument and we should find out the RL of; suppose this is X how much. So, already I have discussed in the last class in my last discussion that if we know the RL of the point P suppose RL of P, then from the height of instrument then height of the reflector we will be able to get the height of the point X.

Now, what we need to do we can now from this angle and this angle as well as this L 1 and this L 2 by making use of our trigonometrical knowledge we can get the RL of this which is not accessible. So, inside the total station there are computer program which takes height of the instrument height of the reflector then suppose it is alpha 1, alpha 2, alpha 1, alpha 2 this alpha 1, alpha 2 and then L 1, L 2 it will be able to measure and from all these parameters using the trigonometry they will be able to find out what is the height of this point about this point height. So, by adding the RL of this point with this height, the RL of this point it can provide, so all these thing total station does automatically.

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Now, apart from method of radiation there is another method which is very important in carrying out the detail.
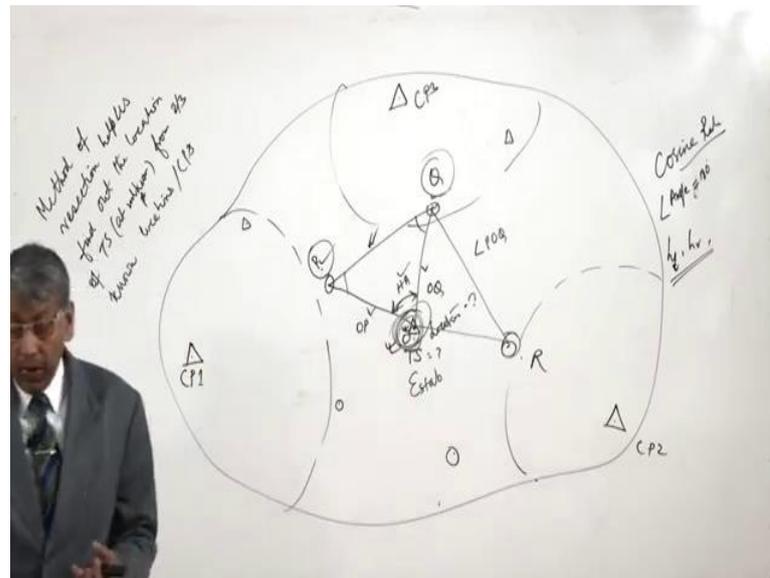
Now, in the method of resection there is a big area; suppose there is a big area and we have some control point establish using GPS. In case of resection method, it is usually it is the 2; minimum 2 and 3 is a required and if it is more than it will be preferable. Now sometimes or we may have some control point C P 1, C P 2, C P 3 which may not be intervisible. However, there may be some location somewhere from which they are visible.

So, in those cases or sometimes we may have surveyed some area using this some tower station, but there may be some area where we will not be able to see the control point, but there are some other point whose location has already been established. So, if we have some points which are known, whether it is control point or some point established from control points. We can also find out the location of our total station by using a method called method of resection.

Now, what is that actually in case of method of resection we want to know the location of this total station location. So, what we will do suppose this point on this point are known, this is P and Q correlate of this known. So, this the distance between this and their bearing is known, now if we place the reflector here then we will be and if we place the reflector here the length and the if you measure the angle; this angle horizontal angle. So, by placing reflector P and Q, we will be able to measure the distance; this is suppose O; O P and O Q can be measured and also angle POQ can be measured.

Now, these distance is known and these distances are known, so now from the cosine rule using cosine rule; we will be able to get the by all these angles as; so once you know the angles then we can check whether some of the angles are 180 degree or not; if it is not then we have to reach it our work and if it is ok if it is 180 degree then it is ok. Then we can also compare whether the computed value of this angle measured and the observed value is identical or not.

So, in that way we can get the length of this line and all these angles and then from the coordinate of P Q, we can get the coordinate of the point O and also if we know the height of the instrument, height of the reflector and also the height of the points P and Q then from there we can also find out the height of the point O, so in that way we can also locate or establish the location of a total station. So, the method of resection helps or you helps us to find out the location of TS total station at unknown point by at unknown point from 2 or a 3 known locations of the control points, so this is the main point. So, in that way we can identify the location of the total station or we can find out the location of the total station where it is placed and from the non coordinate of the total station then we can go for further surveying.

So, this is what it is written here that total station when a total station is placed at the point whose location is not known then how do carry out the detailing survey total station that is can be done by applying the method of resection to find out the location to establish the location of the total station and then for further it can be used. Basically two points will be for planimetric position and if we want to go for height also should go for the third points and also third point is to be used for verifying our work.

So, first we should work, so suppose P Q and R that are three points whose locations are known, so from P and Q we can find out the location of O then from Q and R, find out the location O and you have to check whether these two locations are identical or not; if not necessary measures has to be taken and if it is same then it is we can say that the location of the total station is correct then we can march forward to go for our further detail.

So, in that way we can find out the location as well as bearing of the different lines and direction. So, with this I like to conclude today's class and in the next class I will like to really demonstrate how in the field we do collect the data about different objects which

are accessible as well as inaccessible and some of them using reflector and some of them we are using reflector with this I like to conclude today's class.

Thank you.