Digital Land Surveying and Mapping (DLS&M)

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Lecture - 30
Contouring

Welcome students. This is the 30th lecture on Digital Land Surveying and Mapping. Today, I am going to discuss on method of Contouring; that means, how to draw the contour line from (Refer Time: 00:38) measurements.

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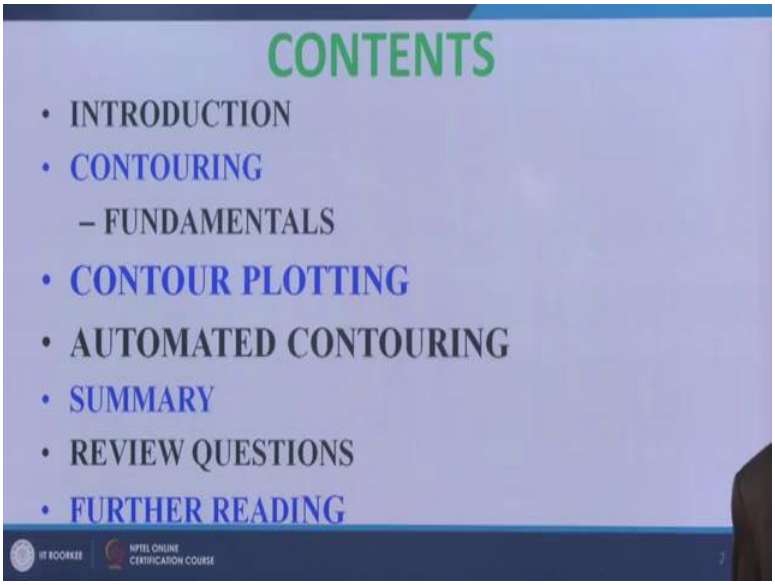

So these classes will be consisting of this topic; that means, to introduce what is contouring and what to do, how to do. Then fundamentals then contour floating automated contouring, because these are digital land surveying and mapping, so we will like to have everything to be done digitally. So, I would like to discuss at length how to go automatic contouring. However, the automatic method of contouring that the software does basically based on whatever we do manually. So, we need to know a little bit about the fundamentals, so I will be discussing these things.

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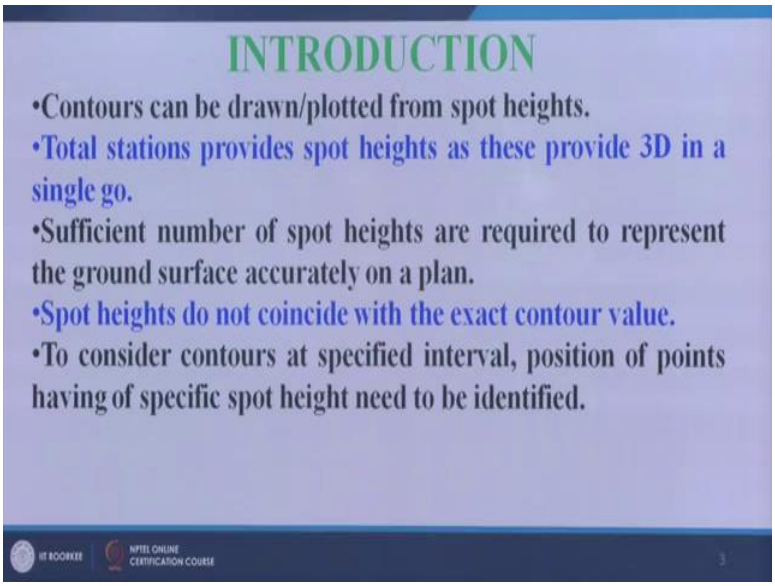

Now, contours as I have told in the last class are the line which defines or which is taken or drawn joining points of equal elevation. Now these contours generally we do get from the spot heights of different points which has been already plotted; that means, planimetric position of the points has been plotted in the map and those points are associated with some heights and then from those heights which is called spot heights of the points, we do go for contouring; that means, joining lines of having the same elevation and since the spot heights of points for contouring needs the planimetric location as well as high; that means, all the three dimension, so total station expected to be the best instrument to go for contouring, so because total stations provides spot heights in 3D in a single go.

Now you know because we want to draw the contours to represent the relief of the topography or the undulations or the change of variation of the topography, we need to have as many spot levels as possible so that the more number of spot heights on the surface of the earth now better we will be are accurately we will be able to derive the contours. However, the spot heights individually does not represent any particular contour, so we need to find out some method to find out the contour having some particular value or contours at specified intervals.

So, that is what we will talking over here, so drawing lines at some particular elevations all throughout is what is called contouring and as I already told that contouring needs

planimetric position of the points associated with its height and from but not planimetric position of points of spot heights as well as height or elevation of points or spot heights is spot height points.

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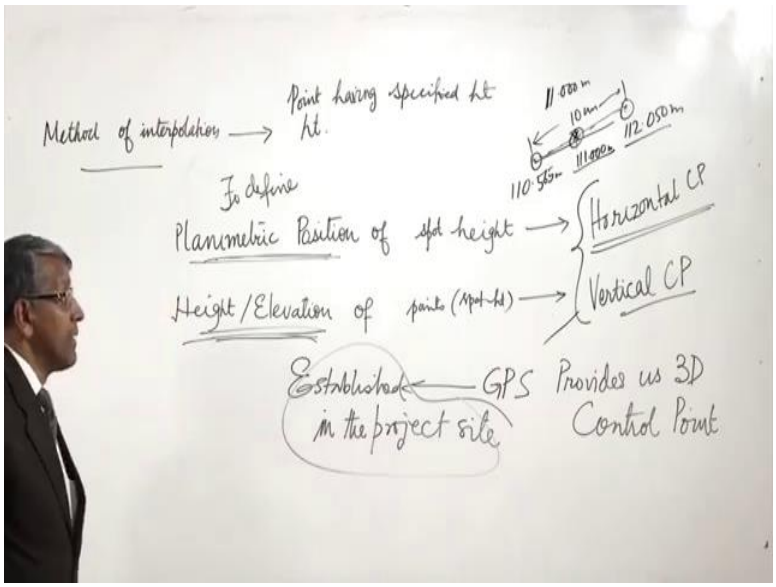

So, for this purposes planimetric position to define the planimetric position of spot height, we need some horizontal contour point in the map or in a area for which we want to go for the contouring as well as for the to define the elevation of height also we need vertical contour point, so contouring a needs the horizontal contour point as well as vertical contours point. Now the concept of this control points as separate that is of old concept, nowadays we can have the control point in a single go like using GPS, so GPS provides us 3D control point. So, and we like to go for GPS based 3D control point to be established in our project site and that control point, we will make use for our defining the planimetric position as well as height or elevation, so with this how we will proceed forward?

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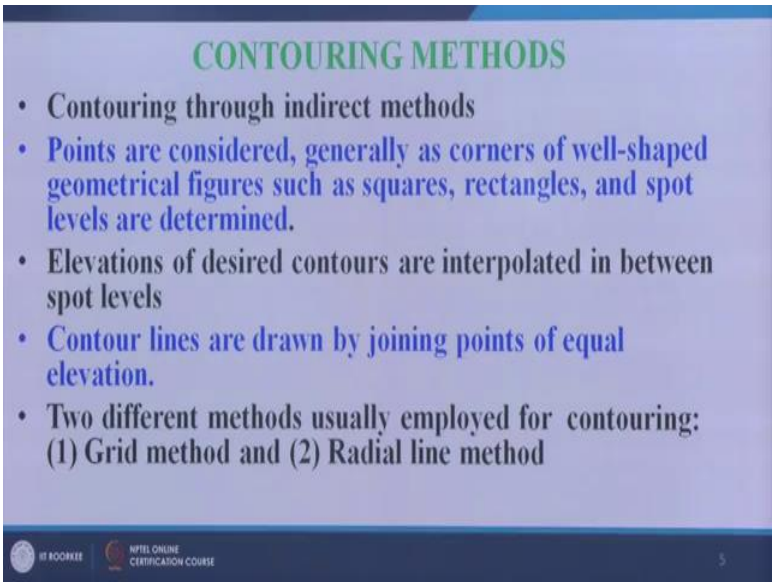

Now, contouring methods generally we do go for contouring by indirect method; that means, we will find out the spot heights as many number of points as possible or as visible or many other criteria on which we do and then from those spot heights having the specific planimetric location and height with aspect to control point we can go for we will go for drawing the contour lines by joining the points and interpolating in between. So, what are the interpolation method of interpolation which really we make use to find out the height is a; points of specific height points having specified height, we do find out in between spot levels suppose this is 110.565 meter and this is the 112.050 meter.

Now if we want to find out the elevation of the point having 111 meter, so I can say that this will be in between this because the basic assumption in that the line joining the two points having the uniform slope this is the assumption we do. So, now from this much of distance, suppose the distance is suppose 10 centimeter, the difference in elevation is about 110.565 to 112. So, we can find out where approximately it will be in location the elevation will be 111 meter.

So, this is the location are we infer that it is having the elevation 111, so in that way all we will have a number of points and all those number of points in between whatever contour lines we will like to draw in that map, we will try to see if any one of them in falls within that or not if it is then why it is. So, that is the (Refer Time: 09:02) basically the way how we do go for; another interpolation. Now before we apply interpolation

actually we should first know, we should first go for field observation in a particular way to collect the data and those data collected has to be represented in the map and then those by making use a method of interpolation, we will decide about the position of the points having our desired elevation then points having equal elevation will be joined to get the control line.

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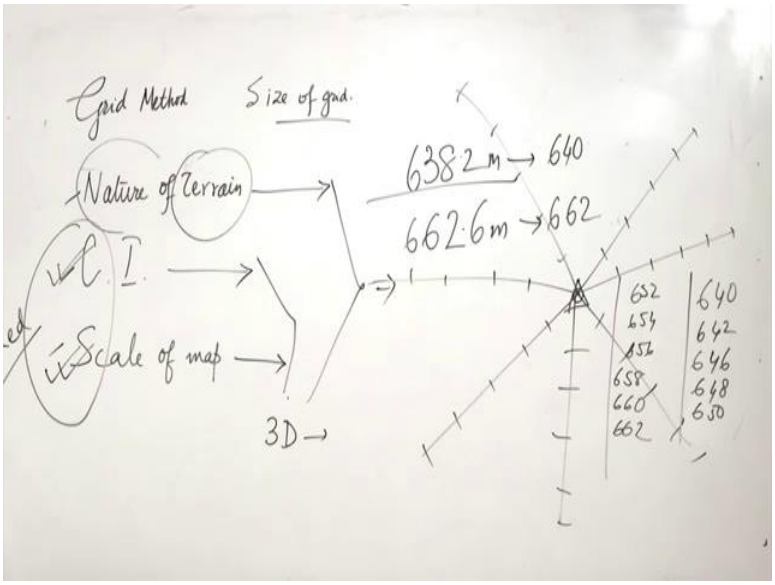

So, in a classical method generally we make use of two ways how these data has to be collected and placed in for mapping that is called grid method. Now under grid method what we do? We do take some of the height of a spot height of points at particular interval in grids. Now what is the grid size that will depend upon some factors like what is the nature of the terrain then contour interval required, so scale of map? So, these are the three criteria's on which the size of grid for having this (Refer Time: 10:52) heights will depend.

Now if the terrain is very gentle then we can say that the height will not be changing much then we can go for bigger grid size. Now if we want to have the contour interval very small, so in case of contour interval less contour interval then we need to have contours very frequently, so we need to go for our grid size small. Similarly vice versa if we want to have the contour interval high large like 2 meter, 3 meter and we can go for larger grid size.

Scale of map is also important factor; if the scale of map is large then we need to have our grid small. So, you can see that the criteria's are mutually contradictory for some reason, so if the area is heavy (Refer Time: 12:00) and then we have to go for small grid, but if the contour interval is more then we have to go for large size, so there is a contour grid, so we have to arrive at a solution and we have to say what is the grid size. Now many times we have found that for a same area there maybe combination of different types of terrain; however, definitely the scale of the map as well as contour interval; this will be the fixed for any map this is fixed, but the terrain may be defined in any size. So, even if we are this is have the fixed, but we will call of the different nature of the terrain we may have to have the grid size different at different location.

So it is not fix that the grid size should be constant for any area or for any study or any server, it can be of any size are different size. This is the most important thing about the grid and then (Refer Time: 13:15) the as per the grid whatever you have decided for the particular area, we have to go for some regular geometric figure may be squared in shape may be triangular in shape and or polygonal in shape and had the effects of those geometrical figures.

We do consider the heights of the points and we do determine the 3D location using the total station, 3D coordinates of those and then those points can be plotted on the paper using the horizontal; using the 3D control point and we will get the spot heights and from there by the (Refer Time: 14:02) interpolation, we can go for contouring. Now one thing is to be important because as the grid will not be always present grid (Refer Time: 14:16) may not be always present in some salient objects there is there are so high, some very high point there may be certain several low points.

So, definitely we will like to have our spot levels at the highest point, lowest point, some there will be some streams, there will be some other important feature which we may like to have; we just individual like to have, but the big point may not be there.

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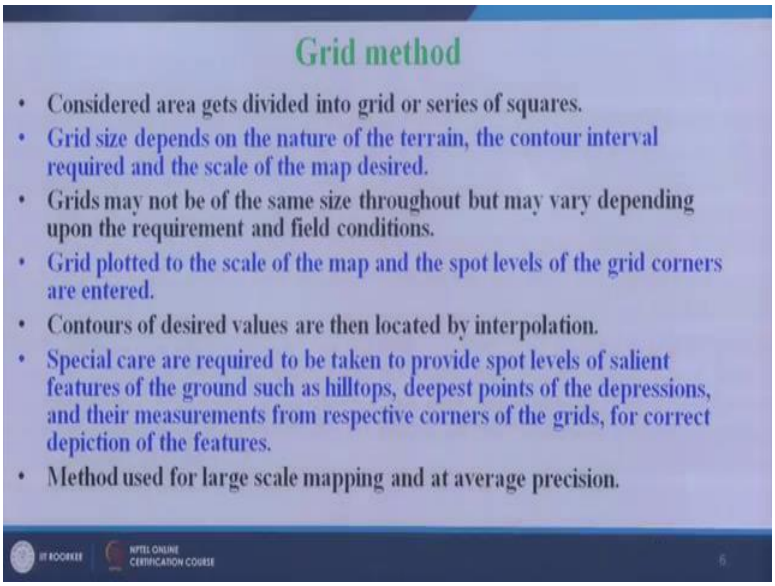

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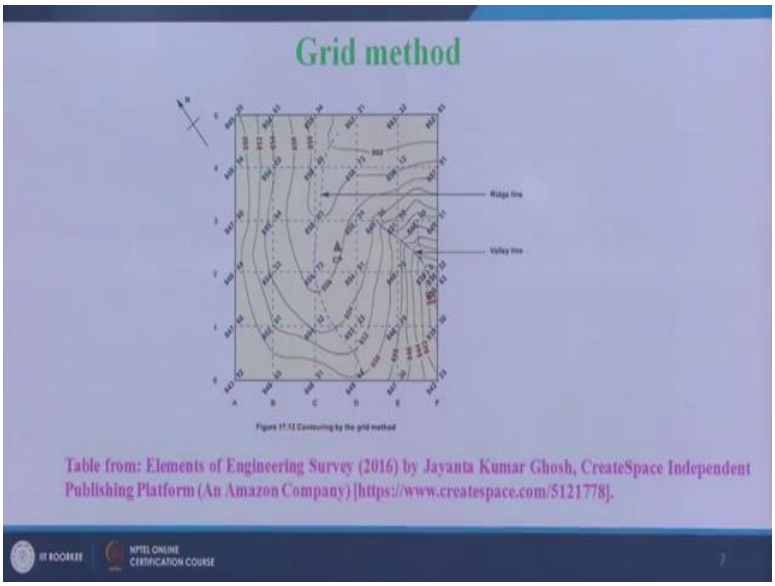

So in those cases special points, so those special locations we have to take care to find out the spot levels. Now where you can see one where I have shown you one sample that now this is the control point, now that maybe both horizontal vertical control point 3D control point and the square grids we have taken here and the elevation of this all this what corners of the grid we have taken elevation and then using those elevations, we had interpolated like it 849, 848 but we need to have 850, so 849, 854.

So, here the 2 meter is the contour interval, so from 49 to 54, 850, 852, 854, 3 contours we are getting at this side. Now 54 to 59, 56, 58; 2 contour point like that I we have to see what is the value in between what are the contours we need want to have that we have to identify and that location we can get and looking into the area, we will be having this is the because this is a line; this is the ridgeline. So, we know that characteristic of ridgeline is that it will be the now you see our; it is the ridges increasing that site and in the last class we are (Refer Time: 16:27) we have told that along the ridgeline there will be inverted you should contours and with the effects or along the contour line, so this is the in that way we can draw this thing.

So, all those characteristic knowledge we should have along with the interpolation; interpolation provides us the location and our knowledge about the characteristic of the contours has to be applied we have to see the field and then we have to draw the contour lines. So, that is all about the grid method and another method is the radial method; in the radial method what we do we do take a central station and we do take lines in radial in nature from the station and we do take spot levels at certain distances and like this and since all this 3D location and (Refer Time: 17:35) known then we can we do plot it and we can get the contours by method of interpolation as it is done for our grid method.

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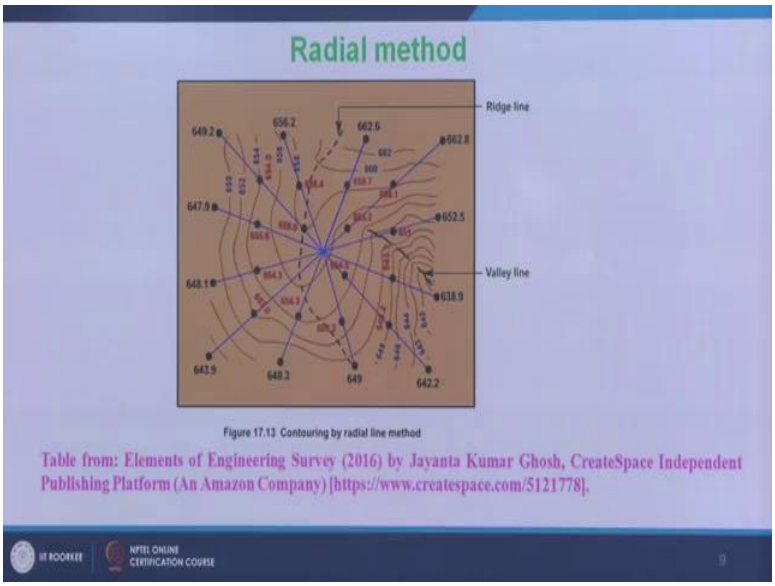

So, these type of methods are useful and we will specifically for hilly terrain or in terrain where the commanding area in can be seen from a single location. So, if I somewhere

here and all the area can be seen by me although out then I can go for this type of method of collectionals spot height and then subsequently to go for contour. Now, so after we get these spot height as it is shown here then we will draw these location in the map and then we will write down the spot heights and then we will say what is the minimum elevation, what is the maximum elevation and also we will be getting what is the contour interval at which we like to go for contouring.

Now, suppose our in this case our minimum is 638 yes 638 is the minimum and our maximum value is 56, 62. So, 638 is the minimum value, 638.2 and 662.6 is the minimum value maximum value of the elevation and it has been decided that we will be going for now contours at two meter intervals. So, though we can go for 640 of the minimum contour value and then 662 as the maximum contour value, so 640, 642, 46, 48, 50 then 652, 654, 656, 658, 660, 662, so these are the elevation which we have to interpolate in between. So, now we can see 666 and 658, so in between that we get 660, 662. So, these are a two value we can get and then between these two we have interpolated based on the distance. The assumption is that the elevation from here to here is uniform slope, now for this much of distance if the defines in elevation is this minus this; then what will be the difference in elevation between 660 and this, so this much of distance. In that way we do find out the location of the desired elevation and now 1.660 here 1.660 here one point is like this then we do join it as per the shape of the topography in the field.

So this is the way why we got and we should remember that contours are shown by brown color and every fifth contours are to be drawn with more prominence at (Refer Time: 21:13) layer and in the contour value we draw the contours in between somewhere we have to give the value of the contours right 660.

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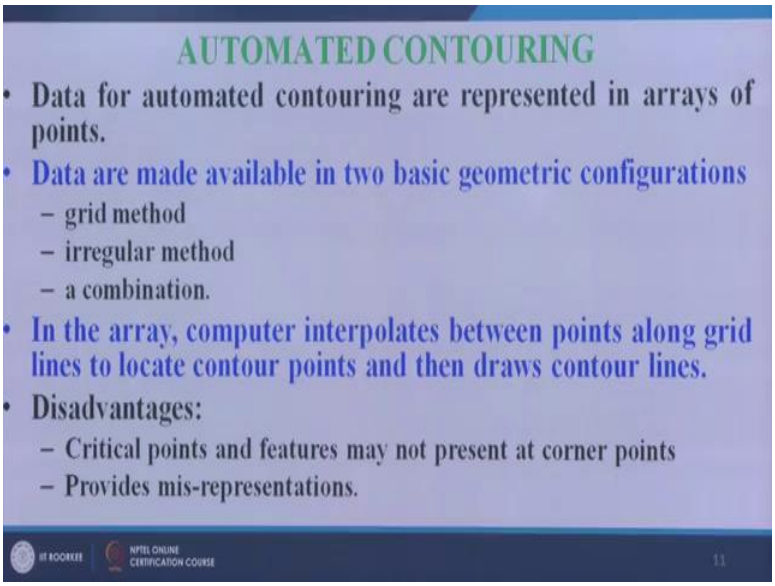

So, or a this is the minimum thing then only you will able to know what is the contour value and what are the contour available in them in a and now actually in case of digital land surveying and mapping, we will not go for contouring by minimal way because minimal way are contouring; when I saw very good result when I get the person who will be doing the contouring is efficient to do as well as he has enough knowledge information, but it is a very tedious process and also time consuming process and there are many other hindrances that will face while we go for our minimal method of contouring.

So, now a days we will like to go for automated contouring now and we know all automation we do, make use of them software and we make use of computer. Now a days, we do go for contouring by through automation; that means, we can make use of a software in a computer to drag the contour lines; now when doing that what we need to do?

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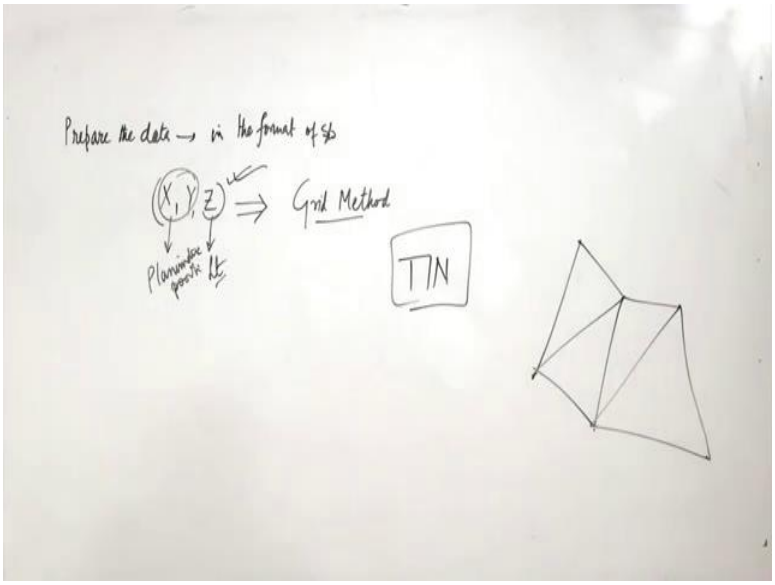

We have to first prepare the data, prepare the data as in the format of the software; that means, what format of software. So, what the software we will accept we have to first convert our data to that form, but whatever is the format all the data should have three components; the first two component x y is the planimetric position of the point and the z is the height, this is the planimetric position of the and this is the height. So, as per our requirement of reference system; we have to convert our location and height in this format and then this data we do for into the software and software provides the contour lines.

But how these data has to be there are different ways how the data has to be collected and submitted. So, one of them ways is that grid method as already I have discussed similar to that we can take the data in grid format; that means, grid data and then we can fed it and we can get the contour, but in case of grid data that error computer interpolate between points along grid lines to locate contour line and then draw contour lines, but it has the disadvantages that whenever as I told you the grid points or grid corners may not be always present at the location which are of important like very high height or changing slope or there is some depression.

So, then the output of the computer, output of the automated contour will be mistaken because I human being actually we can do some manipulation to attribute those feature,

but computer will not be able to do. So grid method is not that successful generally we go for irregular method where the data we have to collect data in a very efficient way.

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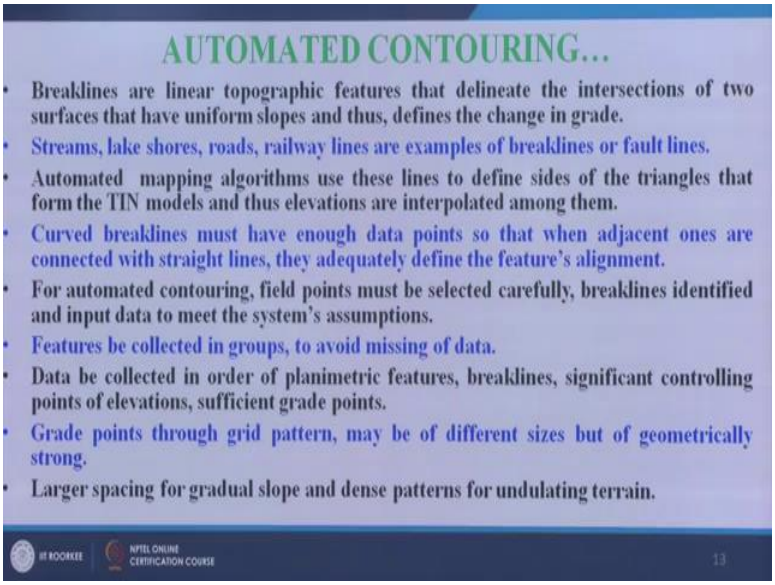

We should collect data in a very systematic way first we should collect data for automatic contouring tin point must be selected carefully. How you know order of planimetric feature then break lines then significant controlling points of elevation and sufficient grid points. So, committed contouring with very controlled and very efficient become a collection of data because computer has no knowledge or information only it will do it mechanically, so all the data should be such that the final put from the computer really represents the terrain for which we want to go for our contouring.

So, this is very important that the data collected in on a planimetric features then break lines, now what is break lines? Break lines are the linear topographic features that delineate the intersections of two surfaces that have uniform slopes and thus define the change in grade, this is the important thing. Now like a streams, lake shores, roads, railway lines; so these are the examples of break lines. So, these break lines are we should take care and we should tell them that yes these are the break lines. So, what the software we will do, they we will take those break lines as the basis for its further analysis.

Another thing what automated contouring do; actually under automated contouring they go for development of tin. So, tin is the basis for automatic contouring triangulated

irregular network, so what is that? Actually, we will have so many spot levels, so what it will do; it will form some regular should triangles. Now how these triangles will be formed, there are different modules available, different options available as a user we may give some option to form the triangle the way we want. One of the option is that like equilateral network, this is the basis for automated mapping that they will go for tin and then there are two assumptions it does, it assumes that the sides of the triangles are uniform slope and the plane of the triangles are plane in shape. So, these surface of the triangles are planar in shape and the sides of the triangles are having constant slope.

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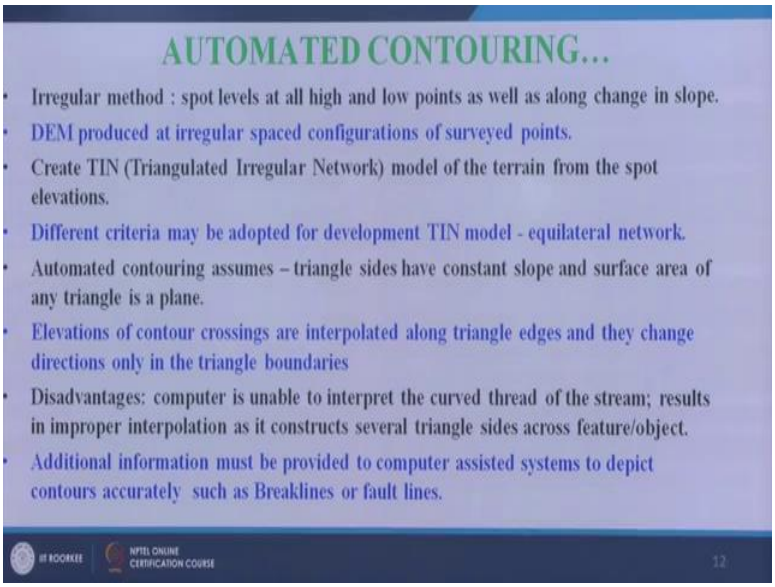

So, triangles sides are constant slope and surface area of the triangle is a plane, so under this assumption it will do and whenever we will define the break lines and they will try to form the break this sides they will the software will try to from the tin triangles along the break lines. So, with this they go for interpolation method of contouring again the value of this is known, so computer will interpolate the value of the contours value of the elevation which through which they we will like to have the contours and once it is done then they will join the line and make the contours. So, automated contouring is good provided we do give the sufficient amount of data and sensible data.

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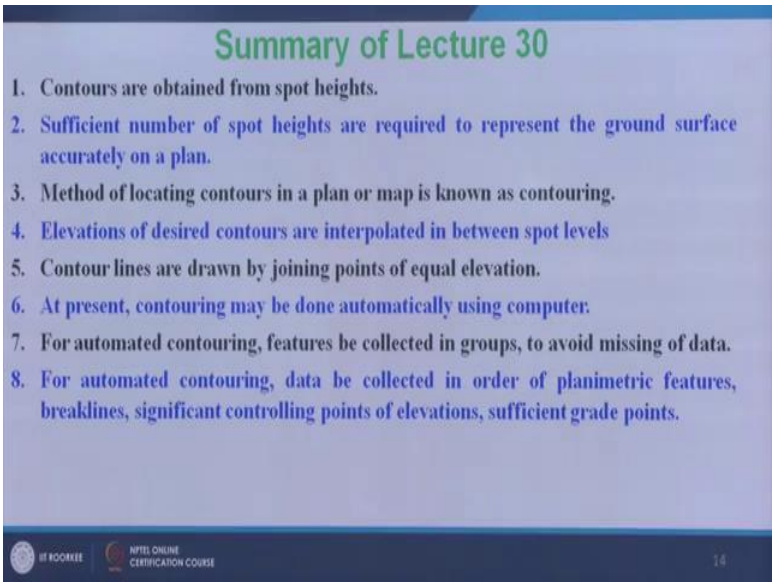

With this I will like to conclude today's class having the summary that contours are obtained from spot heights; however, we need to have sufficient number of spot heights to represent the ground surface accurately on a plan and this method of locating of contours in a plan or map is known as contouring and from the spot heights, the elevation of the desired contours are interpolated in between spot levels or spot heights. Contour lines are drawn by joining points are equal elevation are present now-a-days, contouring may also be done automatically using computer, but for automated contouring features to be collected in goods to avoid missing of data.

So, with this I will like to conclude today's class and next class I will be talking on more on fundamentals of mapping.

Thank you.