

Digital Land Surveying & Mapping
Dr. Jayanta Kumar Ghosh
Department of Civil Engineering
Indian Institute of Technology, Roorkee

Lecture – 35
Working Steps for DLS&M

Welcome students, today is the 35th class on Digital Land Surveying and Mapping. In today's class I will discuss the salient steps that is to be taken for carrying out the digital surveying and mapping; that means, leading to preparation of a topographic map. So, the objective of surveying is to prepare a topographic map of an area and the objective of this course is that how to prepare the topographic map using digital data collection and digital way of mapping.

So, actually for development of any topographic map the most important thing is to know what is the objective for which we will like to have our topographic map like I make use of topographic map for constructing a building, in that case I will be need to prepare the map in to certain service specification or we will be need to collect the data having certain quality or if I want to go for making use of topographic map for town planning. In that case I will be in need of topographic map having a different specification, as a result of which I will be need to making the different types of instrument, different quality of data like that type of map we will prepare, the type of data we will collect, the quality of the data will be collecting and many other specifications as well as many all activities will depend on first what is the objective for which we will be going for making use of the topographic map.

So, the use or utility of the topographic map will guide for our further action, activities, methods, instruments and every other details about our digital surveying and mapping. Now once the objective has been decided like maybe we will be using the topographic map for constructing a building or may be town planning or may be any other engineering project which has to be defined. Then we have to decide what type of quality of the map we will be need to go for that type of accurities.

Now depending upon that then we have to see what is the specification of the surveying. That means, what should be quality of data that we will like to have for to meet the specification or to meet the objective of the topographic map. Now if we want to go for

first order surveying or second order surveying depending upon that already I had discussed in some other class about the type of order and then in that guides us the quality of the measurements.

(Refer Slide Time: 04:06)



So, based on that actually we have to decide, so we need to go for specification of the surveying; that means, what should be the order of the surveying work, what should be on the basis of that we will have to decide about the type of instruments to be used because each instrument does not provides us the equally good quality of data and quality of data will also depend upon the type of instrument as well as cost of the instrument. So, if I need of very high quality data we need to go for some instruments which will be very costly, so our project cost will be very high.

So and then also methodology will depend upon what type of instrument we will use or what quality of data we will like to have. So, then another specification which is important that is the mapping specification; that means, what will be the quality of mapping; that means, and is specifically mapping quality will depend on two ways one for telemetric scale; that means, if we want to have a very precise map we will be need to have large scale map and if we go for large scale map then we will be need to have a very precise quality data. So, if we go for precise quality of data; that means, we will be need to go for a lot of measurement as well as measurement should taken by very good instruments, so project cost will be high, time taking will be high.

Now, another point which is important for mapping specification is the contour interval; that means, vertically scale. So, in case of building project we will be in need of having contours at very close interval; that means, difference in height between two consecutive construct should be less and for having that type of contouring, we will be need to have a lot many spot heights and high data of the study area and as soon as the number of points or number of points whose height has to be taken more, more number of points will be involved in mapping purpose. So, we will be in need to go for large number observation, the time of surveying will be more and the cost will be more.

So, specification should be decided in the beginning itself and that specification will depend on the objective of the surveying objective of the topographic map. Once the specification has been decided about the surveying as well as mapping then we should go for actual land surveying. Now in case of digital land surveying and mapping establishment of control point may be a single control point or it may be number of control point or it may be a network of control points. So, what is the; how what will be the number of control point, how it will be established and all these thing has to be first taking into consideration and the establishment of control points consist of four broad operations; first we have to go for planning and then we should go for actual field survey then you should go for processing and then transfer.

Now in case of digital land surveying and mapping actually we will like to make use of GPS for establishment of control point. Now depending upon the specification of the control point; that means, specification of surveying what type of survey we want to do; that means, what is the order of the survey; we have to choose the type of instrument GPS receiver and like if we want to go for highest order control point then we should go for very highly accurate GPS receiver like frequency receiver dual frequency at the point of exit.

Now all this come under the work planning, so to establish control point first we should plan. So, planning consist of first to visit around the area called recognizing survey and recognizes can be done in two types first we can do the recognizes work in the office by making us of the existing maps and Google map and to come across the about area to have an idea about the area and then in the existing map we is also called base map, we can locate the possible station points. Now station points which can be we can used as will be used as control point will depend upon our specification. So, if we want to go for

very high order specification then we should be very precise about our instrument location and we should accordingly plan.

So, after recognizing survey then we should think of what are the instruments to be used again the type of instrument to be used depends upon the specification, if we want to go for very high order control point we need to use very sophisticated GPS receiver which are very costly and generally the dual frequency or triple frequency receivers are very precise or they provide very good location and highest order GPS control points.

So, then also we have to decide about the methods, but establishment of control point we do go for static method invariably. So, about the method it is fixed, but about depending upon the specification of the control point we have to decide about the duration of observation; that means, if the higher the order longer will be the duration for observation and also we need to decide about the length of observation for establishment of control point generally we take (Refer Time: 11:07) of high duration like 15 seconds or 30 seconds.

So, like that we have to plan the different activities that one more thing is important is that planning is that network design. So, how the network design means how these station points will be considered and how the observations have to be done in different control points of course, these things I will discuss more when I will take up the lesson on establishment of control point. Now once planning stage is over means we decided what is the location of the station points, where we will go for establishment of control point and how this in observation will be taken care of, what will be the duration, when it will be taken all those important what are the instruments to be used and it is a statistical methods of surveying which we will do.

So, with this the ground we should go to the field using our instrument with our instruments personally and enough sources. Now once we go to the field then we should go for actual surveying; now surveying using GPS receiver consists of us locating the station points which we have already decided in the field and the first we mark properly and on that station point, we should set up our instrument properly. Now setting of the GPS receiver means first to set up the tripod stand as I have shown you in some other classes and then on that tripod stand should be properly leveled as well as properly centered over the station point.

Now once this tripod stand has been set up then we will fix up the antenna generally antenna is the part of the receiver which is placed over the station points and then antenna should be properly connected to the receiver as well as to the controller and there should be adequate power supply. Now that is a very important point in case of establishment of control point or in case of GPS surveying that the supply of power should be adequate during which all throughout the observation. So, we have to preplan what will be the duration of observation and accordingly we have to make available the power.

So, and then the after setting of the instrument we have to go for giving the different data to the receiver that is called initialization like cutoff angle, then in proper observation then our what do will in which co-ordinate system will be taking the data etcetera there are so many things is to be given. Once this has been set up then as per our preplan we have to take the data cone observing the data. Now while doing the data observation we should go for intermittent quality checking. So, once the data has been collected then we should also process the data, during processing actually as we already know the GPS data may not have the proper quality then we have to improve the quality by doing some processing techniques or when the quality is sufficiently good then we should go for further processing.

Now, processing involves pre processing where we convert the good quality data to double differencing. And then a double differenced observation has to be processed further processed to find out the location of the control point. Now once the data has been processed then and we got the cover point then we should transfer the data. Further detail about the control point establishment will be discussed in our next class.

So, once the control point has been established and we have located the point and we have collected the data and we have processed the data and we got the location of the control point, then that location of the control point has to be transferred to the total station, because we will make use of total station to collect the detailed information about the topography of the area that is called detail survey.

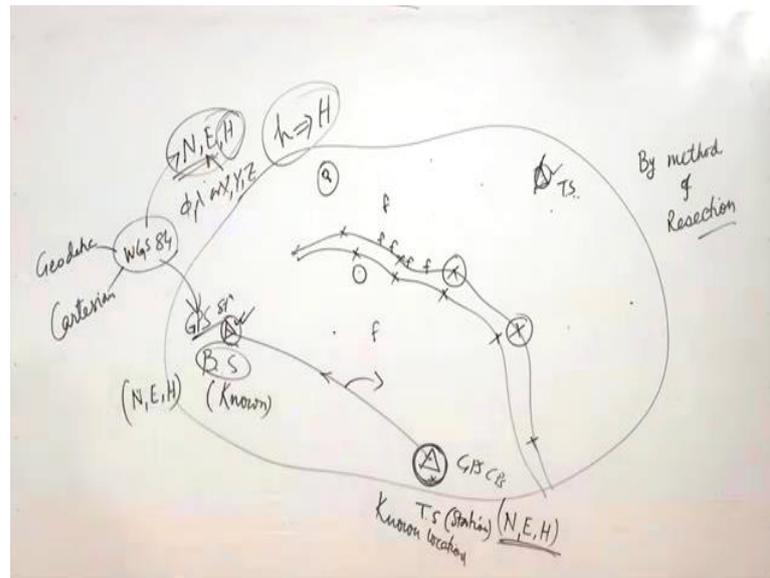
Now, to for detail survey; that means to collect the detail information about the topography; that means what are the objects present, what are the important objects, which are relevant to our objective of work is there, what are the objects we have to

omit, which of the object we have to take into consideration. Then how many objects we have to take into consideration, what are different points we have to consider, what are the how many spot levels we have to take. So, there are so many other thing will be there in the which as per the surveying specification we have to decide and that has to be planned.

So, during planning we have to decide about the field activities to be carried out as well as about the instrument to be used whether these instruments are properly working or not has to be checked. And then if there is a requirement then permanent adjustment has to be checked, so laboratory. So, all these thing has to be done during planning. Now once planning has been done then we have to take our instrument to the field for actual surveying work that is called field survey. Now in case of total station the field surveying is done by two methods basically; one is for back sight method in which we will be in need to have at least two points whose coordinates are known. So, that thing we will do by making use of the GPS survey which has already been done.

So, from GPS survey establishment of control point at least two control points we will like to provide for carrying out our field survey work using total station. And those two points will be used by method of back sighting establish the location of the total station. And subsequently those different points or objects have to be collected or noted down. The location of the objects has to be noted down along with their different features; that means if there is a tree not only we will locate the coordinate of the tree, but also we will note down along with that that it is a tree corner of the building or lamp post or corner of the road; all those things we have to note down during field survey.

(Refer Slide Time: 19:09)



Now, another way how we do go for sometimes for some area? Suppose this is the area for which we like to go for surveying and we have a control points somewhere here, another control point somewhere here, but we will be in need to do the survey throughout. So, may be by setting up of instrument first we will set up our instrument on one of the control points and we will give the coordinate to the total station; TS as station known point, known location. And we will take the back sight to this and that is also known location. So, from this to known location this both are GPS station or points, GPS control points you can say.

So, this is the thing we will start with, that is called back sighting this is the back site station; so back sighting. So, we will set up the total station on a point whose location is known. This we will find out by making use of GPS in digital land surveying mapping. Then we will take a back site to a station whose coordinate is known. That point is also our location, whose location has been found out by GPS surveying. Now in doing that the azimuth of this line has also been can be determined, because we will like to give the coordinate in north eastern height; north eastern height coordinates system.

And then any other points suppose there are so many other point objects are there which will be able to identify; like trees, telephone line, road corners, like this points; we will note down the using the total station corners, salient points. And then there may be tree,

telephone line, there may be some this area may not be visible from this side, so I may. Next we will set up our instrument somewhere have.

Now because there is no control point have then in the location of these will be established by already known. Suppose this is known, this is known, this location is known, and this location is known. So, from already known location by method of resection we will find out first the location of the total station. Then once the location of this station is known then we can find out the location of other thing. So, this thing already we will discuss in another class afterwards.

So, in that way we will like to collect the location of different objects as well as their feature. So, once this is over that means our land surveying operation has been done. Then we will go for our data preparation. That means now actually GPS provides us data in WGS 54 coordinate system and there may be it may be or I will teach you geometric or geo coordinate. But generally we prepare our map using the local coordinate system as I told you north east height.

So, the WGS coordinate has to be converted to north eastern height. Now for that first we need to transform the geographic height to orthometric height already we have discussed. And the lifelong or $x y$ or the $x y z$ can be converted to north east. So, this is the way first we will transform then once the coordinate has been transformed; means once the location of GPS is transformed to this then the location of our total station can be converted that is call Reduction.

(Refer Slide Time: 24:00)



So, reduction will be done for all the points whose location has been done find out by using total station that has to be converted to any h. So, that is call reduction. So, transformation and reduction has to be done before we import the data to the mapping software. Now do the mapping as I have already discussed there are different types of mapping software and each software has its own advantages and disadvantages. So, depending upon our specification; as I told you specification of mapping is also important.

So, as per the need of our specification of map we have to decide what will be the, which software will be using. And once we decide about the type of software which where the mapping will be done then we have to convert all our data it used data to the format that the particular software supports. Now once the mapping software imports the data then those data will be kept in a file. Now our mapping software map independently do plannimetric mapping and contouring some mapping software, they does all these thing together.

So, depending upon what type of modules are available let us say first plannimetric mapping. So, all the points will be taken care of the plannimetric position as well as feature. So, in plannimetric mapping the software will take care of the plannimetric position like north east and the feature like road corner or tree or building corner, etcetra, etcetra. And accordingly it will be depicted in the map. Now that those points

has to be meticulously represented along with symbols. So, we have take care in making use of appropriate symbol that has to be used for particular to note down different particular object. Once the plannimetric mapping of the area is satisfactorily done; that means we have to compare our map with the actual area and we have to see whether all the objects or all the features which we wanted to note down in the map is available or not. So, if it is fine if it is not then we have to take care to get all those thing it will be done and properly noted down using the appropriate symbol.

So, after plannimetric map has been done then we can go for contouring. So, for contouring we will be in need to have all the three coordinates, like its north eastern height. North east will provide the positivity position and height of the point and then we ca the each. And then every software as their own techniques for interpolation of height between different points, so we can make use of the interpolation technique which we find to be suitable for our work; and we can do the contouring, sometimes we can test whether our contouring we will really represents the field which really we are want to represent. And sometimes we may be in need to change the interpolation technique to get the appropriate the contours.

So, once the contouring and plannimetric mapping has been done and put together then we should go for different cartographic elements to be shown like the direction of the map that scale of map, then symbols, lisions and many other things as we have already discussed. And once all these have to be done proper colour has to be used. So, when all these have been used and we are satisfied with the pre presentation, then we can say that our final map has been prepared.

So, before really we want to say that our map is representing appropriately to the field, we have to compare our map with the actual field and to see whether really all the objects and feature which we wanted to represent is available here or not. And the contour which we have represented in our map really represents the type of topography that we wanted to represent in the map or not. So, when satisfied then only we will say yes, our topographic map has been done.

So, these are in short the different steps which one has to make use off, one has to adopt in sequence to develop a topographic map by digital land surveying and mapping.

Thank you.