GPS Surveying

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Lecture - 16
Procedure of GPS Surveying- I (Introduction & Planning)

Welcome friends. Today is the 16th Lecture on GPS Surveying. In this class we will be talking on Procedure of GPS Surveying. Now already so far you have seen many activities on GPS surveying, now we can see that land surveying using GPS provides us very precise position quickly as well as economically using a very little resources. The methods used for GPS surveying are quite simple in comparison to the existing no conventional methods. Moreover the different operations that we carry on for GPS surveying depends on many factors like; the project area, project objective, accuracy we are looking for instruments we are using many other factors.

However to achieve the GPS surveying output as per standard specification we may attain it quite easily in a very economically as well as. But in order to achieve these desired output we need to go for a thorough planning of the GPS surveying as well as we need to execute GPS surveying operations efficiently in order to carry out GPS surveying properly we need to conduct the GPS surveying following certain procedure or certain definitive steps.

Now, in this class we are going to discuss on those steps which to be required to be taken during GPS surveying, because this procedure of a GPS surveying is a elaborate thing, we need to elaborate the procedure for GPS surveying. Today we will be talking only on certain part

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So, the salient step in GPS surveying consist of first you should go for planning, then you need to carry out preparation for it, followed by field observations, after the field observation we have to process the data and finally we have to prepare the report.

Now, these steps though looks independent, but in many of the GPS surveying work you will find that these steps are not that apparent. However, to carry out the GPS surveying nicely or properly we need to understand each and every step clearly. Now today's class I will be talking on the planning part and in next classes we will go for other part of this procedure for GPS surveying

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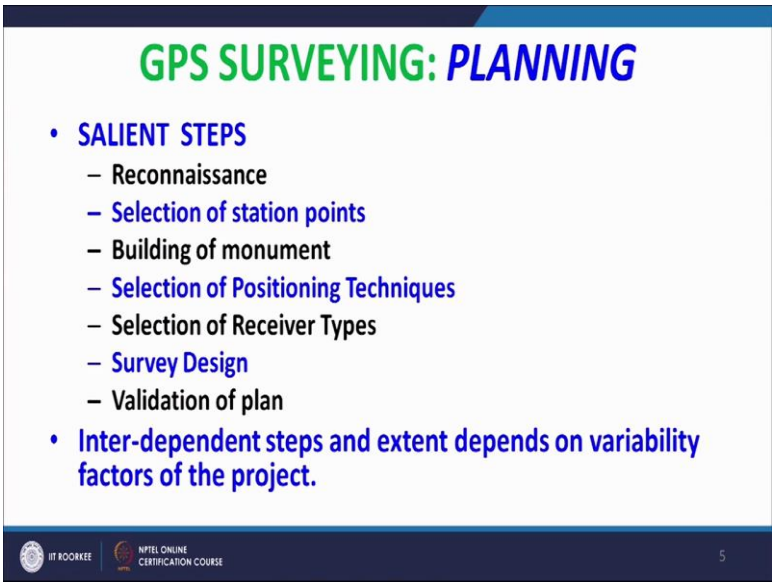

Now the GPS surveying planning starts with reconnaissance, followed by we have to go for selection of station points.

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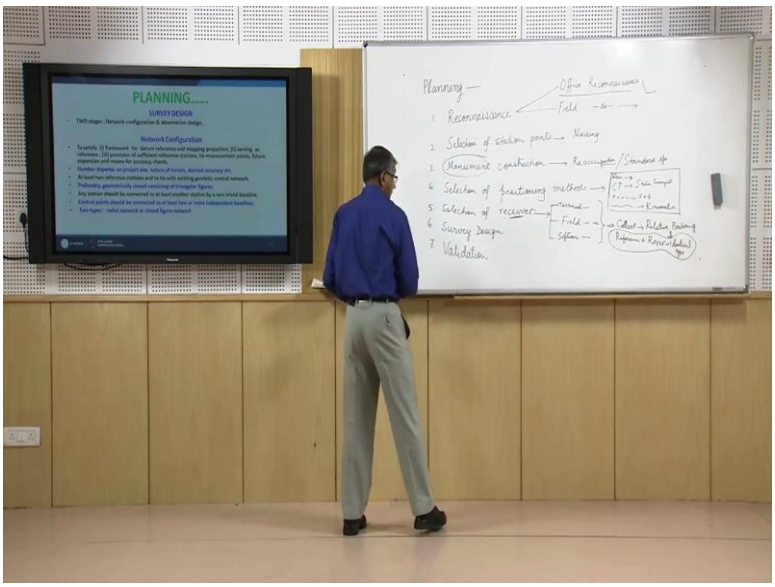

So, planning of GPS surveying consists of reconnaissance, and then we have to go for selection of station points. Once the station points get selected we should go for monument construction. Then we should go for selection of receivers holds. Of course before receiver we should look for selection of positioning methods. Then we should go

for selection of receiver. Then we should design the survey. And finally, we have to validate our planning.

So, these are the 7 steps which we need to follow during planning operation. Now, what is reconnaissance? Why we you go for reconnaissance? In during reconnaissance we do carry out extensive inspection and examination of the project area to find out the suitability of the land of the area as well as many other points like, selection of station points then satisfied for surveying or not all those things we have to do during reconnaissance. Now reconnaissance carried out under 2 steps; one is in the office that is called office reconnaissance and after the reconnaissance has been done in office we have to carry out the reconnaissance in field that is called field reconnaissance.

Now, in case of office reconnaissance actually we do it inside the office. So what we do, we take the existing topographic maps, images, aerial photographs as large as called as possible. And in that existing maps images we do thoroughly see about the project area and whether the area is valuable for GPS surveying or not from the tropical map we try to understand. And we try to find out the possible locations where stations may be established. And also we look for the possible roots through which we have to go to the sight, and then possible infrastructure, whatever infrastructure we need to have like how to stay, how to communicate to the project area.

So, many other requirements are will be required during surveying and those requirements whether fulfilled, and how it can be fulfilled. Those preliminary ideas we should gather using office reconnaissance. That means, the output of office reconnaissance will be the approximate location of the station points we should be marked on the map and the possible root should be mapped and preliminary idea of the map it should be noted down.

Next with these backgrounds we should proceed to the field actual survey area. There we should carry with us one navigational GPS receiver so that we can also keep track of our activity throughout GPS. Now, in during field reconnaissance the most important thing is to identify the actual location of the probable stations which has been marked in the base map. And then we should go to the field and find out in the field whether those stations are really suitable for GPS surveying or not.

Now if it suitable means whether the location is free from electrical interference or above from or it divide of any reflecting surfaces and the stations should be clear from physical abstraction at an angle of cut off angle of 15 degree probably. So, these are the primary things. Now if it is there any type of problem then we should find out what are the possible problems and we should try to take out the solution and conduct the solution, means the implement the solution so that the stations are good for or appropriate for GPS surveying.

Then another important point during field reconnaissance is to check the stability of the stations whether the location is stable or not. For long time GPS surveying or we need to have permanent stable location. Also during field reconnaissance we also require some field data which will be using in future for our planning purpose. Once this field reconnaissance is over, so now we have more or less decided locations where station will be install or station will be considered and our root to the stations or project area. And we should also check if there is any kinematic survey whether that root of the kinematic survey is free from physical abstraction. That means, free from sky view or whether sky view is clear or not.

During selection if station points those locations which have been conformed after field reconnaissance as to be probably marked on the ground. And if we are in need to carry out surveying for long time or we will be need to carry out surveying reoccupation of the stations then we need to for the construction of monuments. So, reoccupation requirement will be required construction of monuments otherwise marking operations in the field for will be sufficient. And if the monument is to be constructed then it should follow some standard specification. So, that is also important that is the monument should have some standard specification.

Once these stations are available now we should go for selection of positioning methods, actually depend or the methods that has to be followed in during GPS surveying depend upon the nature of project and the accuracy requirement. And also what are the purpose like if we want to establish control point and depending upon the order of control point. For control point we should for static surveying, relative static if we have control point is already available, but if control point is not available then we should go for autonomous static control establishment.

In that case we have to go for longer observation duration, or if we want to establish the baseline depending upon the length. If it is very high length then we should go for static relative positioning and the deadline is small then we can go for rapidly static method. Like, during reconnaissance we should go for autonomous navigation in positioning. If we have refer two plot a different point objects then we should go for stop and go method of surveying and if we going to have the linear objects then we should go for kinematic positioning.

So, depending upon what type of objects or what type of surveying we need to do we should go for different methods. Now after deciding the methods we need to know what the accuracy we need to is have and what type of measurement observables which will be making use for achieving our objective. Depending upon that and many other factors actually we should go for selection of receiver. Now the selection of receiver is very complex process if we want to end up with economic solution as well as if we want to maintain the accuracy or if we want to achieve the objective of the work within standard specification.

Now, to select the proper receiver actually depends upon 3 factors; one is the technical reason, next is that your field requirement, and software. These are the 3 points which we have to emphases during selection of receiver. Now technical reasons as I told you what are the different observables we will made use for our achieving the objective, what is the degree of objective we need to have. What type of signals we will have to acquire whether it is from GPS only or also GNNS. How many channels of receiver we will make use.

So, almost technical aspects will be required to be taken into account for identifying appropriate receiver. Now field condition like what would be the physical characteristics of the receiver. Why not yet, what is the volume like that what is the power capacity, how many hours the receiver can work without having any external power. Because in the field we may be working for 6 hours or 8 hours, the battery backup of the receiver may not be having such. That means, the receiver should have the (Refer Time: 17:08) backup of that.

So, like that many field conditions we have to consider. Like also the operating temperature, what is the temperature, in which the receiver can work and what is the

field condition of temperature humidity and all those things? So, these points are required to be considered in selecting the receiver. And the finally the software, that means, the each receiver will be compatible to some particular software in general. That is important while selecting the receiver. But finally, the receiver should be able to collect the type of measurements which we are looking for from particular GPS surveying. And the appropriateness of the type of receiver will have to be validated through validation, so that is important.

And one more thing, that if we generally we go for relative positioning and so it is important to know that for relative positioning it is our advisable to go for receiver of similar type in base as well as reference and rover receiver preferably be identical type. So, that we will minimize many of the problems that is we encounter during GPS surveying, so that can be minimized by taking this.

The appropriateness of the receiver has to be validated during validation process. Next survey design actually before we go for actual validation part also we need to design our survey work.

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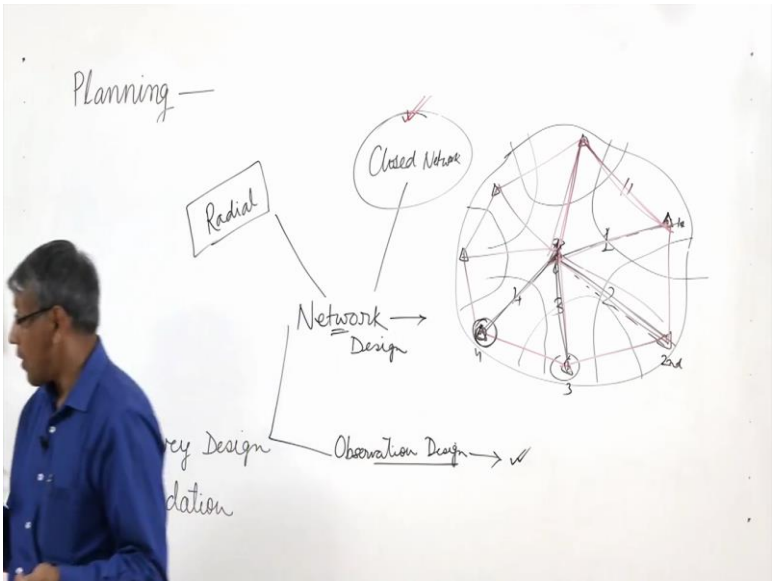

Now in case of GPS surveying the survey design consist of 2 parts; one is that to develop the network of the stations. How these networks are to evolve the stations has to be placed in the project area, and that is called network and the observation design. That means how the receiver has to be placed in different station points during observation. If

we have the number of receiver as the number of stations then there is no problem in observation design, no network.

What is network? It is the particular way how the station will be present or will be selected in the project area. There should be sufficient number of station to achieve the objective of the project. So, the number of station that is to be selected within the project area will depend upon what is the extract of the area and what is the nature of the terrain in which project will be carried out as well as your positioning methods, and finally the accuracy of the specification that the surveying has to achieve.

With these backgrounds we should provide a framework stations in the area so that it provides the proper reference in carrying out the surveying work. That means, it should be widely spread so that each area have the surveying from more or less equal distance of the stations. Now, another point which is important not only normal, but these stations should be tight to national surveying network so that we can have the local network system. And also it should be designed in such a way that in future we may extend our network. These are the primary points which we should keep in mind during the network design; so network design.

Now there are 2 standard ways how network has designed at present. One is the radial method another is the closed network method. Now in case of radial method means where the one of the receiver will be placed at the centre and if we have more than, because we need more than one receiver relative positioning and if we are suppose I have this is the configuration of the stations. Now if I have 1, 2, 3, 4, 5, 6, 7, 8 if I have 8 receivers what I will do we will do simply we will place 1 here and all the 7 one, one, one all these thing.

But if we have less than 8, then the question comes how to place the receiver. So, one of the method is the radial method. Suppose we have two receiver then what I will do one will be I have placed here and another will be kept 1, 2, 3, 4 like first I will place here then I will take reading between these two. After sometime I will shift it to this and then I will take reading between these two, this is the baseline. Then after sometime we will take.

So, the configuration is like that 01, 02, 03, 04 means this is the baseline. So, we will taking reading between these two then first, then these two second, then these two third

this is the fourth like that. So, this is called radial method of network or radial observation. In this type of observation the relative positioning between these and these or these and these will be very good, but there will not be any relative positioning between adjoining stations. And the position of these stations cannot be verified or restricted by geometric consideration. So, the accuracy we achieved between nickels will be less. So, it is for a small area surveying this is a good method, but for when we want to go for very accurate method of surveying then instead of these radial method we go for closed network. In that case what we will do? We will do some networking like this. So, it is like this.

Generally we will be needed more than 2 at least 3 or 4 receiver. So, in closed network generally we go for baselines which will be forming some closed network of triangles. And the observations will be taken in such a way that at least 2 adjoining stations should be observed simultaneously. So, there will be sub overlapping of observations between adjoining stations. And so this type of means this this red one closed type of network design provides a very accurate positioning of the stations, because we can also go for geometrical adjustment during our processing.

Now, this observation design; that means, what is the way we should go for observation stations that is called Observation Design. So, the ways we go for observation sessions are constitute the observation design.

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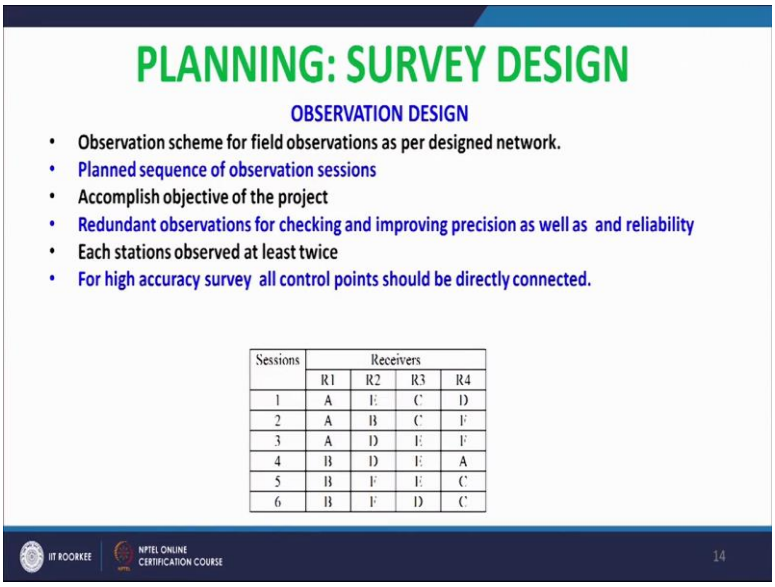

In case of observation design first thing is that there should be overlapping of observation duration between or among adjoining the stations, so we should see this and this together. And again this is the most important thing. And another thing which is important during observation design is that there should be some redundant observations so that this redundancy in observations will actually help us to check many errors as well as it provides it improves the precision as well as reliability of our result.

So, redundancy in observation is also very important. Each of these stations should be connected with a non-trivial baseline and all control point should be connected with 2 to 3 independent baseline. And for in each closed network at least there should be 2 control points. So, these are the minimum requirements which we should go for during observation design. Finally, we should go for validation of the planning work.

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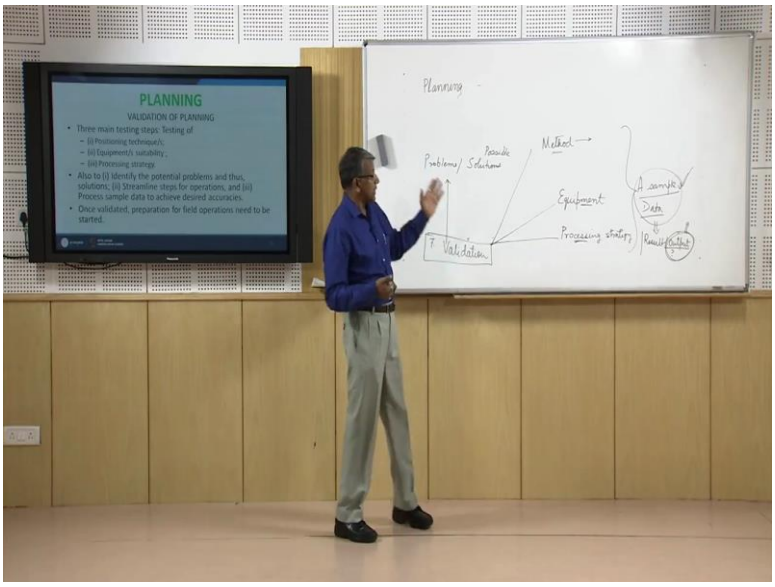

The validation of a planning GPS surveying in GPS surveying consist of; you should first validate the method then validate the equipment and you should validate the processing strategy. So, these are the 3 means whose positions the measuring methods which we have considered as during our planning it should be validate. In order to do these thing we should take a sample data, as I told you during our field reconnaissance we have collected the sample data sand that sample data first to be processed and after processing the sample data we should see what are the result or output is meeting our standard specification or not.

If it is meeting then ok that means our equipment used or the method we have considered or the processing strategy all are. If not then we have to identify the reason why these output is not meeting our standard specification and accordingly we need to change the method or equipment or processing strategy or all or some of these.

Moreover during validation also we need to see what are the problems we encountered and we have to find out possible solutions and though have to be implemented during actual surveying. Finally, we have to go for processing of sample data and we have to see the output, where the output is meeting the standard specification or not. That means, if it is not then we have to change our planning our process and we have to redo the thing iterative so that our method equipment and processing strategy lead to final output which is our standard specification. With this planning stage will be over then we should go for precaution stage which we will be discussing in the next class.

So, let me summarize today's class; that in order to carry out GPS surveying we need to go proper planning and efficient execution of some standard steps. In order to achieve the objective of any GPS surveying and to meet the standard specification we need to have followed standard procedures which consist of planning, preparation, field observation, processing, and report generation. Of these planning stage has to be done thoroughly and it consist of reconnaissance followed by selection of stations and it is construction, then selection of receiver as well as positioning methods, then survey design. Finally, our planning whether the planning is correct or not. That is to be validated through processing a sample data. And the output of the sample data should meet the standard specification of the objective of the surveying work.

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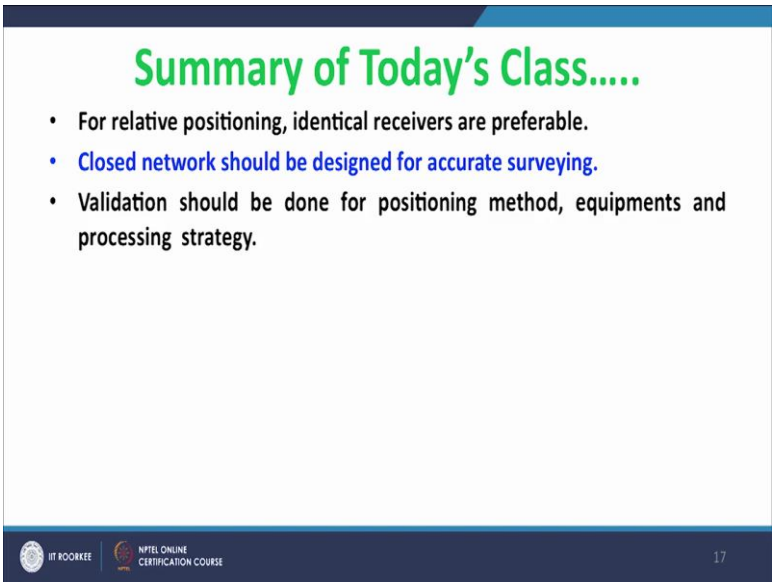

Now, in case of receiver selection preferably we should look for receiver having identical specification. And in case of closed network in case of networking we should preferred to go for closed network for accurate surveying. And finally, we need to complete our validation through satisfying our output, meeting the standard specification, which is to follow the particular method equipment and processing staging.

With this I want to conclude you. In the next class I will be talking on preparations as well as field observation.

Thank you.