Laboratory Practices in Earth Sciences: Landscape Mapping

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Lecture- 32

Hello everyone. So, in our last lecture we learned how we can use real time kinematic GPS to map the different landforms. So, today we will start with a new instrument that is the total station and with the help of this total station how we can map different landforms that we will see in todayís lab. So, as its name suggests, it can measure your distance and angle. So, it can measure your horizontal and vertical distance as well as the horizontal and vertical angle. So, that is why its name is called total station.

Usually this total station you might have seen is in use for the civil engineering project. So, in construction of buildings and in road construction you might have seen this instrument people are using for the serving purpose. But, nowadays this total station is quite popular in the field mapping of earth science. So, in earth science particularly in the field of paleo seismology and active tectonics.

So, people are using this instrument for the mapping of different kinds of tectonic geomorphic landforms. So, this total station was introduced in the field of paleo seismology by James Hamilton in 1980. And since then this instrument is quite popular in this field. So, with the help of this total station you can map the river offset height of the terraces and the height of the fault scarp. So, with this kind of geomorphic feature you can map very precisely at millimeter level accuracy.

So, the precision of this total station is 0.1 to 20 seconds. So, with this high precision and high accuracy of millimeter level scale gives you a quite high accuracy of landform mapping. So, here you can see what your total station looks like. So, this one the total station is provided by Leica.

So, this is the company which provided this Leica total station and the model number of this total station is MS 50. So, this one is a robotic total station and you can manually or single handedly open operate this total station. So, first I would like to tell you some features of this total station. So, this total station is basically an inbuilt is it is a kind of theodolite which is associated with your EDM that is the electronic distance measurement and microprocessor or that is your CPU. So, this EDM basically helps to calculate the slope distance.

So, slope distance is basically the distance between your center of T S. At this point I will explain to you what is your center of center of T S and the center of the object. When you see your total station though it can rotate horizontally and as well as this can rotate vertically. So, here you can see that EDM can rotate vertically. So, there you're it this EDM is rotating on a vertical plane and this total station is rotating on a horizontal plane. So, this center of T S is basically an imaginary line where your vertical axis and horizontal axis is crossing and the center of point you can consider from here is a point here you can see this point you can consider as your center of T S.

So, the center of T S and your center of object. So, that would be if we are using the prism. So, the line between your center of T S and the center of the object is called the line of sight. So, with the help of this line of sight, this T S EDM calculates your slope distance. So, and this slope distance is helpful to this slope distance is used to calculate your angle as well as the horizontal and vertical distance of your particular points.

So, the basic concept of this T S is that it measures an unknown point with respect to a known point. So, you have to assign a known arbitrary coordinate value to the total stations the base station and with the respect of this arbitrage values or the the easting northing or height of this instrument it can measure the or it can map the unknown point that unknown point you can that you can map either with using a prism and another way is the directly with any surface method. So, we will discuss it in the coming few minutes. So, if I talk about this instrument. So, this instrument here you can see one digital screen has been given and this is involved with as I told the EDM the electronic distance measurement and the microprocessor CPU.

So, it is kind of a mini computer. So, this microprocessor can use your 2-bit travel time and with this 2-bit travel time it calculates the distance and EDM is helpful to calculate your slope angle. So, another thing here you can see is your EDM and this is your radio handle. So, this radio handle is useful to connect. You can remotely operate this instrument as I told you that this is an advanced robotic total station. So, you can single handedly operate this instrument from a remote distance.

So, that we will see in a few minutes. So, this radio handle is useful to connect with your remote controller. So, with your remote controller you can connect with the total station with the radio signal. You might remember that in our RTK lab we have connected our GPS with the remote controller with the help of Bluetooth, but in the total station we will connect it with the radio signals. So, here in the radios radio handle you can see that this radio handle you can remove or mount on the top of the total station.

So, here one key is given and with the help of these keys you can fix this radio handle on

your TS. So, once you fix here you would see some options are given: this is power options and this is the signal and this is the signal transferring options. So, once we connected this radio, this TS with the remote controller, then this light you will see here, but right now it is on. So, that is why this signal is showing green. Another thing is that this is your eyepiece and with this eyepiece you can manually find an object or position as your target point.

So, that you can do manually, but this MS50 instrument can do that job automatically that we will see. And here you can see one optical lens has been given and this optical lens is useful to identify your objects. Another thing is here you can see this is optical sighting. So, this feature is being used to pinpoint your object and this portion here you can see as this instrument is inbuilt with the automatic target aiming options. So, another option is it can target or lock your desired location or object.

So, you can do it with the help of some laser light. So, that laser is being released from here and transmitting and absorbing the laser with this help of this function. Here at the sight of your instrument you can see three wheels have been given. So, this top must wheel is yours for focusing. So, as I said, you can manually do that by zooming in on your target position.

So, that target positions you can manually focus. So, this wheel is used to focus the focusing option as this instrument is enabled with the autofocus option. So, here you can see one key has been given. So, this key if you press one time. So, that will execute the single time autofocus option and if you press 2 x time.

So, that will enable the re-execution of your autofocus if you press and hold for 2 seconds. So, that will enable you to autofocus for the continuation mode and you can remove the continuation autofocus mode by pressing 2 seconds again or you can simply use this focus wheel to remove or come back to the autofocus mode. Another two wheels you can see over here. So, this lower one wheel is for the horizontal movement of your idiom portion. So, if you rotate this one.

So, in your idiom you can horizontally move left or right if you want to aim your target in manual mode. So, that you would be able to do with this lower wheel. So, this is your horizontal wheel and this one is your vertical target aiming wheel. So, you can move your object or you can move your idiom vertically on an up and down portion. So, you first have to locate any object.

So, you have to manually focus and then if you want to move it horizontally. So, you have to use the lower wheel. So, you would see that your idiom is moving in the left or right direction. And another option if you move this wheel. So, this will move your object, move

your area up and idiom up and down positions.

So, these two wheels you can use, these three wheels are basically useful to identify, locate and target on your particular object. So, another option here you can see is that your one socket has been given and if you open these one keys it has been given you over here and if you press. So, this will open and here you can see one s d card slot has been given. So, in this s d card you can directly save your data on your s d card. So, as I said, this instrument is itself a mini computer.

So, you can save your data over here or you can remotely operate this instrument with the help of a field controller and you can save your data in the field controller. So, both the options are available. Another socket here is the USB portal. So, you can also connect this system with the USB device. On another side of your total station here you will see another wheel. So, this one is also your vertical wheel.

So, with this wheel you would be able to rotate your idiom on the up and down portion and this one is your position for the battery. So, here you can see you have to remove this and one battery slot has been given and here this is the battery for your T S. So, this is also the lithium ion battery and it is 14 to 15 volts. So, here you have to place your battery and then you have to and you have you have to place it on you have to fix this battery on the given slot and then you have to rotate this wheel to lock your battery slot. So, another option, one slot has been given at the bottom side of your T S.

So, as I show you in the GPS, you can connect your GPS with the computer. So, that also you can do in the case of total station. So, one slot has been given over here. So, with the cable you can connect your total station directly with your PC or laptop and another IPs is given over here. Here you might see you can see over here this is IPs and with these IPs you can directly pinpoint the exact location over which this T S is being placed.

So, you have to look over here and you would be able to see the positions where your T S is directly placed on your tripod. So, this station is directly placed on the tripod. This station is given a position of unknown point with respect to this point over which this T S has been placed. So, that position you can directly pin point or mark from here. So, another option if you want to pinpoint your position over which your T S has been placed.

So, that you can do with the laser facility. So, you the two-laser option has been given one you can aim your object with the laser option that will emit from here and another laser option has been given at the bottom side of your T S. So, with the using this bottom laser facility you would be able to pinpoint over where your instrument is placed. So, that you can do by enabling the laser point. So, that we will see in the coming few minutes.

So, the pin precisely marks your position where your T S is placed. So, that you can do by the labeling part. So, the labeling part is the same as we did in our article lab. So, with the similar technique or method you have to label your tripod and then you can do the slide modification in labeling with the with this labeling foot screw which is given over here. And that you can see one labeling circle has been given over here on the just above your screen touch pad over here you can see this is the one labeling circle has been given.

So, you can see whether your instrument is perfectly label or not if not then you can do the slide modification if it is required slide modification that you would be do with the help of this labeling foot screw or if your more modification it is required that you you would be you can do with the help of the slide adjustment with your leg of your tripod. So, that we learn in our article lab. So, once you have understood all the all the parts and all the functions then we will see we will open we will power on on our total station and then we will see how we can set our instrument or how we can we can map the different landforms. So, to power on your total station you can simply press the power button which is given on your keyboard. So, you keep it long, press and remove then you would see that your screen is on.

So, here you can see this instrument is on and as we were talking initially about the center of the object. So, here you can see. So, to mark or identify the object two options are available in the total station. So, one is marking your object or aim with the help of a prism. So, here you can see you have to use one pole and you can place the prism on your pole.

So, here you can see this is a pole, this is a pole and this is your prism. So, you can place this prism over your pole and this prism would be used as a position on the point where your pole has been placed on the surface of the earth. So, this prism is used to detect and reflect the laser which is which the laser will be emit by your total station. So, that we will see. So, here you can see this prism is basically reflecting your laser light which laser light it is getting from your total station.

So, the line between the center of your total station and the center of your object that is in this case is your prism. So, this line is called your line of sight. So, with this line of sight this total station or EDM or the microprocessor is calculating your slope distance. So, that slope distance is basically calculated with the help of your height of the instrument, your height of the object and some corrections. So, basically your microprocessor is doing three kinds of corrections.

So, first is your atmospheric correction, another is your mean level correction and third is your projection correction. So, you have to assign a projection as we did in our article lab.

Similarly, you have to assign the projection or you have to tell your total station the exact datum reference frame on which you want to do your measurement or mapping part. So, these three types of corrections are being done by the microprocessor of your total station. So, one one is your DD1 that is also called the atmospheric correction and that correction is basically a function of your temperature, atmospheric pressure and humidity.

So, with this atmospheric correction you have to give the or it can manually calculate this parameter, but you have some in some cases you have to assign this parameter to the instrument to do the atmospheric correction. And obviously your base sea level correction means sea level correction and the projection correction is done by this microprocessor with the help of the information you input in your system. So, here you understood about your center of object. So, this is the center of object and center of object is basically an imaginary line and this is by intersection between your line of sight and the axis of your pole or the rod which you are using. So, this is the one method to mark or your object and another method is any surface method.

So, any surface method you can do with the help of a total station instrument only. So, you have to enable the laser facility and with the help of the laser facility you have to first identify any object or any surface where you want to take your measurement. So, that object you have to find and you have to transmit the laser and with the transmitting and reflecting it will calculate your distance and angle. So, these are the two methods. So, today we will show you how we can do the measurement with the help of a prism.

Once on your total station here you would see a computer like window and the software is the smart work viva that is the similar software which we use for our mapping with the help of r t k. So, this software you can use. So, you have to double click on the software. So, here you can see the smart work viva is the software work viva version is 5.

05 and this is provided by the Leica geo system. So, once it is on you can see a few options over on your screen. So, the first option is to use a total station and only use both g p s and total station. So, this total station you can use as a smart station. In the smart station you would be able to mount gps on your total station.

So, one g p s. So, this is your g p s mount. So, you can remove this radio handle and you can place this g p s mount on your total station. So, now I have removed the radio handle and now I will place this g p s mount on the t s. So, with this g p s mount here you can see two keys have been given and when you will press your key and here on this here you can mount your g p s. So, and that g p s you can directly connect with your total station. So, in that case all the points or the survey which is given here is the total station.

So, you can use this g p s mount on your total station and you can use this g p s mount on your total station. So, you can use this g p s mount on your total station. So, in that case all the points or the survey which you are doing. So, that point will match the true latitude, longitude and elevation, but in the total station case it will measure the point of position of unknown point and unknown location with reference to this total station only and those points will be some arbitrary values.

So, that we will input in our total station. So, we will see how we can put the arbitrary values, but in case of g p s that value will be changed with your true northing string and elevation. So, this g p s holder you can mount on your total on above the total station and you can place your g p s over here. So, that you can place the base station over here and you can place the rubber on this given screw. So, that system is called your smart station. So, that smart station will give you an accuracy of your distance measurement as well as the accuracy in the elevation and the northing string with the help of your g p s.

So, that system is called your smart station. So, today we will give a demonstration on the total station part first and then if we have some time. So, then we can take one another to the smart station. So, that is a different lab. The setup and the steps are different from this total station. So, first we will start with the total station if we have some time then we will do the smart station. So, today we will in this lab we will do the use total station part only if you are mounting your g p s on your total station that in in that case you can use choose the use both g p s and total station, but for this this scenario we will choose the use total station only and when you will choose the total station only.

So, you click on the next option and once you click the next option you can see the similar kind of option which you saw in your R T K lab. You have to create a job. So, we will start with the new job and when you will go to the new job option. So, we have created here the you can see a b c that is the job name and you will see the similar kind of window which we saw in our R T K lab. So, go to work and use the instrument. So, now we will show you how this was the part where you can use your total station to do the mapping.

So, we will connect this instrument with the remote controller and that remote controller with the use of a remote controller you would be able to do your mapping on your own. So, we will connect this. So, you have to first go to your remote where you can see your remote controller is on and you have to open your software. So, you have to choose the total station only and click next and here you have to choose the job or you have to create a new job.

So, keep in mind that if you are using your field controller. So, all the data would be saved in the job which you are creating in your field controller. It will not save on your total

station which we have created a job a b c, but if you are we are connecting this field controller with the total station in that case all the data would be saved in your field calculator field controller. So, you have to assign a name.

So, you have to assign a name. So, you have to assign a name. So, you have to assign a name. So, you have to assign a name. So, you have to assign a name. Once you choose your name then you have gone to the coordinate system and then you choose your coordinate reference system.

It is this similar step which we have used for our article lab. If you are doing the survey in the in for your respective areas you can choose accordingly you can choose the coordinate reference system. So, for this area we have chosen the UTM 44 and it is WGS 84. So, once you choose your parameter you just keep store. So, here you can see your job has been created. It is lab TS and now we will connect this remote controller with the total station.

So, we will stop here and we will continue with the next lab. In the next lab we will show you how we can connect the field controller with the total station and we will set up our instrument and the mapping part. Thank you.