Digital Land Surveying and Mapping (DLS&M)
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Lecture - 26
Other Errors in Total Station

Welcome students. This is the 26th lecture on Digital Land Surveying and Mapping. In this class, I will discuss about the other errors that we come across during use of total station.

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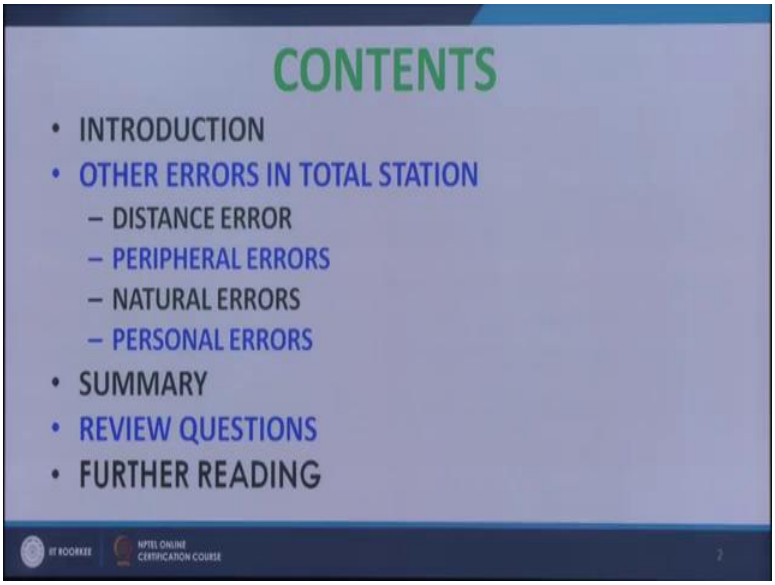

The class will be discussed under following heads like introduction. Now, other errors that we come across in that total station other than the instrument error are the distance error, peripheral error, natural error because we work in nature. So, there will be some factors or disturbance factors which cause errors in total station measurement due to nature and personal error. So, I will be discussing this points with an intention that we should take care of, so that these errors should not be occurring in our measurement or we should take due care so that the errors are minimized.

Now, the main errors which come across in total station is due to nonpermanent adjustment of the instrument. And we are seen that most of the errors how arises out of the nonpermanent of the instrument can be taken care of by taking the observation in both face left and face right condition. Then taking the errors or we should go for

calibration through which we will get the calibration parameters which will be automatically taken care of by the software to take or to make necessary corrections. Now, there are different types of errors that we come across which leads to the error in measurement of distance, the one of the most permanent errors is the zero error.

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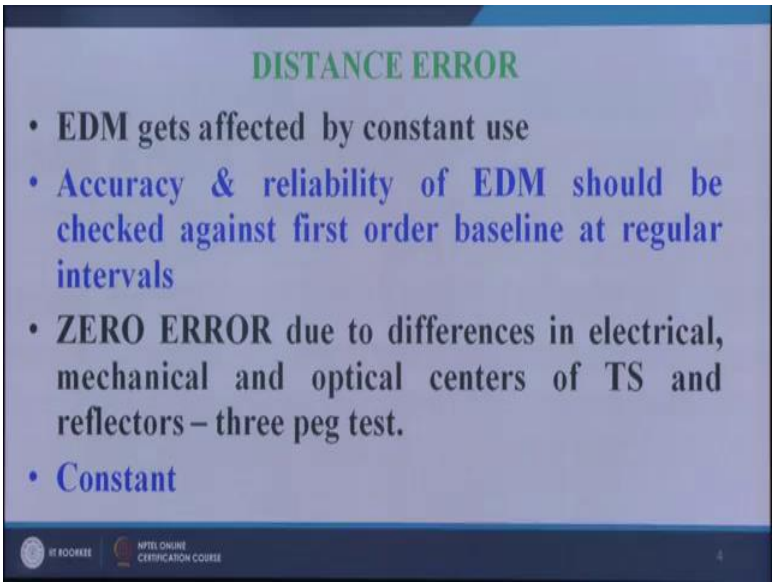

Now, what is zero error, actually these instrument is having many centers like electrical centers, physical center or mechanical center and one we make use of the reflectors then we are the optical centers. So, all these centers may not be in a position, where we expected to be. So, there is some error in this position and those errors are called zero error.

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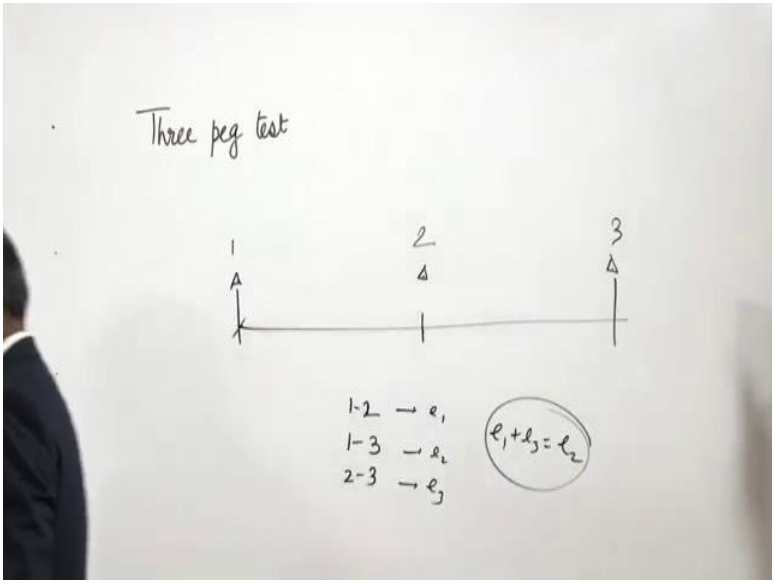

Now, these zero error is defined or determined by using a test called three peg tests which is very simple. In three peg test, what happens we do make use of three pegs peg 1, peg 2, peg 3. And we feel we can measure the distance between peg 1 and 2, peg 1 and 3 and distance 1-2, 1-3, 2-3 all these distances we can measure and there are two errors one. So, we can find out the errors e 1, e 2, e 3 and the error in 1-2 and 2-3 that means, e 1 and e 3 should be equal to e 2. So, the error in measuring distance from 1 to 2 should be equal error measuring distance 1 and 3 should be equal to error measurement 1 and 3. So, from that we can compute the amount of errors that is associated with the zero error and the amount of this error actually is constant.

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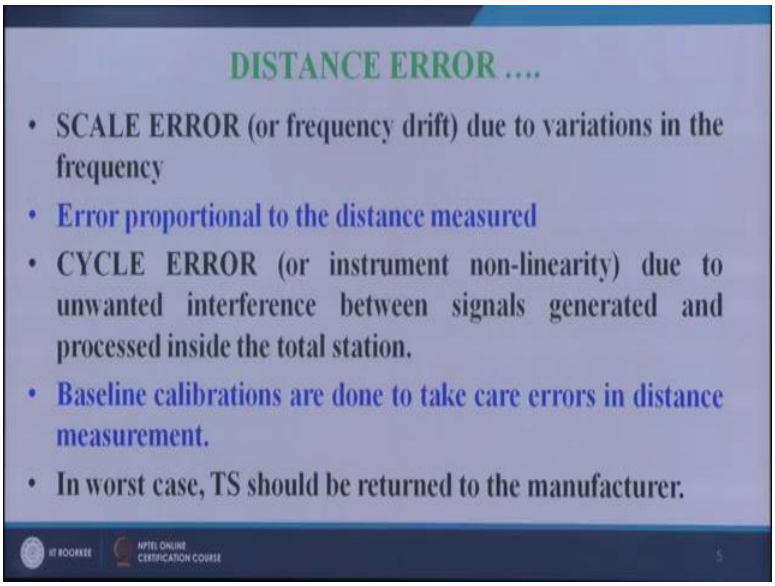

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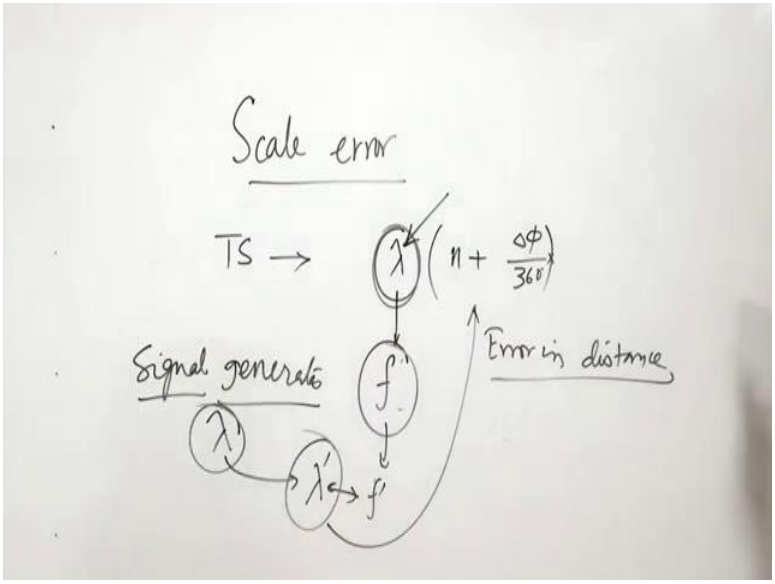

Now, another error which is the use of a very important that is call if we remember the total station makes especially face shift method makes use of the wavelength of the frequency multiplied by the number of del phi 360 like that. So, if we remember this is that means, the fundamental frequency relevant of the fundamental frequency is the most important or multiplying factors to the number of cycles and then this. Now, these verbal and means frequency of the signal; actually the total station it in self generates the signal and generates. And this helps having particular wavelength.

Now, if there is any discrepancy in working of the signal generation part of the instrument, all there may be some other problem then there may be some variation in the frequency or wavelength. So, this will lead us to error in distance measurement, error in distance, so this is called cycle error. And there are maybe some unwanted interference between the signal generated and processed inside the total station.

Now, there is another error called cycle error. So, another error is called cycle error. Now, this error arises out of the interference between the signal generated and process inside the total station. So, these two errors are associated with the frequency or the wavelength. And this is a very important thing to be taken care of, and that can be measured or identified by making use of the calibration called baseline calibration. So, manual we will have some standard procedure to for these baseline calibrations. So, should make use of that baseline calibration, and you should find out what is the amount of error and we have to make this have correction. Now, sometimes these errors may exceed the limit permissible limit in that case or sometimes it may not be possible to do the necessary correction or calibration; in that case we have to sum our total station to the manufacture.

So, actually distance error is very critical in measurement process. Now, apart from these system errors there are some other error that is associated with this instrument. For these errors are associated with the peripheral instrument that we used it this total station like we have that tripod stand. Now, in this case, we are making use of a very good quality of tripod stand, whose head is perfectly made as well as virile means and the fixings are nice. So, well maintained and well good quality tripod stand, but many times with many instrument or whenever we will use this tripod stand in the field some loose it may get loose are there many some break up, breaking up the instrument or a the tripod stand or its head or there may be some wear and tear.

So, similarly there is a try back this try back should be very good at means well made and well maintained as well as perfectly it should be leveled type thing. But in low cost or if we make use of these more in the field, if we handle this roughly all due to the different fell condition this may not be in good condition to use. But in spite of that if we use then there is a possibility of errors associated with these. Then we make use of optical plummet, you know we make use the optical plummet here. So, for centering

purpose that if the optical plummet is not an in good condition then the centering that will be done through these optical plummet may not be correct.

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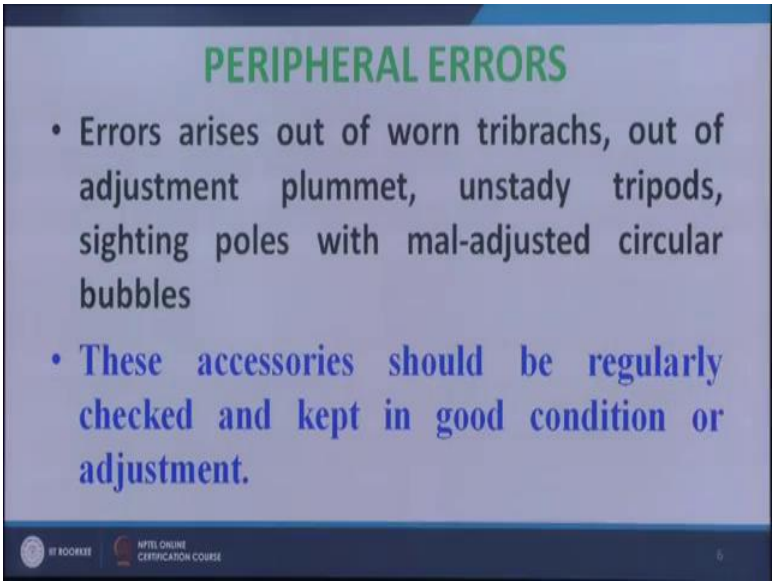

So, all these will lead to different errors, you know a leveling as well as errors while we will be taking the measurement. So, these errors are termed together in termed as peripheral errors. So, this errors can only be avoided if we make use of proper type of peripherals like our tripod stand should be a good quality; it all these legs should be properly fixed with the its head the head should be properly level try back should be a good quality as well as you should be properly made like that. And all these instruments has to be maintained properly or in good condition for future work. So, in this way, we can minimize the peripheral error only way to minimize or to remark by using proper instrument and proper maintenance of these parts.

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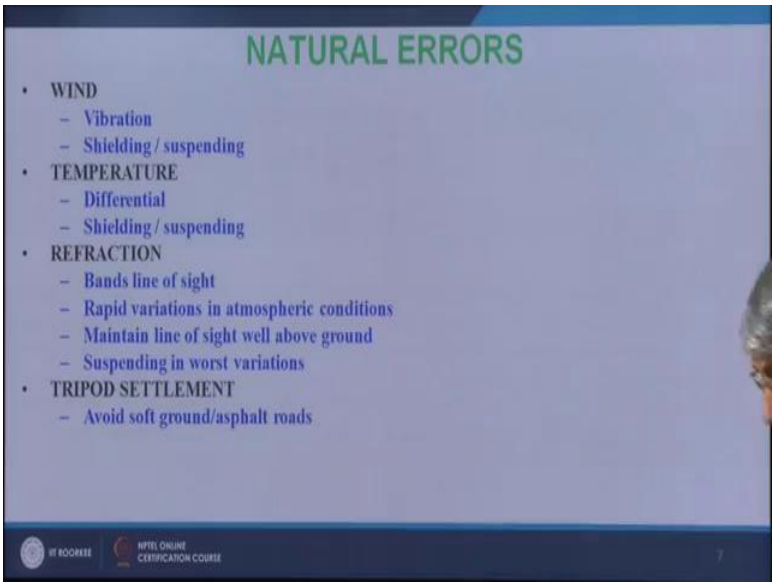

Apart from these instrumentation part, there is another type of error called natural error, because we go for fill my observation in the field, so we have to get expose our instrument to the sun, to the wind. Then our instrument has to be setup on the earth as well as the observation we take we make use of some electromagnetic wave or light. So, it will pass through the atmosphere. So, all these actually contribute to some problem or sometimes like if we go to some place where this may be or some days in a observation there may be a large wind; due to wind this instrument may vibrate. If it is not properly setup all the wind is very high then it will; obviously, vibrate, if it vibrates then if centering will get lost.

And if you centering gets lost, all our observation will get lost. Also if we take the reflected base measurement that a reflector will also get vibration and our all measurements will be incorrect or associated errors. So, in those cases, first we have to see that neither our instrument nor our reflector should get vibrated due to wind and that will be possible only each the wind is of mile in nature. But if the wind is very violent, then we should stop working. And on the no circumstances we can allow our observation you know on a vibrated instrument or vibrated reflected.

Then temperature, temperature is a very important parameter which has to be taken into account, because if the temperature fluctuates heavily then it adversely affects the body specifically the body of the instrument. And if it affects the body of the instrument then it

will definitely affect the working of the whole system. And as we know that total station is an electronic instrument; and electronic instrument malfunctions if it goes beyond the ambient temperature or there is a very fluctuating in temperature. So, in this case also, we should take care that our instrument should be maintained within the ambient temperature as the manufacturer has given in their manual. And in some cases, if we are unable to maintain the temperature or the nature is fluctuating so much that the temperature is uncontrollable then in that case we have to stop our work, and we should wait for favorable time to work.

Then the reflection, so as you know that our total station measurement makes use of the electromagnetic waves and electromagnetic wave will get reflected, when it is passes through the atmosphere. Now, when the atmosphere is common quite than the amount of reflection will be within regulated manner and that can great model and we can make use of that more goes model to make the necessary correction. But if the atmosphere is turbulent then the reflection amount is also will be very much varying and it cannot be modeled and show the correction cannot be done properly.

So, a reflection actually banes, it will banned the (Refer Time: 15:20) and rapid variation in the atmospheric condition makes the arbitrary bending and expansion of the going this side that side. And the one way to avoid or minimize the reflection is to make use of the instrument to keeping the instrument as above the ground as possible because the variation in atmospheric condition or the temperature of the atmosphere is more near the surface then above these small variation above. So, the reflection will be less critical if we maintain the instrument as high as possible. Now, in worst cases we have to suspend the work, we have to wait for the work for the favorable atmospheric condition.

Another consideration is very important is that whenever, we will set up the tripod stand, we must see that the tripod stand is set on the surface of the earth, which is sufficiently strong. It should not be fluid state or it should not get disturb whenever we work, work or you should not get settled as we fix up the instrument. So, this is a very important thing neither there should be unequal settlement of different legs. So, in this case also you can see we have because of these plane surfaces we have used this plane to set up our instrument. So, that all instrument should be in proper fixed the condition. So, properly fixing as well as standing of the instrument over the ground is very important and particularly chooses the ground which is moderately height. So, where our tripod should

can be kept with sufficiently fixed, and we should avoid soft ground we should avoid the spell roads etcetera.

So, there with this I want to go for next type of errors. Another error which is important is the personal error. Already told you that actually personal errors are the most severe gross errors are arises due to personal error. Now, personal error arises due to different reasons many times, the surveyor may not have the proper knowledge or they may be (Refer Time: 18:17) workers or they may be casual and there may be, so many reason personal reason. However, the personal errors due to those things that we can say that our instrument should be setup a proper location.

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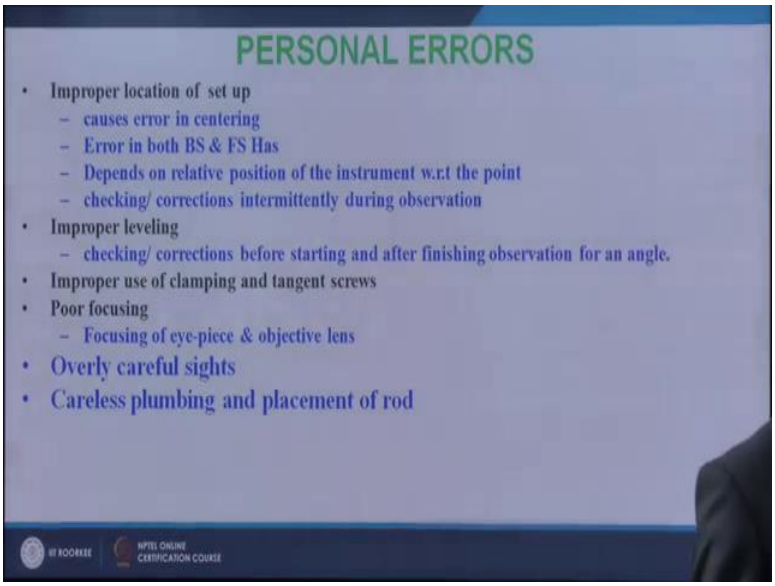

So, sometimes it may be difficult for a person to identify the proper location. So, in the flied because it is easy to satisfy the condition in office, but when we want to transfer the location to the field many times it may not be possible. Now, sometimes there may be problem in centering the instrument. So, due to imperfect centering we will go get different types of error.

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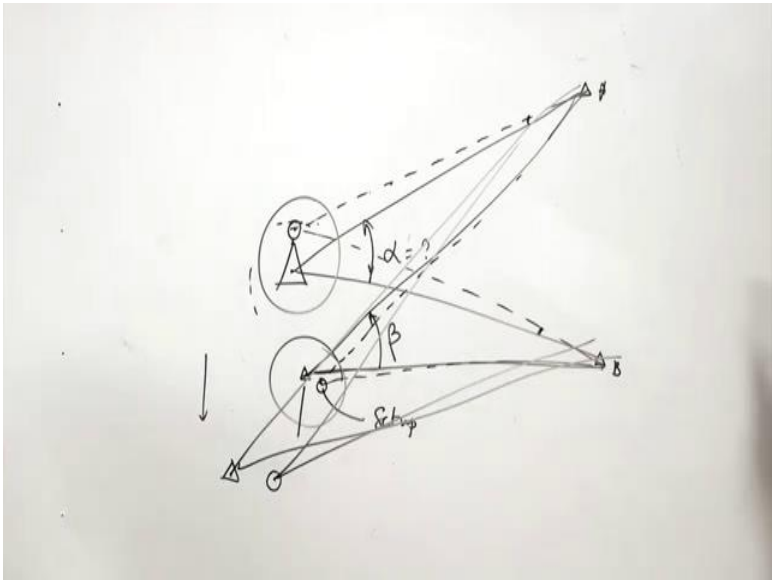

Now, suppose I want to set up the instrument somewhere here, but we have set up the instrument somewhere here. So, the object here A and B between which we want to find out the angle this is the angle we want to find out, but as we have set up the instrument in this location, we will get like this. So, you can see that this is the error, this is the error and this is the error, so now, in one case. So, in another case, if we set up the instrument if we want to setup instrument here and we have setup the instrument there, we want to set up here. Now, in this case, if the angle is something like this something like this we want to find out this is the angle we have to find out, , but we have find out this.

Now, what I wanted to emphasis that the error that will be associated with the measurement with respect to centering will depend upon the mutual orientation between the actual and between which we have setup required setup and actual setup. So, between that mutual locations in whether it is in that along the same line or it is sometimes we may have the location like this. So, in that case, the location now we want to get this, we are getting this. So, mutual location of the exact position and the position where we have located, the amount of error depends. And this can be minimized during observation we should go on checking, whether our centering is maintained or not. If it is not maintained then we should center again, and then we should take the observation.

Similarly, this is the error due to centering. Similarly, we are maybe error e due to leveling. Now, if the instrument is not properly leveled, now meaning is that the

horizontal circle is not horizontal; and the vertical circle will not be vertical. So, we will be having our measurement of random errors. So, before starting to measure any angle, after measuring the angle, we should check the level of the instrument. And before starting if we see that it is level, it is not level then we have to level it. After measurement if we find that it is not level; that means there is some discrepancy in our measurement. So, we have to discard that measurement.

So, we should find that the instrument is level before the measurement, we should check have to find it after the measurement. Again we check you have to find is level then only we will accept that measurement, so improper leveling, the improper use a clamping and tangential screw. So, since this instrument has a number of screw like this is the horizontal (Refer Time: 23:20) screw, it is the vertical plate many screw this is the tangential to the vertical plate, this is the tangential horizontal plate, there are collimation screw, another ibis screw there is a focusing screw.

So, there are so many screws are there. So, there is every possibility that we do make some mistakes in making use of the screws. So, these needs proper training and experience and also practice, and then only we can avoid these things. Many times we are we failed to focus our lenses, so because before as I told you during temporary adjustment first we should focus the eye-piece lenses. So, that we see the cross airs in the reticles clearly.

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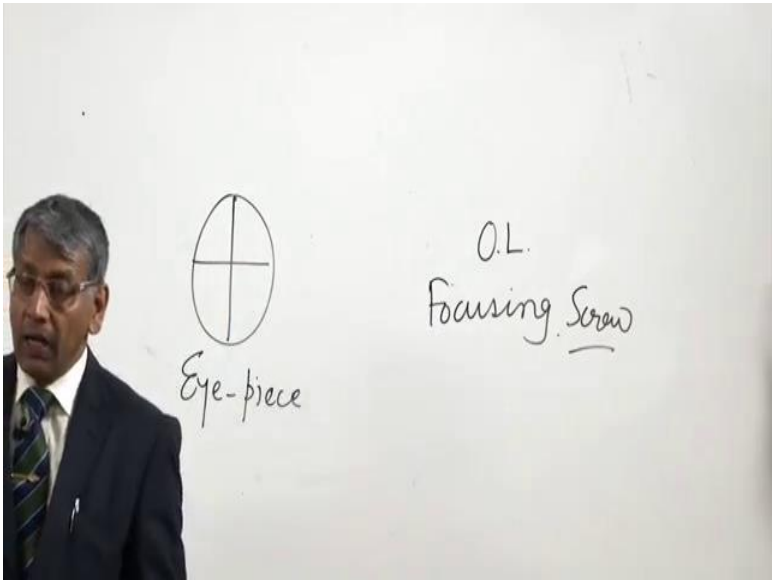

This is the eye-piece lens eye piece lens focusing. Then we should orient our telescope to the object towards the object and bisect the object. And to bisect nicely the object, we should use the focusing screw focusing objective lens focusing screw to focus the object means to make the image of the object fall in the plane of the reticle so that should be done clearly. If we than do then there is a mistakes in measurement, so and there may be some piolex some time. So, we should see that there is no piolex. So, these things we have to very careful during our measurement. And sometimes over careful may also lead to some errors or careless plumbing in placement of error sometimes.

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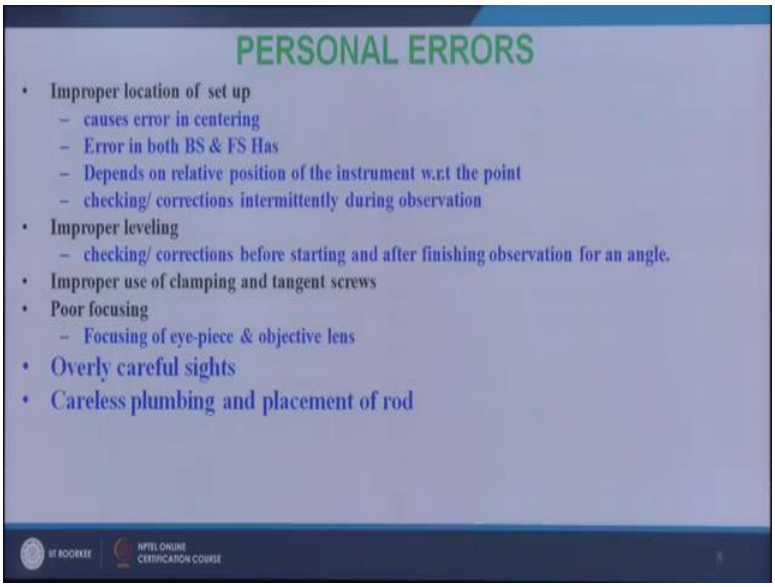

Whenever we make use of the reflectors, we may be careless in holding it. It may not be fixedm it may not be straight, it may be at properly level, you saw actually do with this plumbing bomb, there is a level, so that level should be properly seen and maintained. So, with this, I like to conclude today's class on other errors in total station observation.

So, the summary is that apart from instrumental error due to lack in permanent adjustment of the total station there are many other errors. And these errors are very significant one we should take care to see that those errors should not be occurred during our total station measurements and we should take care to eliminate or reduce as much as possible. With this, I like to conclude this class. And next class, I will be talking on propagation of error.

Thank you.