Transcripts for “Selected Videos”

Surveying to a CSG- When taking foresights on crest stage gages it’s important to know where the crest stage gage is indexed. For the crest stage gage we are going to be shooting today the index is the stud inside of the bottom cap, as shown here. We will be holding our rod on the lip of the bottom cap, which is at the same elevation as the stud inside of the cap. Other indexes for other types of crest stage gages include a bolt that is drilled through the pipe, or even the top of the crest stage gage itself. We have established an instrument height of 12.906 ft from a backsight to reference mark number five. We are now going to take a foresight on the crest stage gage index, which is on the top of the bottom cap. And our first reading is 6.634 ft. I’m going to do a check read. Which is also 6.634 ft, which gives us an index elevation of 6.272 ft.

Surveying to a wire weight check bar- from that backsight to turning point number one I have a new instrument height of 26.111 ft. I am now going to take a foresight, which will be my second foresight on the wire weight check bar. The rod read is 1.468…1.468.

Surveying bottom of wire weight- We have now moved the instrument down to the low water bank, so we can get a foresight on the bottom of the wire weight. We shot a foresight from our initial height of instrument on the other side of the river to turning point number one to establish an elevation. We are now going to take a backsight to turning point number one to establish our second instrument height. The rod read is 3.997. I am now going to ask my rod man to raise the wire weight up until it hits the crosshairs of the instrument. The crosshairs of the instrument are at the instrument height which we established from a backsight to turning point number two. Knowing what the instrument height is and comparing it to the read on the wire weight dial will let us know the wire weight is set at the correct elevation. Bring it up… up. That’s good. I am now going to ask my rod man what the dial reads on the wire weight gage. He says, “14.58” and the height of instrument is 14.58.

Surveying to a staff plate- We are now ready to take our second foresight on the nail that is driven into the backing of the vertical staff plate to check the staff plate elevation. (subtitles- still photo of rod on nail in staff plate backing). And the rod read is 10.061 and my check read is also 10.061 which gives me an elevation of the nail in the backing of 5.678 and the nail is set at 5.68 ft on the staff plate.

Surveying an electric tape index- River stage at this gaging station is sensed inside of a stilling well. Our primary reference gage is the electric tape gage shown here. To obtain a gage height or water surface elevation inside of a stilling well this weight attached to the electric tape gage is lowered down to the water surface and the stage is read at the electric tape index. As you can see this index, which is the black line, is not exactly on the shelf of the gaging station. In order for us to get a foresight at the elevation of the electric tape index we have placed some coins on the shelf. We are using a pocket rod instead of a self reading rod or a bar code rod because we cannot fit those inside of the gaging station. (subtitles- still photo of pocket rod held on coins placed on instrument shelf). We are now going to take a foresight on the electric tape index. If you will notice we are using a pocket rod held on a set of coins that are on the instrument shelf. I have to use the optical system of this digital level because it is a self reading rod and my read is 1.386…1.386, which gives me an elevation of 7.351 ft.

Surveying the water surface- (shooting the water surface directly) we are now going to take a foresight on the water surface. Mike, my rod man, is holding the rod on a rock at the water surface. I'm going to get a reading of the rod and then will ask Mike to provide me with an accuracy estimate of the rod held onto the rock. My initial read is 11.021 ft… and my second read is 11.021 ft as well, which gives me an elevation of the water surface of 4.693 ft. Mike I'm going to ask to get a reading of the primary reference gage the vertical staff plate. He says, "The water surface according to the water plate is 4.68 ft plus or minus .02," and our elevation of 4.693 agrees within the two hundredths accuracy estimate that Mike provided earlier.

(Using shot to stable rock on the channel bottom and depth of water to determine water surface elevation). We are now going to take a foresight on the water surface. Mike is holding the rod on a stable rock on the channel bed I'm going to ask Mike to read the back of the rod, the self reading portion of the rod, to give me the depth of water. The depth of the water is 0.380 ft and I'm going to take a foresight to get an elevation of the water… of the channel bed. My initial rod reading is 6.219. I'm going to take a quick check, which are also 6.219 so I have an elevation of that rock. The top of the rock on the channel bed 2.518 ft. I'm going to add the depth that Mike reported to me of 0.380 ft to get an elevation of the water surface of 2.898 ft.

Running a two peg test- We are now going to run a two peg collimation test to determine any collimation error that our engineer's level may have. The engineer's level that we are using is a digital level that also has an optical system. We will be running the two peg test first on the optical system and then on the digital system.

We have set up our two peg test by driving two rebar pegs into the ground; one over here and one located down there. We will set our instrument up near to the first peg and take a rod reading from the instrument. We will then take a rod reading from this same instrument set up to the second peg over there. After that reading we will move the instrument to be near the second peg and then we will take a rod reading from that location to the second peg and then we will also take a long reading to the first peg. We will be measuring distances between the instrument for each shot to the pegs. We want to set it up so that the instrument for the long shots is no longer than 110 feet.

We are now getting ready to take our first shot to our first peg. As I said before we are using a digital engineer's level that's equipped with an optical system. Because it is common to have to rely on the optical system for various readings when running gaging station levels we need to run our two peg test on both systems. I will first be making manual reads of the self reading rod using the optical system and then I will ask my rod man to turn the rod around, and I will take a digital reading using the digital system of

the level. I will also be needing the distances between this instrument and the various pegs and I will be getting that by using the stadia from the digital system. You could also use the stadia hairs on an optical level or you can stretch a measuring tape between the two points to obtain those distances.

I'm now going to make my first rod reading on the first peg from the first instrument set up. This will be reading number one, R1. And I'm first going to make an optical measurement from the self reading side of the rod. That measurement is 4.631. I'm now going to ask my rod man to turn the rod around and I'm going to use the digital system to get a measurement. That measurement is also 4.631. I'm going to do a quick check; 4.631. My first distance, D1, is 16.8 feet. We have moved the rod over to the second peg so we can now get our second reading from instrument height number one; reading number two, R2. As before I'm going to use the optical system to get a manual read of the self reading rod. My read 4.924. I'm now going to ask my rod man to turn the rod around so I can use the digital system. That reading is 4.925. I'll do a quick check. 4.925, and my distance, D2, is 93.2 feet.

I've now moved the instrument to the second instrument location near to the second peg. I'm now going to make a reading of the second peg, rod reading number 3, R3. I'm going to take an optical read, which is 4.880. I'm going to ask my rod man to turn the rod around so I can use the digital system. And the first digital reading is 4.879. I'll do a quick check. 4.879 for reading number 3, R3, and my distance, D3, is 22.9 feet.

We are now ready to take our final readings of the two peg test. This will be reading number 4, R4. My optical read is 4.589. I'm now going to ask my rod man to turn the rod around so I can use the digital system. My first reading is 4.589. I'll do a quick check. 4.589, that's reading 4, R4, and my distance for number 4, D4, is 87.1 feet.

We have now completed our two peg collimation test of our engineer's level. The collimation error for the optical system of our engineer's level is -0.0014 feet per 100 feet, and our collimation error for the digital system of

our engineer's level is -0.0028 feet per 100 feet. These collimation errors are both less than or equal to the absolute value of 0.003 feet per 100 feet; and therefore, our engineer's level is within acceptable tolerances.

Using a digital level- For this level circuit we are going to be using a digital and an optical engineer's level. The digital system utilizes a bar code rod shown here, which on the back side also has a self reading graduation that you can use the optical system with.

We are going to begin this level circuit with a backsight to reference mark number nine which is our origin. I'm going to focus in on the digital rod using the optical part of the engineer's level and then interrogate the digital system to give me a reading. I'm going to interrogate it twice to get two values. The first read is 4.660 feet, and the second read is also 4.660 feet. I'm going to add this backsight to the elevation of the reference mark to obtain the first height of instrument for the level.

Backsight Example- We are going to establish our initial instrument height. We call that HI1, from a backsight to reference mark number two, which were calling our origin. I'm using a PDA to record this using the station levels program.

My first shot to RM2 is 2 feet, 2.150, and I'm going to record that. I'm going to add that number to the elevation of the reference mark to establish my height of instrument.

Foresight Example- We are now going to take our first foresight to reference mark number one, RM1. My initial reading is 5.346 feet. I'm going to do a quick check read, which is also 5.346 feet, which gives me an elevation of 3.391 feet for reference mark 1.

Reading the rod temperature- When running levels at a gaging station you must consider the effects of thermal expansion or contraction of the rod scale material. This is particularly important when you are dealing with a rod that's made of a material such as fiberglass which has a fairly high coefficient of thermal expansion. To make the corrections for expansion or contraction of the rod scale material you need to have the temperature of

the rod material itself. The best way to get this temperature is with a non-contact infrared thermister such that I'm showing here. You just point the gun at the rod, shoot it, and it will give you the surface temperature of the rod scale. Today we have a rod scale temperature of 85.5 degrees Fahrenheit.

Establish a turning point- Okay I can't with one turn get myself up in position to shoot the top of the bridge railing. So we are going to have to turn and work our way up the hill. What we have done is put a turning point there at the base of Stan's feet and he is holding the rod there on that turning point and I've given that an elevation. Now I will go up and set up on the bridge and back shoot that turning point to get a new HI. Okay what we have done, I've moved up now on the roadway. I'm taking a back shot on the turning point that we set and this will give me a new HI so that I can shoot the wire weight and also the bridge rail. So I need to take this shot now and I've got a 7.601.

Transcripts of videos in module “Leveling Equipment”

Slide 2

For this level circuit we are going to be using a digital and an optical engineer’s level. The digital system utilizes a bar code rod shown here, which on the back side also has a self reading graduation that you can use the optical system with.

We are going to begin this level circuit with a backsight to reference mark number nine which is our origin. I’m going to focus in on the digital rod using the optical part of the engineer’s level and then interrogate the digital system to give me a reading. I’m going to interrogate it twice to get two values. The first read is 4.660 feet, and the second read is also 4.660 feet. I’m going to add this backsight to the elevation of the reference mark to obtain the first height of instrument for the level.

Slide 8

We are now going to run a two peg collimation test to determine any collimation error that our engineer’s level may have. The engineer’s level that we are using is a digital level that also has an optical system. We will be running the two peg test first on the optical system and then on the digital system.

We have set up our two peg test by driving two rebar pegs into the ground; one over here and one located down there. We will set our instrument up near to the first peg and take a rod reading from the instrument. We will then take a rod reading from this same instrument set up to the second peg over there. After that reading we will move the instrument to be near the second peg and then we will take a rod reading from that location to the second peg and then we will also take a long reading to the first peg. We will be measuring distances between the instrument for each shot to the pegs. We want to set it up so that the instrument for the long shots is no longer than 110 feet.

Slide 9

We are now getting ready to take our first shot to our first peg. As I said before we are using a digital engineer's level that's equipped with an optical system. Because it is common to have to rely on the optical system for various readings when running gaging station levels we need to run our two peg test on both systems. I will first be making manual reads of the self reading rod using the optical system and then I will ask my rod man to turn the rod around, and I will take a digital reading using the digital system of the level. I will also be needing the distances between this instrument and the various pegs and I will be getting that by using the stadia from the digital system. You could also use the stadia hairs on an optical level or you can stretch a measuring tape between the two points to obtain those distances.

I'm now going to make my first rod reading on the first peg from the first instrument set up. This will be reading number one, R1. And I'm first going to make an optical measurement from the self reading side of the rod. That measurement is 4.631. I'm now going to ask my rod man to turn the rod around and I'm going to use the digital system to get a measurement. That measurement is also 4.631. I'm going to do a quick check; 4.631. My first distance, D1, is 16.8 feet. We have moved the rod over to the second peg so we can now get our second reading from instrument height number one; reading number two, R2. As before I'm going to use the optical system to get a manual read of the self reading rod. My read 4.924. I'm now going to ask my rod man to turn the rod around so I can use the digital system. That reading is 4.925. I'll do a quick check. 4.925, and my distance, D2, is 93.2 feet.

Slide 10

I've now moved the instrument to the second instrument location near to the second peg. I'm now going to make a reading of the second peg, rod reading number 3, R3. I'm going to take an optical read, which is 4.880. I'm going to ask my rod man to turn the rod around so I can use the digital

system. And the first digital reading is 4.879. I'll do a quick check. 4.879 for reading number 3, R3, and my distance, D3, is 22.9 feet.

We are now ready to take our final readings of the two peg test. This will be reading number 4, R4. My optical read is 4.589. I'm now going to ask my rod man to turn the rod around so I can use the digital system. My first reading is 4.589. I'll do a quick check. 4.589, that's reading 4, R4, and my distance for number 4, D4, is 87.1 feet.

Slide 11

We have now completed our two peg collimation test of our engineer's level. The collimation error for the optical system of our engineer's level is -0.0014 feet per 100 feet, and our collimation error for the digital system of our engineer's level is -0.0028 feet per 100 feet. These collimation errors are both less than or equal to the absolute value of 0.003 feet per 100 feet; and therefore, our engineer's level is within acceptable tolerances.

Transcripts of videos in module “Basic Concepts”

Slide 4

We are going to establish our initial instrument height. We call that HI1, from a backsight to reference mark number two, which were calling our origin. I’m using a PDA to record this using the station levels program.

My first shot to RM2 is 2 feet, 2.150, and I’m going to record that. I’m going to add that number to the elevation of the reference mark to establish my height of instrument.

Slide 5

We are now going to take our first foresight to reference mark number one, RM1. My initial reading is 5.346 feet. I’m going to do a quick check read, which is also 5.346 feet, which gives me an elevation of 3.391 feet for reference mark 1.

Slide 11

When running levels at a gaging station you must consider the effects of thermal expansion or contraction of the rod scale material. This is particularly important when you are dealing with a rod that’s made of a material such as fiberglass which has a fairly high coefficient of thermal expansion. To make the corrections for expansion or contraction of the rod scale material you need to have the temperature of the rod material itself. The best way to get this temperature is with a non-contact infrared thermister such that I’m showing here. You just point the gun at the rod, shoot it, and it will give you the surface temperature of the rod scale. Today we have a rod scale temperature of 85.5 degrees Fahrenheit.

Transcripts of videos in module “Running Levels”

Slide *5*

Okay I can’t with one turn get myself up in position to shoot the top of the bridge railing. So we are going to have to turn and work our way up the hill. What we have done is put a turning point there at the base of Stan’s feet and he is holding the rod there on that turning point and I‘ve given that an elevation. Now I will go up and set up on the bridge and back shoot that turning point to get a new HI. Okay what we have done, I’ve moved up now on the roadway. I’m taking a back shot on the turning point that we set and this will give me a new HI so that I can shoot the wire weight and also the bridge rail. So I need to take this shot now and I’ve got a 7.601.

Slide 14

We have now moved the instrument down to the low water bank so that we can get a foresight on the bottom of the wire weight. We shot a foresight from our initial height of instrument on the other side of the river to turning point number one to establish an elevation. We are now going to take a backsight to turning point number one to establish our second instrument height. The rod read is 3.997. I’m now going to ask my rod man to raise the wire weight up until it hits the cross hairs of the instrument. The cross hairs of the instrument are at the instrument height which we established from the backsight to turning point number two. Knowing what the instrument height is and comparing it to the read on the wire weight dial will let us know if the wire weight is set at the correct elevation. Bring it up, up. That’s good. I’m now going to ask my rod man what the dial reads on the wire weight gage. He says 14.58. And the height of instrument is 14.58.

Slide 16

We are now going to take a foresight on the water surface. Mike is holding the rod on a stable rock on the channel bed. I’m’ going to ask Mike to read the back of the rod, the self reading portion of the rod, to give me the depth of water. The depth of the water is 0.380 feet, and now I’m going to take a foresight to get an elevation of the channel bed. And my initial rod reading

is 6.219. I'm going to take a quick check, which is also 6.219. So I have an elevation of that rock, the top of that rock on that channel bed of 2.518 feet. I'm going to add the depth that Mike reported to me of 0.380 feet to get an elevation of the water surface of 2.898 feet.

We are now going to take a foresight on the water surface. Mike, my rod man, is holding the rod on a rock at the water surface. I'm going to get a reading off the rod and then ask Mike to provide me with an accuracy estimate of the rod held onto the rock. My initial read is 11.021 feet. And my second read is 11.021 feet as well, which gives me an elevation of the water surface of 4.693 feet. Mike I'm going to ask to get a reading of the primary reference gage, the vertical staff plate. He says the waters surface according to the staff plate is 4.68 feet plus or minus 0.02 and our elevation of 4.693 agrees within the 0.02 accuracy estimate that Mike provided earlier.

Transcripts of videos in module "Example Level Run"

Slide 3

We are here at Snake Creek near Charleston, Utah. Mike freeman and I are going to run a set of station levels. We have a gaging station which is a stilling well equipped with an electric tape gage which is our primary reference gage. Stage is sensed inside of the stilling well. We also have an auxiliary gage located outside of the stilling well which is a vertical staff plate. We have an RM on this side of the bank located right next to the structure over here. We have a second RM located on the other bank on the other side of the structure. We also have a third RM located on a piece of concrete upstream from where I'm standing.

Slide 4

We are going to begin this level circuit with a backsight to reference mark number four to establish our initial instrument height. My first reading is 5.153 feet. I'm going to do a check reading and it is also 5.153 feet, which gives me an initial height of instrument of 8.737.

Slide 5

We are now going to take our first foresight to reference mark number one, RM1. My initial reading is 5.346 feet. I'm going to do a quick check read, which is also 5.346 feet, which gives me an elevation of 3.391 feet for reference mark one.

Slide 6

We are now going to take a foresight to reference mark number five. My initial reading is 4.889. I'm going to do a quick check. The check reading is also 4.889, which gives me an elevation of 3.848 feet.

Slide 7

River stage at this gaging station is sensed inside of a stilling well. Our primary reference gage is the electric tape gage shown here. To obtain a gage height or water surface elevation inside of the stilling well, this weight

attached to the electric tape gage is lowered down to the water surface and the stage is read at the electric tape index. As you can see this index which is the black line is not exactly on the shelf of the gaging station. In order for us to get us a foresight at the elevation of the electric tape index we have placed some coins on the shelf. We are using a pocket rod instead of a self reading rod or the bar code rod because we cannot fit those inside of the gaging station.

We are now going to take a foresight on the electric tape index. If you will notice we are using a pocket rod held on a set of coins that are on the instrument shelf. I have to use the optical system of this digital level because it is a self reading rod. And my read is 1.386, which gives me an elevation of 7.351 feet.

Slide 8

We are now going to take a foresight to a reference point on our auxiliary vertical staff gage. The rod is being held at the point of 5.52 feet on the vertical staff gage. And now we are going to read the rod. Our first reading is 3.203 feet. We'll do a quick check read here, which is also 3.203 feet which gives us an elevation of 5.534 feet at that point on the vertical staff gage, which is a difference of 0.014 feet.

Slide 9

We are now going to take a foresight on the water surface. Mike is holding a rod on a stable rock on the channel bed. I'm going to ask Mike to read the back of the rod, the self reading portion of the rod, to give me the depth of water. The depth of the water is 0.380 feet and now I'm going to take a foresight to get an elevation of the channel bed. And my initial rod reading is 6.219. I'm going to take a quick check, which is also 6.219. So I have an elevation of that rock, the top of that rock on the channel bed, of 2.518 feet. I'm going to add the depth that Mike reported to me of 0.380 feet to get an elevation of the water surface of 2.898 feet.

Slide 10

We just got done shooting our fore shots on the water surface, now we need to check our reference gages. We are going to take a reading on the ETG here; by lowering the brass weight down to the water surface, I've got a gage height of 2.90. Then I'm going to look at our recorder which is a float tape and we have a stage of 2.90 as well.

Slide 11

The final objective point of this level circuit is a shot on the bottom of the electric tape weight. However, because the electric tape weight is below the shelf we need to move the instrument so that it's low enough to hit the bottom of that weight. In order to do so we have established a stable turning point by driving a screwdriver into the ground. So now I'm going to take a foresight on that turning point, the screwdriver. And my first read is 6.131 feet. I'll do a quick check, and my check read is also 6.131 feet, which gives me an elevation of turning point 1 of 2.606.

I've now moved the instrument to where it's low enough so that I can get a nice shot into that door of the gaging station and now I have to establish this height of instrument from turning point one that we established with the past foresight from the last set up. My first read is 3.009, and my check read is also 3.009.

Slide 12

The final objective point of this level circuit is a shot on the bottom of the electric tape gage weight. I've set the instrument up low enough so that I can see into the gaging station. I'm going to ask Mike, my rod man, to lower the weight until the bottom of the weight is at the cross hairs of the instrument and then I'm going to ask him to give me a gage height reading at the electric tape index, and if the two are in agreement, I would expect that, that value will equal the height of instrument. Down, down, right there. Mike what's that reading. The reading of the electric tape index is 5.61 and the reading in the height of instrument is 5.615; those agree.

Slide 14

We have obtained our first foresights and computed our first elevations for all of the objective points in this level circuit. We are now at the point in which we need to take our second foresights to obtain second elevations for those same objective points. So we've established another stable turning point over by the gage from which we can get an established elevation, shake up the instrument and move it, take a backsight back to it, to obtain a new height of instrument. And our rod reading is 1.349, and I'm going to do a quick check and that is also 1.349, which gives me an elevation of our second turning point of 4.266 feet.

So now I need to establish a new instrument height so I'm going to shake up the instrument; slightly move it in its space so it's at a new instrument height.

I've shaken up the instrument by changing its height and now I'm ready to take a backsight to turning point number two to establish a new instrument height. After I establish that new instrument height I'm going to follow the level circuit backwards from the way I shot it the first time and get my second foresights on the bottom of the wire weight and then similar to the first level circuit I'm going to move the instrument back to that same location through the use of a turning point. I'm going to get another height of instrument and I'm going to shoot the same reference marks, the water surface, the auxiliary gage, the electric tape index, and then finally close it out with a final shot to the origin, reference mark number four.

Slide 15

I'm now going to take a foresight to the bottom of the electric tape weight. I'm going to ask Mike to lower it down so it's in the cross hairs of the instrument. Mike, down, down, keep coming. That's good. What's the reading of the index; 5.66, and my instrument height is 5.666.

I now have to move the instrument to an area where I can shoot all the rest of the objective points, so I'm establishing another turning point. We are going to call it turning point three. And the rod read is 3.061. I'm going to shoot it again; 3.061, which gives me an elevation of 2.605 for our new turning point.

Slide 16

I'm now ready to establish my final instrument height from a backsight to turning point number three. My rod reading is 6.094; quick little check; 6.904, which gives me a new instrument height of 8.699.

Slide 17

We are now going to take a foresight to the electric tape index. Just as before we are going to be holding a pocket rod, so it's a self read I have to make with the optical system of the digital level. And the reading is 1.350, which gives me an elevation of 7.349.

We are now ready to take our second foresight on the water surface. Similar to the way we did it before, Mike has found a stable rock onto which he is holding the rod. I'm going to shoot a foresight to the rod to obtain the elevation of that rock. I'm then going to ask Mike to give me the cut, essentially the depth of the water above that rock, which I'm going to add to the elevation to get the water surface elevation. My initial rod reading is 6.201, and I'll do a quick check, 6.201. Mike, I'd like a cut please. We are going to have a cut of 0.42 which we are going to add to the elevation of the bottom of the channel which was at 2.498 to get a water surface elevation of 2.918. I'm also going to ask Mike for an accuracy estimate. He's saying the rod is being held plus or minus 0.02 of the water surface. We are now going to read the reference gage and the auxiliary gage as well as the data recorder.

We are now ready to take our second foresight on our auxiliary vertical staff gage from a reference point on the backing. My first shot is 3.166 feet. I'll do a quick check; 3.166 feet gives me an elevation of 5.53 and on that staff plate that reference point is marked at 5.52 feet.

We are now going to take our second foresight to reference mark number five. My rod reading is 4.853. I'll do a quick check; 4.853, to give me an elevation of 3.846 feet.

We are now going to take our second foresight on reference mark number one, RM1. My rod reading is 5.309 feet; quick check and its 5.039 feet, to give me an elevation of 3.390 feet.

Slide 18

We are now ready to close out this level circuit with a final foresight to our origin, reference mark number four. The first rod reading is 5.114; quick check, 5.114, to give me an elevation of 3.585 feet.

Slide 19

We completed our level circuit with a circuit closure error of 0.001 feet. We had four instrument set ups which gives us an allowable closure error of 0.006 feet. So the levels have closed successfully.