YOGA

The merits of yoga are widely advertised today.

The following photos are examples of yoga practiced in different parts of the world.

First India:

Asanas with Props

The ancient yogis used logs of wood, stones, and ropes to help them practice asanas effectively. Extending this principle, Yogacharya Iyengar invented props which allow asanas to be held easily and for a longer duration, without strain.

YOGACHARYA IYENGAR IN SETUBANDHA SARVANGASANA

This version of the posture requires considerable strength in the neck, shoulders, and back, requiring years of practice to achieve. It should not be attempted without supervision

!

And now

West Virginia:

Taping
and
Level Surveying

Surveying

Surveying is the art and science by which lines, distances, angles and elevations are measured on or under the earth's surface. NRCS Engineering emphasizes the importance of surveying by devoting the first chapter of the NRCS Engineering Field Handbook to "Engineering Surveys".

Survey skill is only obtained by practice. This week we will give you an introduction to surveying. You must develop your skills by practicing the techniques we will show you.

Surveying Resources

Also remember that you have been given a very valuable resource this week. That is the combined experience of the instructors and technicians here this week. Please ask them for assistance at anytime now or in the future.

No greater compliment can be given to your instructors than by asking one of them a question.

Basic Surveying Skills

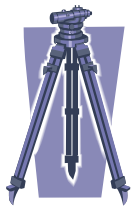
The three basic skills we are going to introduce you to are:

- Linear Measurement
- Differential Leveling
- Note Keeping

Basic Surveying Skills

- Linear Measurement
  - Linear Measurement is the basis of all surveying. Standard Taping procedures are, in fact, so basic that they are often overlooked as a source of errors in a survey.

- Differential Leveling (Level Surveying)
  - Differential Leveling is the other basic survey skill needed in conservation engineering. Differential leveling is a method of determining the difference in elevation between two points.

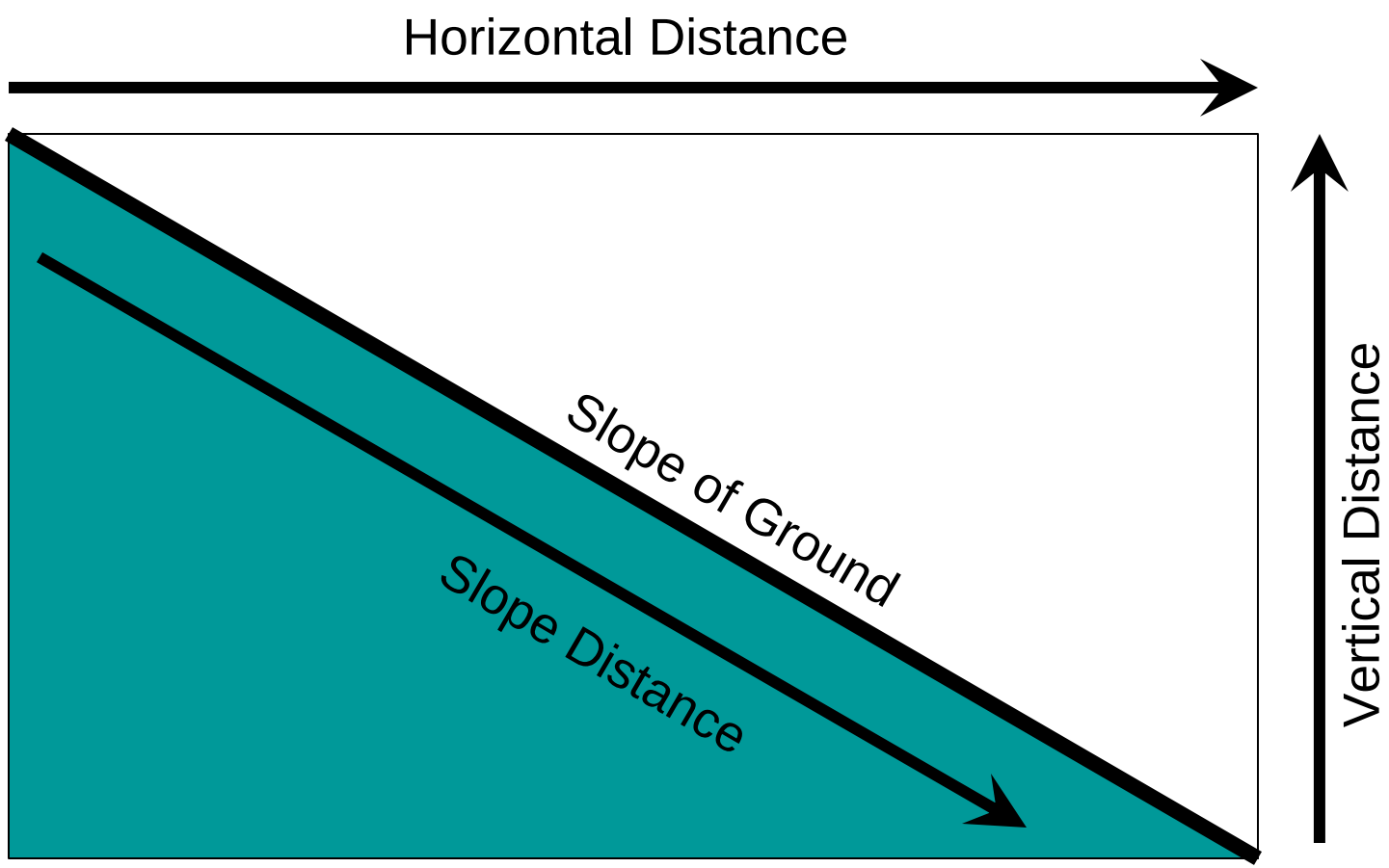


Basic Survey Skills

- Note Keeping (Remember CIA)
  - Clarity – Legible, Neat and Clear.
    - Notes and sketches are an asset only if they can be understood.
  - Integrity – Field Notes are only of use if the integrity of the notes are not compromised.
    - Fudged notes, erasures, scratch outs, and missing pages in the field book all compromise the Integrity of the survey.
  - Accuracy – Bad data is far worse than no data.

Linear Measurement

Types of Distance Measurements

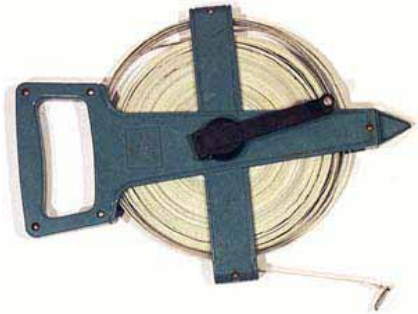


Measurement Methods

- What tools do we have available to measure linier distances?

Measurement Methods

- Pacing
- Taping
- Wheel
- Total Station
- GPS



Pacing

Pacing is an easy and quick way to determine ground (slope) distance between two points. Pacing is just counting the number of steps between the points then multiplying by the length of your step. With practice it is amazingly accurate.

Questions?

- Do steps get longer or shorter pacing uphill?

- Do steps get longer or shorter when pacing downhill?

Answer

- Steps get shorter going uphill.

- Steps get longer going downhill. **Up to a point**. With most people, after the ground reaches a certain slope, their step shortens again.

More Questions?

- Do you know how many steps you take per 100’?

- Do you know average step length?

Tapes (Chains)

- A tape should be graduated in feet, 1/10's and 1/100's of feet.
- Be constructed of non-elastic material (fiberglass tapes works well)
- Be at least 100' long (300' is my personal choice)

Taping Crew

- Positions
  - Head Chain Sets the pace, keeps line and marks the distances measured on the ground.

  - Rear Chain Watches procedures, keeps line and records distances measured.

Slope Distances

Again…. Slope distances are measured along the slope of the ground.

When do I use slope distances?

- Determining certain material quantities.
  - Example: Pipeline quantities needed for a watering system. Animal Trails and Walkways lengths.

- Planning and functionality measurements.
  - Example: Estimating length of an Animal Trails and Walkways for program applications. Estimating the length Stream Restoration practice.

Horizontal Distances

How do I measure a Horizontal Distance?

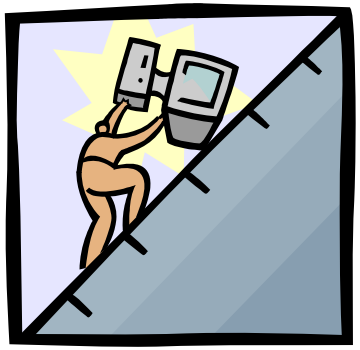
Breaking Tape

- Horizontal distances are needed for engineering designs. Horizontal distances are also important in the calculation of slopes and grades.
- Breaking tape is the easiest way to measure horizontal distances for conservation practices.
- Breaking tape is holding the tape <u>level</u> for the longest distance possible. For steep slopes, use a rod instead of a tape (or when you are by yourself).

Figure 4-5. Breaking tape.

When to use Horizontal Distances

- When specific slopes are to be constructed.
  Example: 8:1 maximum slope on stream crossing ramps
- When earthwork volumes are to be calculated from the survey data. Example: Measurements for estimating the volume of earth to be excavated from a stream bottom for a stream crossing.
- When grades or slopes need to be determined.
  Example: Stream channel slope for velocity calculations in a stream crossing design.



Question?

- What type of distance measurement does the following instruments/actions give?

The answers are: <u>horizontal, slope, both or neither</u>.

- Pacing _____
- Wheel _____
- Tape _____
- Total Station _____
- Hand held GPS unit _____

Question?

- What type of distance measurement does the following instruments/actions give?

The answers are: <u>horizontal, slope, both or neither</u>.

– Pacing	Slope
– Wheel	Slope
– Tape	Both
– Total Station	Both
– Hand held GPS unit	Neither

Calculating Slopes and Grades

Slope

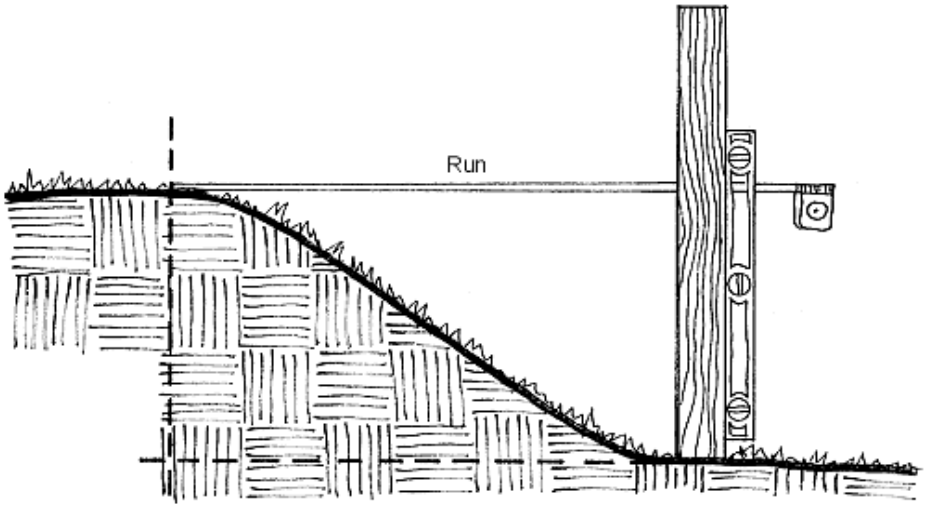
Slope is a ratio of horizontal distance (run) to vertical distance (rise).

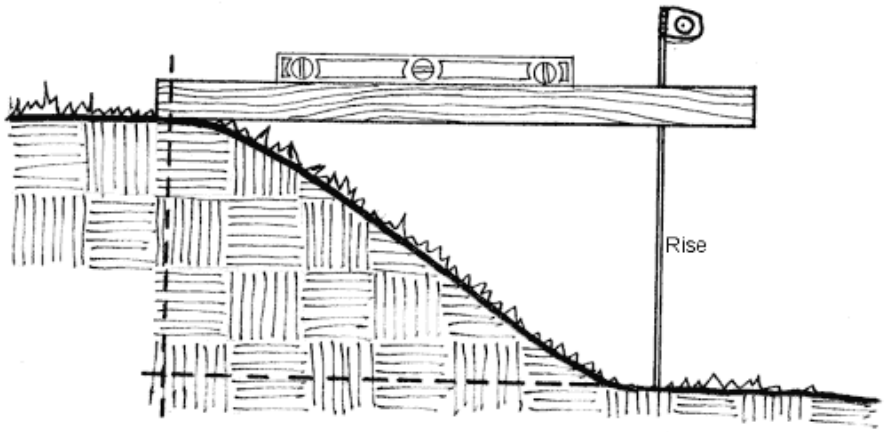
Slope = Run **:** Rise

2**:**1 slope = 2’ run to 1’ rise

Calculation method: Run/Rise = Run:1

Example 24’run/3.2’rise=8.44:1 slope





Grade

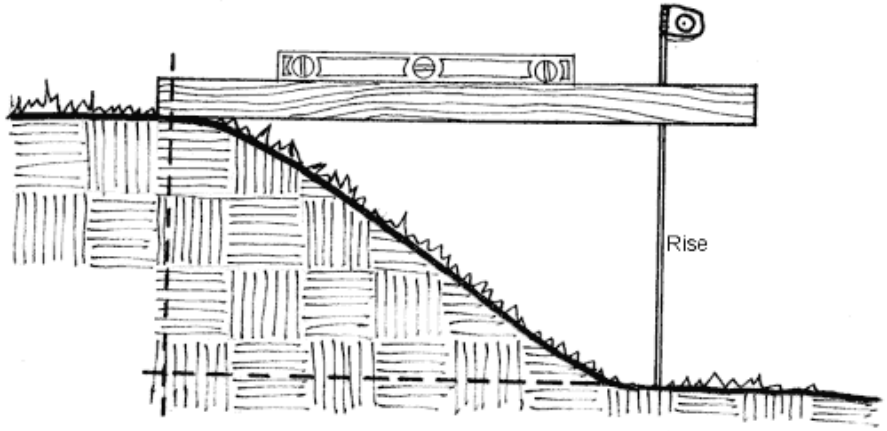
Grade is a way to express rise (or fall) per 100 feet of run.

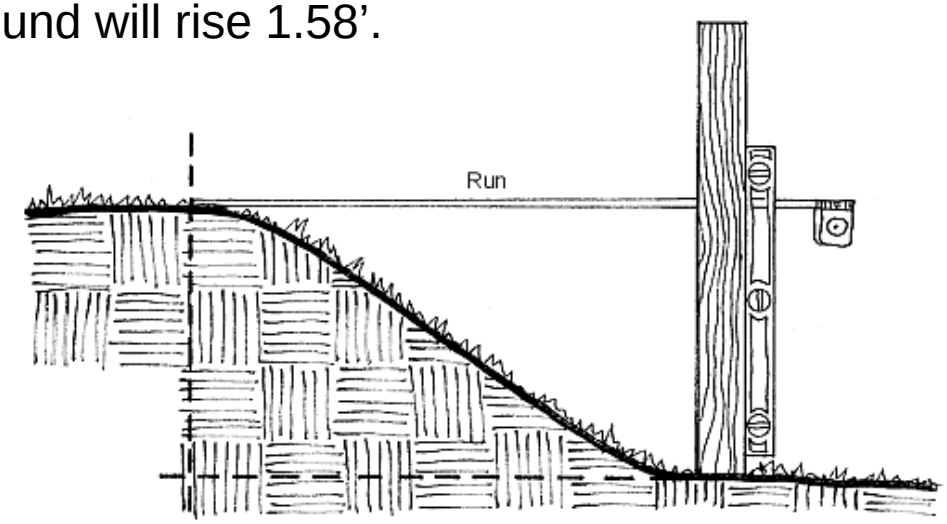
How to calculate Grade:

$$\frac{\text{Feet Rise}}{\text{Feet Run}} \times 100 = \text{Grade (\%)}$$

Example (1.5’ rise/95’ run) x 100 = 1.58% grade

Which means for every 100’ of run the ground will rise 1.58’.



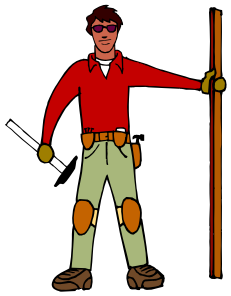


Reading a Level Rod

Leveling Rods

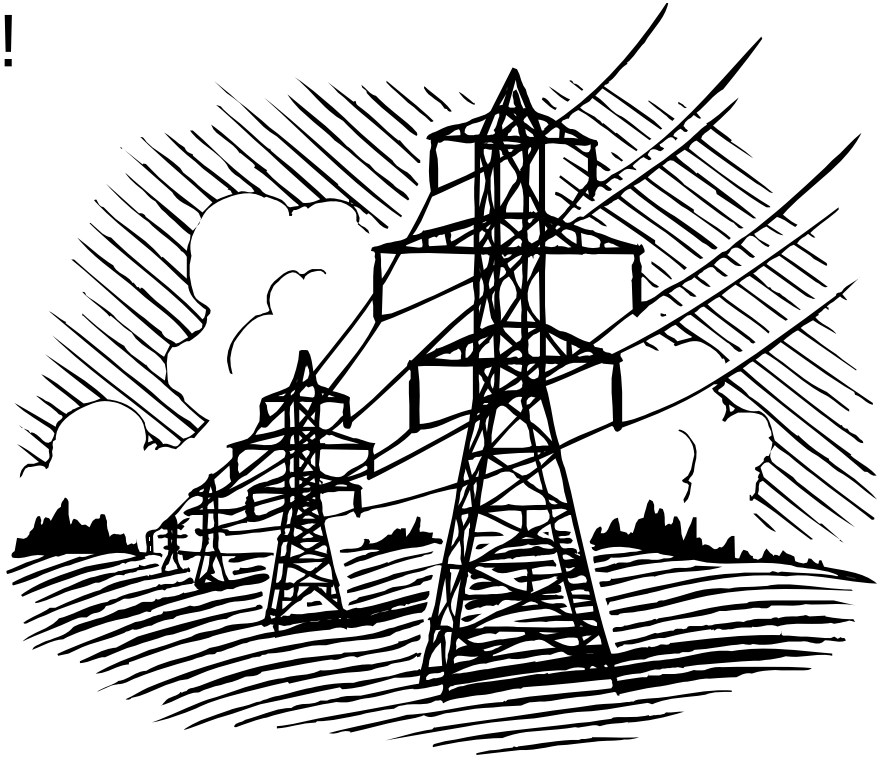
Leveling rods used for NRCS field work are:

- Graduated in tenths and hundredths of a foot.
- Made in multiple extendable sections, generally 25’ total length.
- Constructed of a non-conducting material such as fiberglass.



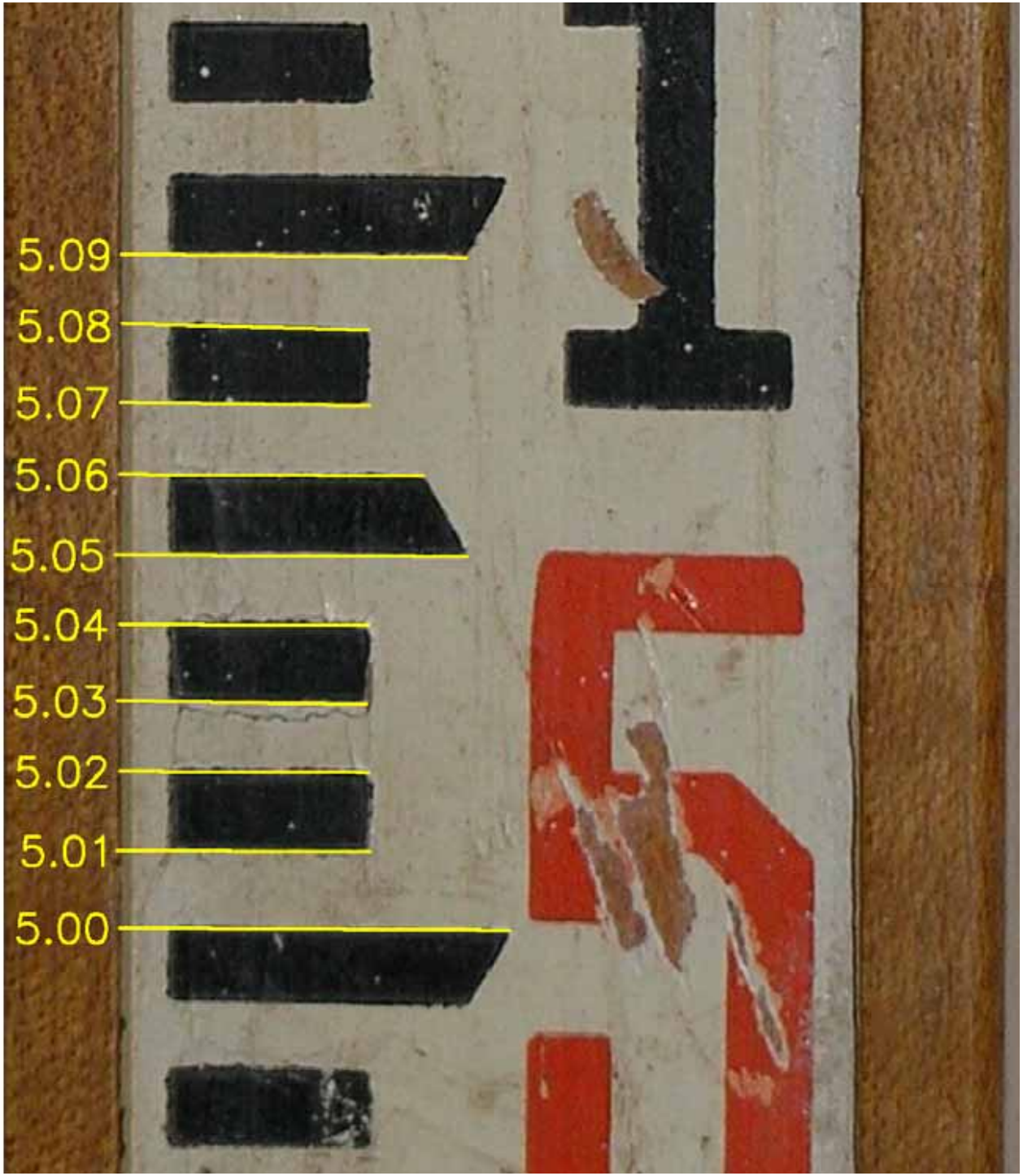
Safety Note

Please avoid getting the rod near overhead electric wires when level surveying. Get the elevation from another setup that does not require the rod so high!

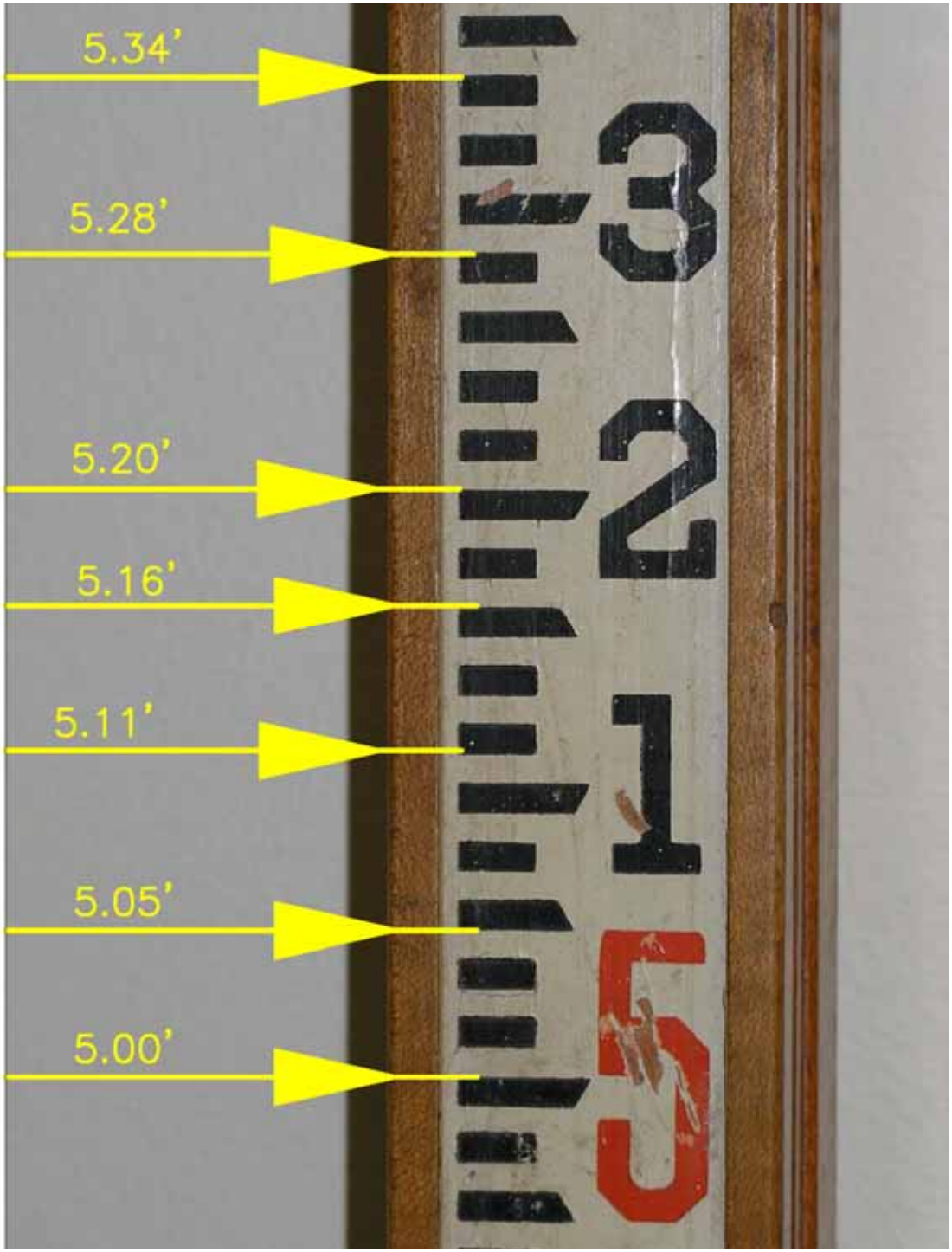


Rod Graduations

- Red numbers are feet.
- Black numbers are tenths of feet.
- Lines with the point on the top are tenths of a foot. (0.10’)
- Lines with a point on the bottom are 5 hundredths of a foot. (0.05’)
- Squared lines are hundredths of a foot. (0.01’)

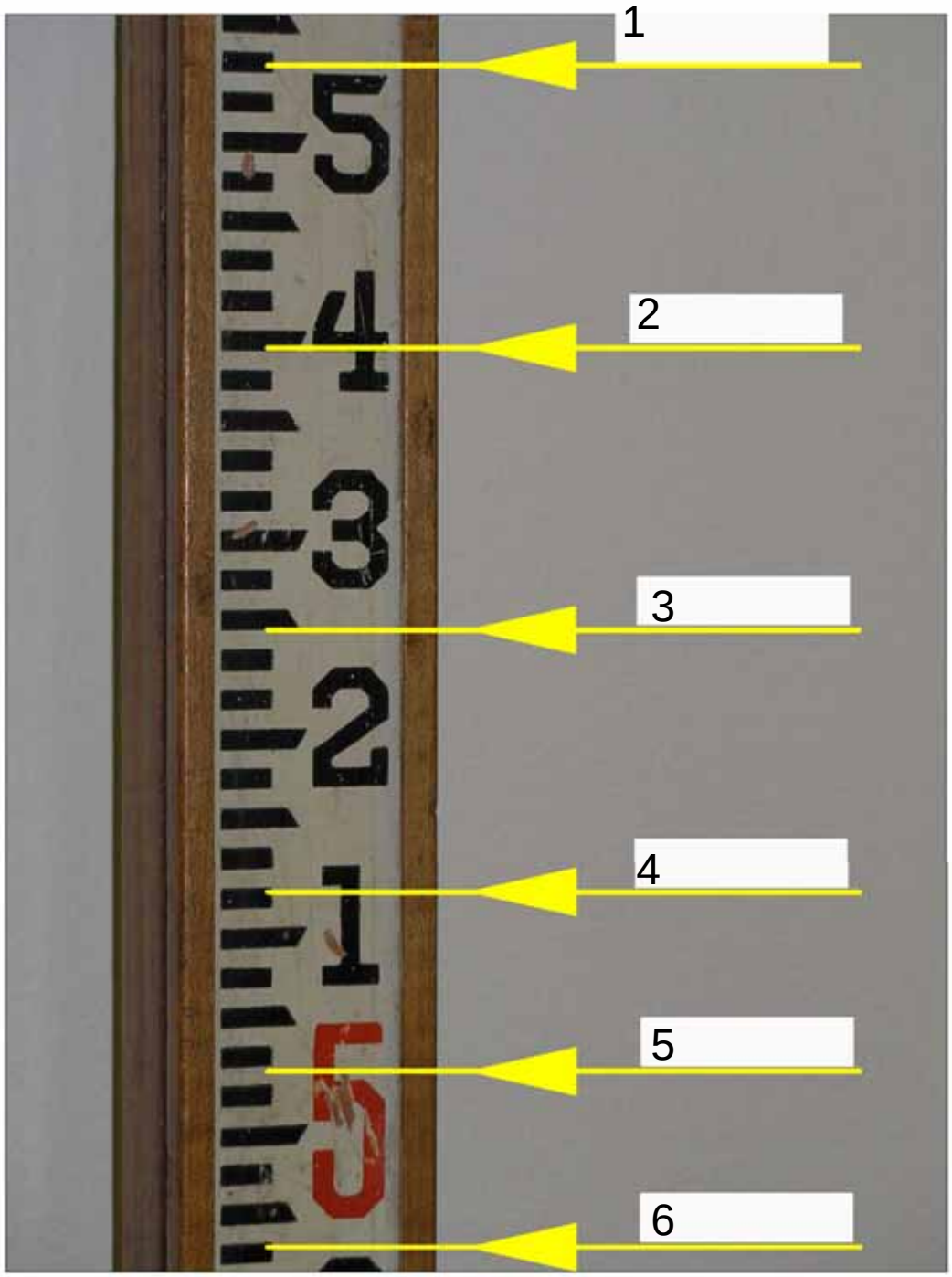


Examples

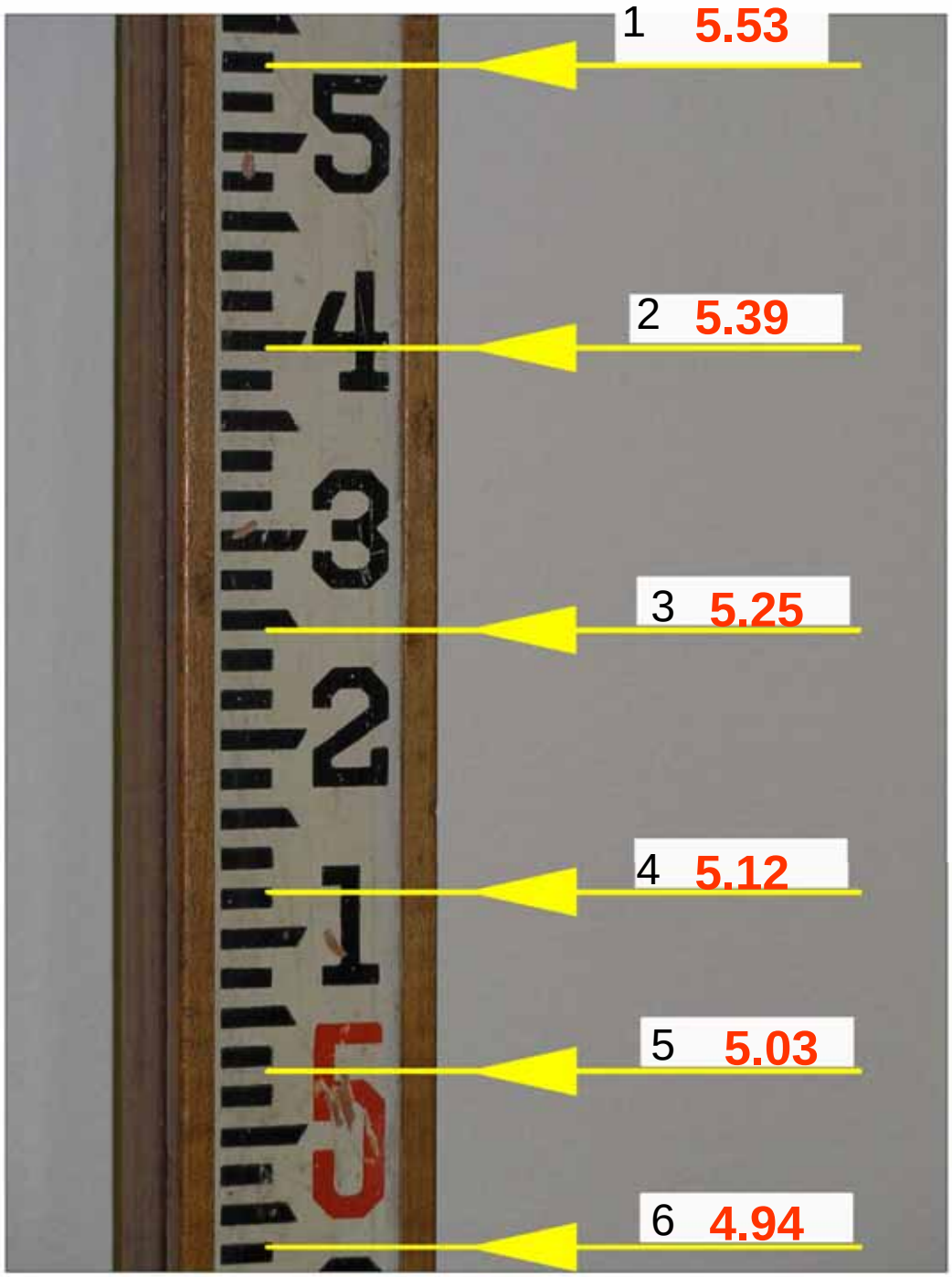


Pop Quiz

Determine the correct rod reading for each line.

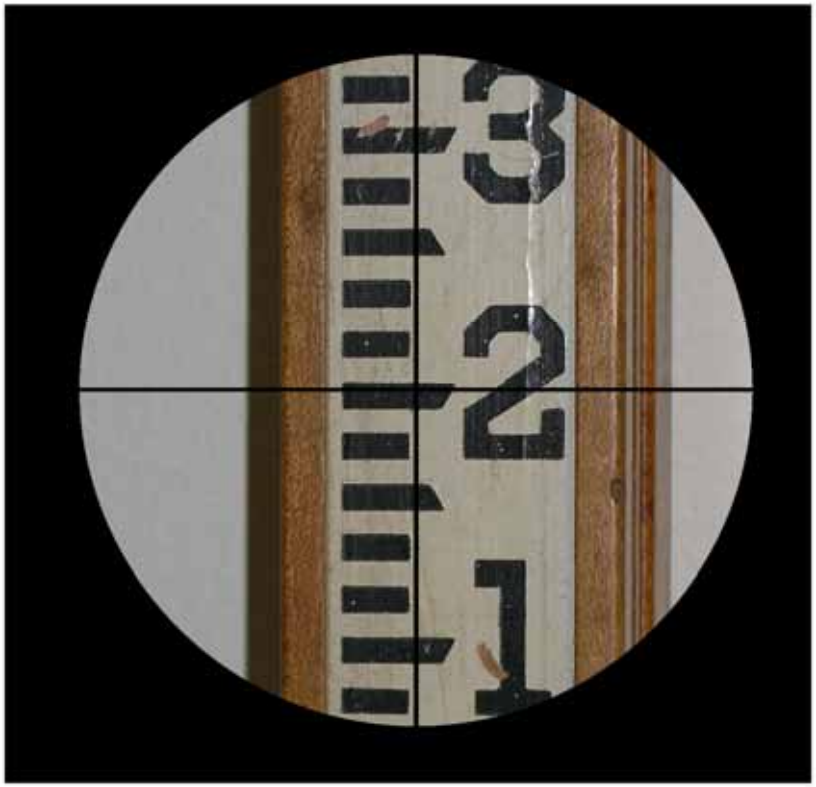


Answers



Raising for Red?

When the rod is too close to the instrument the instrument man will be unable to see the red foot numbers.

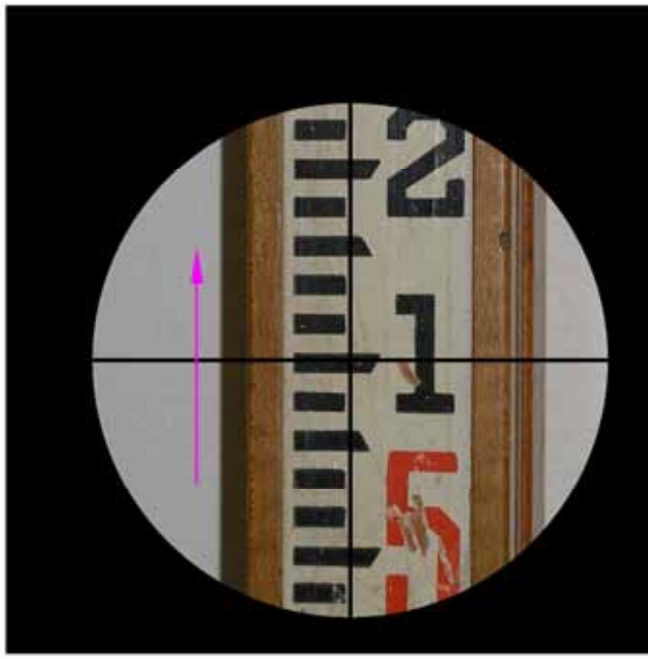


Raising for Red

Record the tenths and hundredths then ask the rodman to “Raise for Red”.

The rodman should then slowly raise the rod up until the red foot number is visible. This is harder than it looks!

Record the feet in the fieldbook.



Hand Levels and Clinometers

Hand Level

- Determines a level line of sight.
- Some have up to 6X magnification. Most have 1.5X to 2X.
- Robust construction.

Abney Level

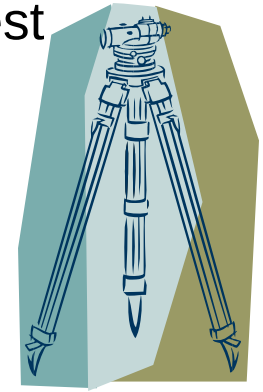
- Determine level line of sight.
- Determine slopes and inclinations in degrees and percent of slope.
- Magnification 1X to 2X; most at 1X.
- Very Rugged.

Clinometers

- Determines level line of sight.
- Determines slopes in degrees and percent of slope.
- Magnification 1X.
- A little delicate. Check calibration often.

How to use a Hand Level to Determine Difference in Elevation

- Stand approx. half way between the two points you are checking and a little to the side. Make sure you can comfortably swing your body and head to see both points with the hand level.
- Hold the level with both hands and sight on the rod at the first point. Read the rod to the nearest 0.1'.
- Do not move your feet until you take the second shot! Record the rod reading in the field book. Have the rodman move to the second point at the same time.
- Read the rod at the second point. Record the reading. You may now move about.
- Subtract the lowest (greatest value) rod reading from the highest (lower value) rod reading. That is the difference in elevation between the points.



Not steady enough?
Try a Jake Stick!

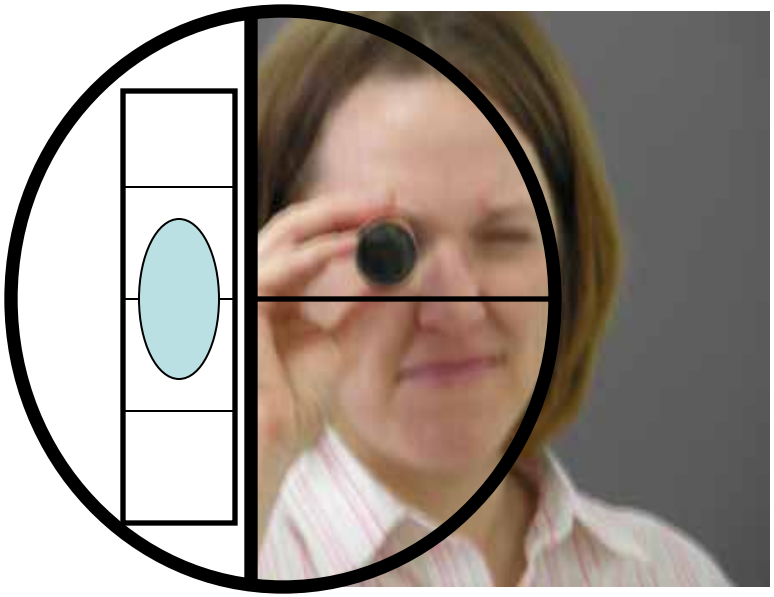
NO Jake Stick?
Use a Survey Rod!

How to Check the Calibration of a Hand Level, et al

- Take the level to a mirror.
- Stand as far from the mirror as you can and sight upon yourself.
- If the level is correct, it will show a line through the center of the hand level.

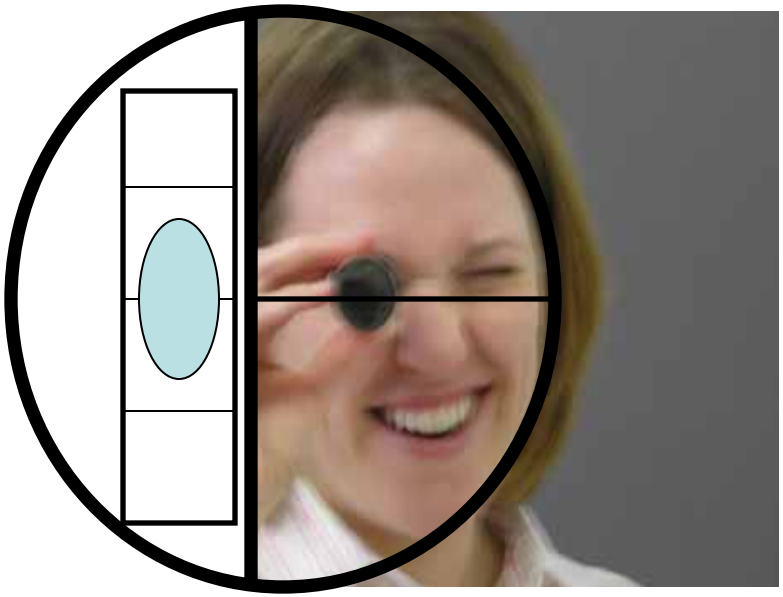
Sad Kelly

Level out of adjustment!



Happy Kelly

Level OK!



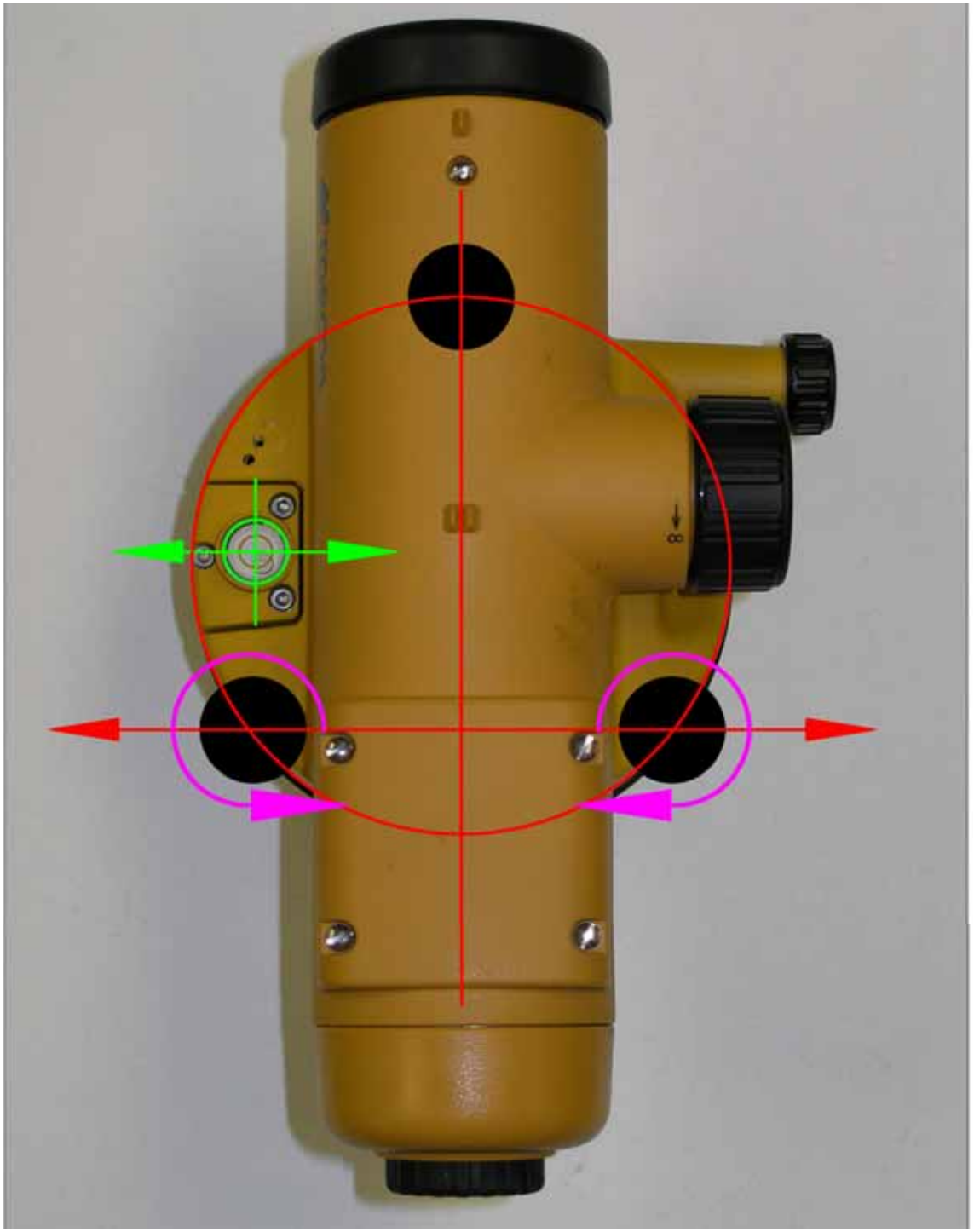
Auto Levels

Setting Up a Level

- Set the tripod up at a comfortable height
- Do not spread the legs too far.
- Level the tripod plate, by eye, using the legs
- Mount the level onto the tripod
- Align the sight tube over an adjustment screw as shown in the following slides

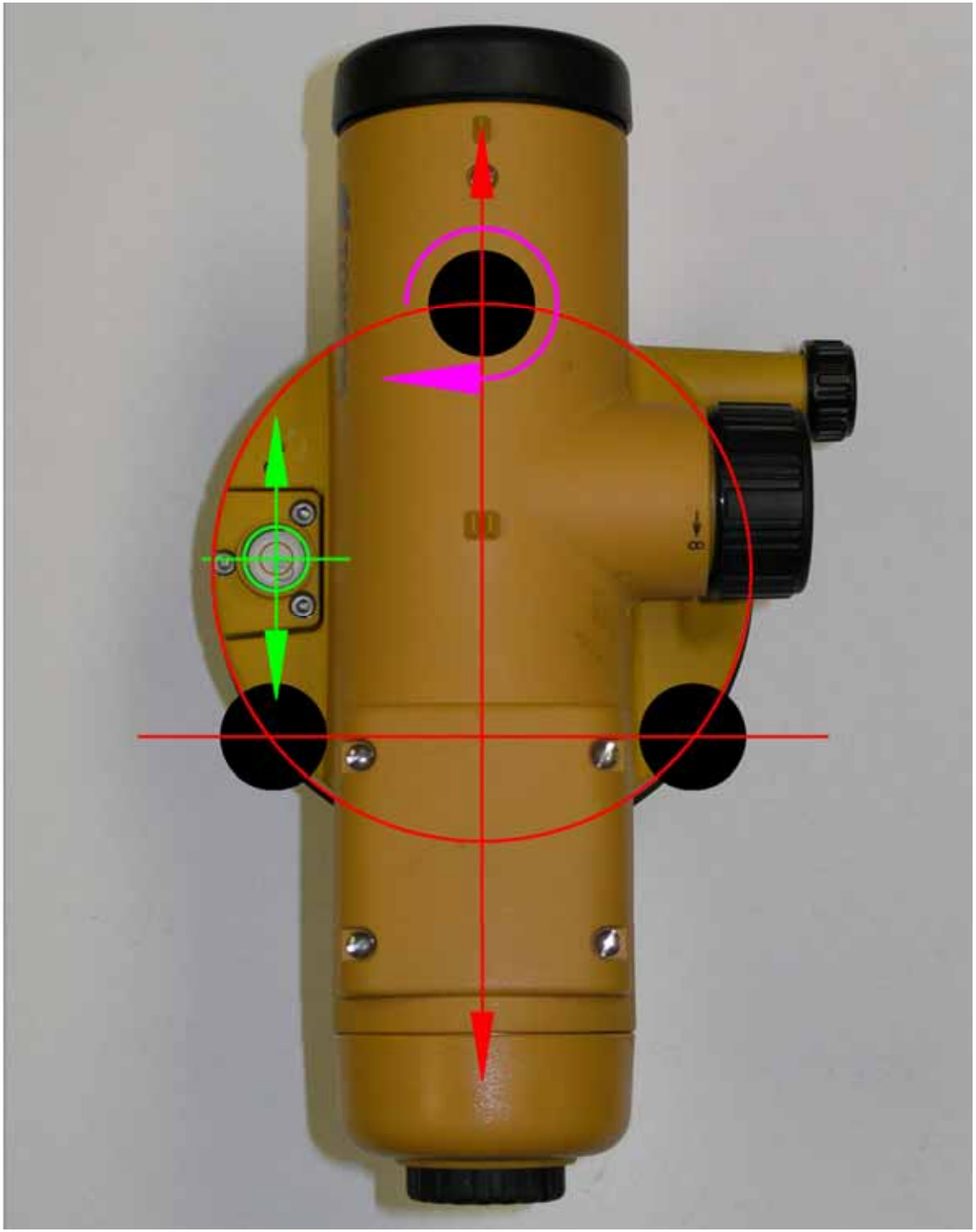
Setting Up

- Using the rear 2 adjustment screws, move the level bubble right or left until the bubble is centered on a line that is through the center of the bullseye level and parallel to the Level tube.



Setting Up

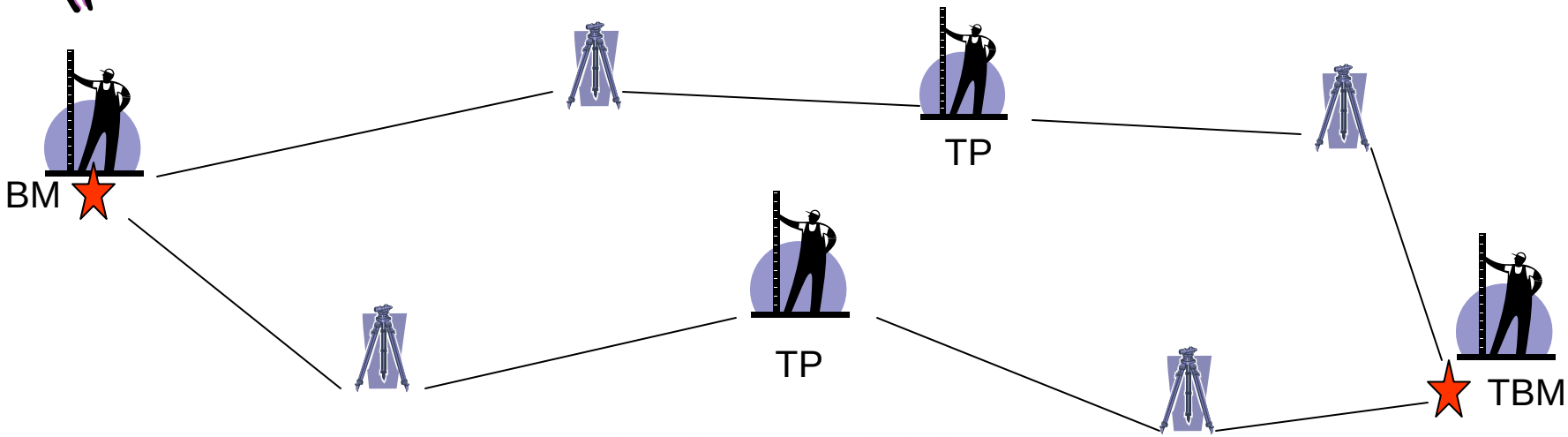
- Using the front adjustment screw, move the level bubble forward and back until the bubble is centered on the bullseye level



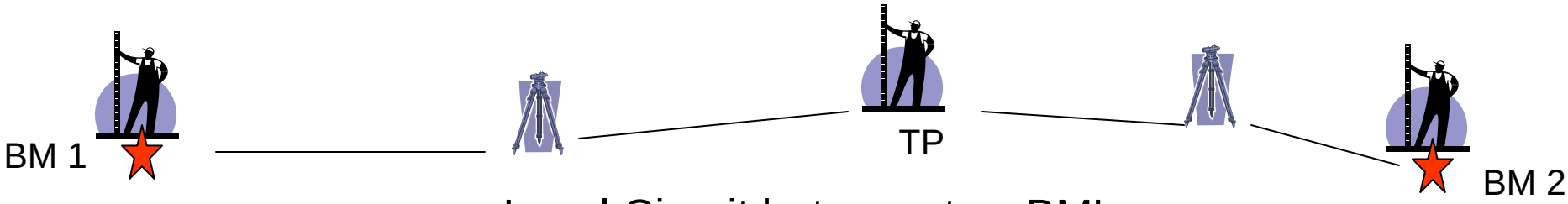
Types of Level Surveying

- Differential Leveling
  - Spot Elevations
    - Setting up the instrument and taking random rod readings to determine difference in elevation of various points.
  - Bench Level Circuit (Level Loop)
    - A leveling procedure that enables you to determine the elevation of a point (TBM) based upon the known elevation of another point. It also provides a self check to assure the accuracy of the unknown points elevation.
- Profiles and Cross Sections
  - Profile Surveying
    - Series of rod readings along a line
  - Cross Sectioning
    - A series of rod readings perpendicular to a profile line

Bench Level Circuit



Level Circuit to establish a TBM



Level Circuit between two BM's

Profiles and Cross Sections

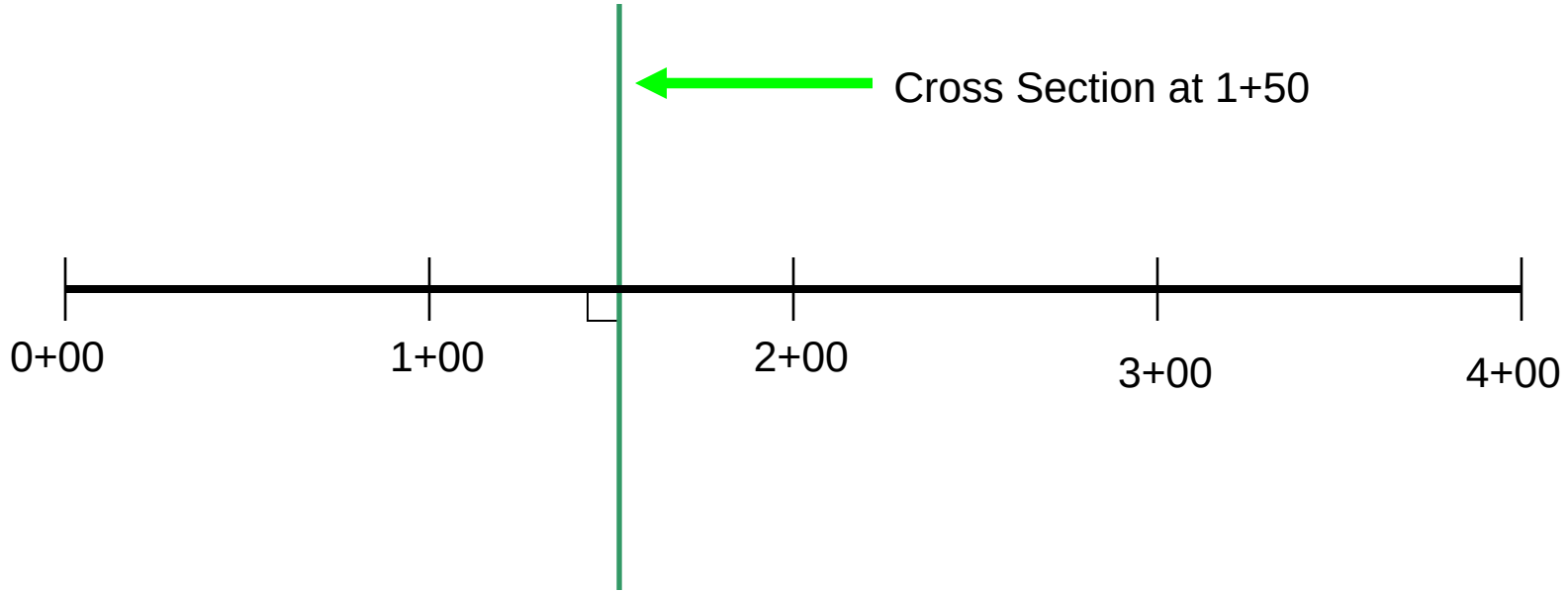
– Distances along a profile line are called Stations.

– Stations are recorded in the following format.

- 0.00’ as 0+00
- 10.00’ as 0+10
- 10.65’ as 0+10.65
- 110.75’ as 1+10.75
- -10.25’ as -0+10.25

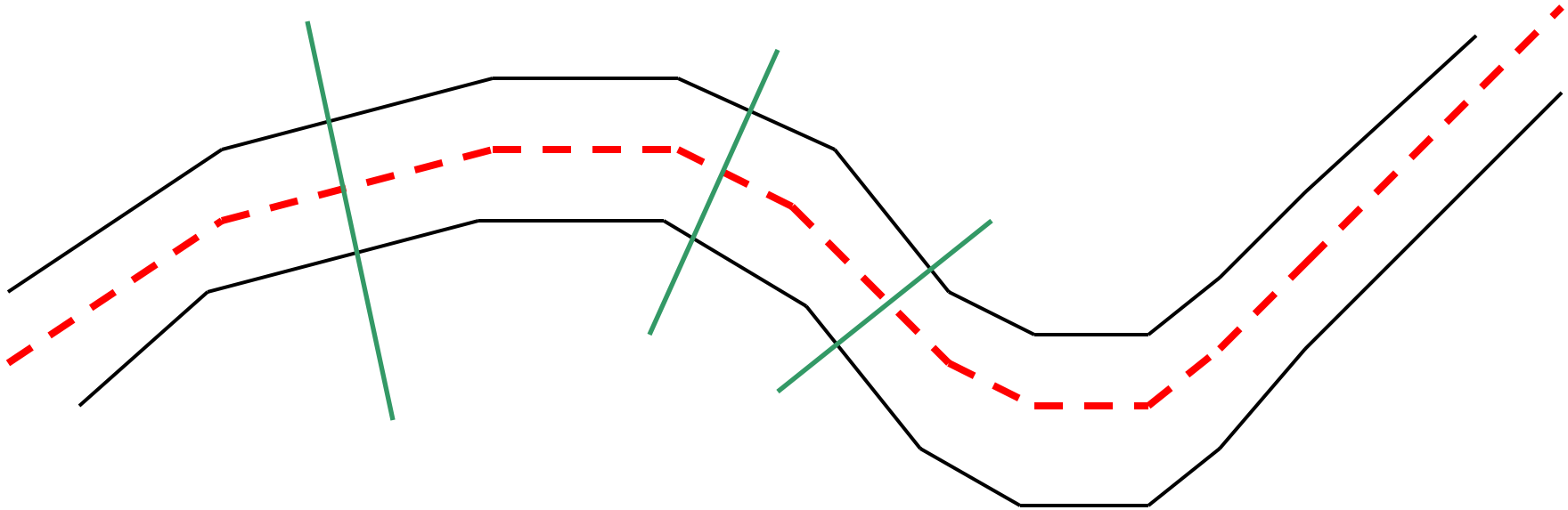
Cross Sections

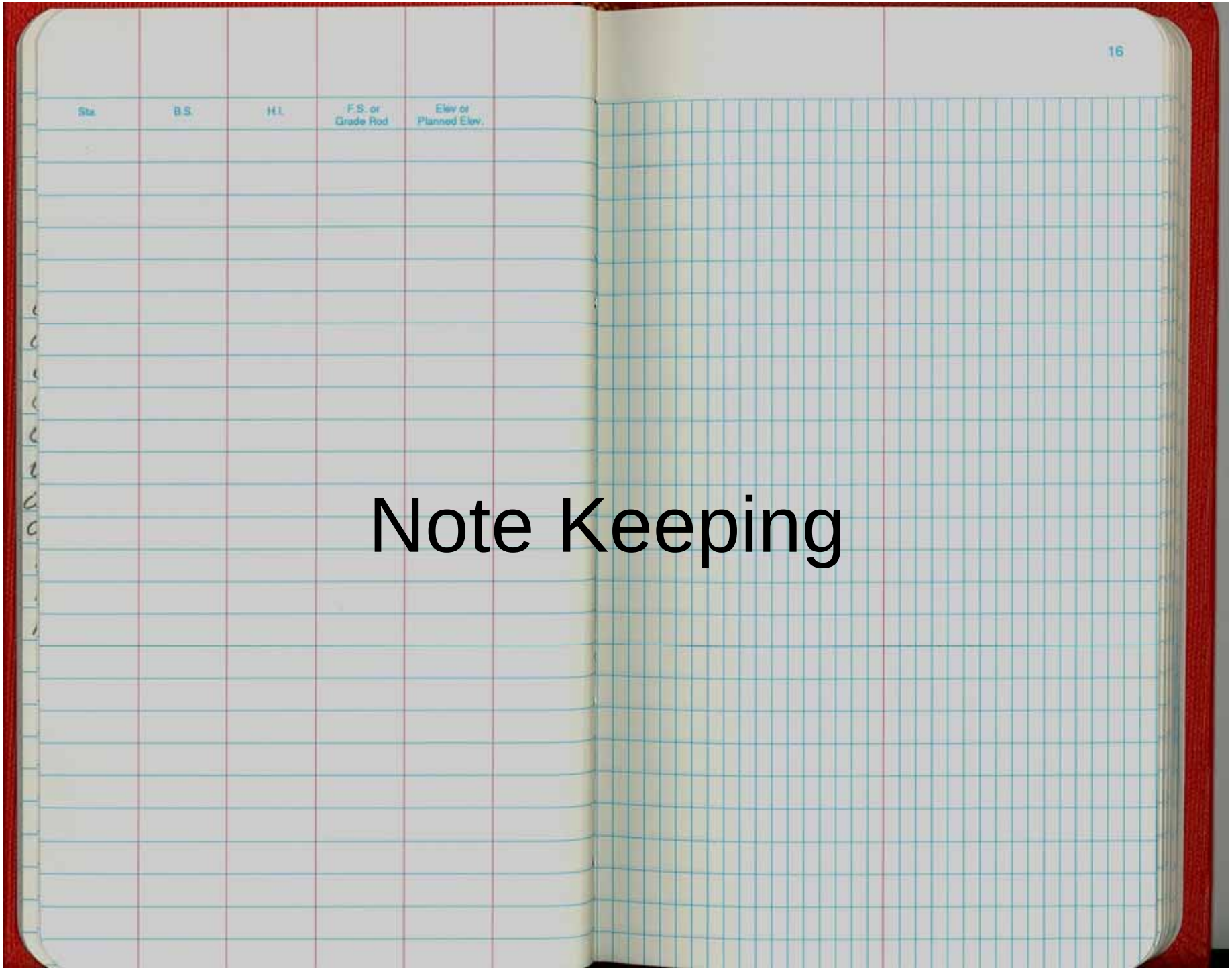
- A <u>Cross Section</u> is a profile survey taken at right angles to the Profile line.



Cross Sectioning a Stream Centerline

Cross Sections should be taken perpendicular to the stream channel at the section location.





Note Keeping

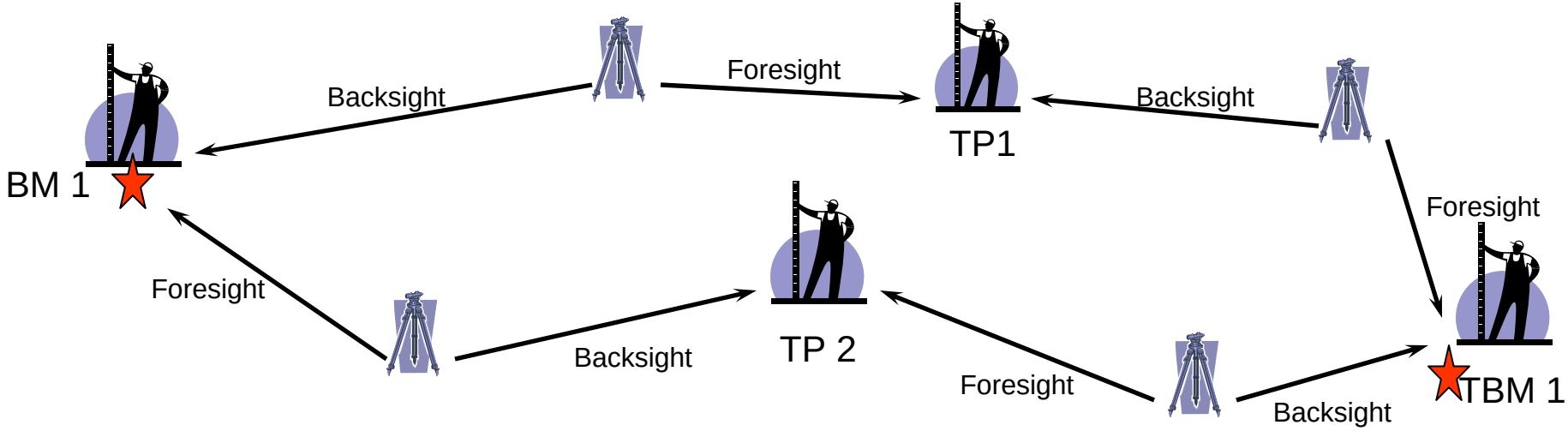
Terms

- Bench Mark (BM) Permanent monument of known elevation.
- Temporary Bench Mark (TBM) Temporary monument of known elevation
- Backsight (BS) Level sight to a known elevation. Plus shots.
- Foresight (FS) Level sight to an unknown elevation. Minus Shots
- Height of Instrument (HI) Height of instrument above a know elevation datum.
- Turning Point (TP) A temporary point which holds elevation while the level is moved to a new location.
- Closure The amount of error accumulated in a survey over the length of the survey.

Note Keeping

- Do Not Erase! Draw a single line through the mistake and write the correction above the mistake.
- Be Neat! Messy field books lead to mistakes.
- Be Consistent! Confusion leads to mistakes.
- Do Not Write Brief Descriptions!
  If you run out of field books we will get you more.
- A Picture (sketch) is Worth 1,000 Words!
  Sketch your surveys. On the sketch note, stations, unusual conditions, buildings, roads, wells, power lines, etc.

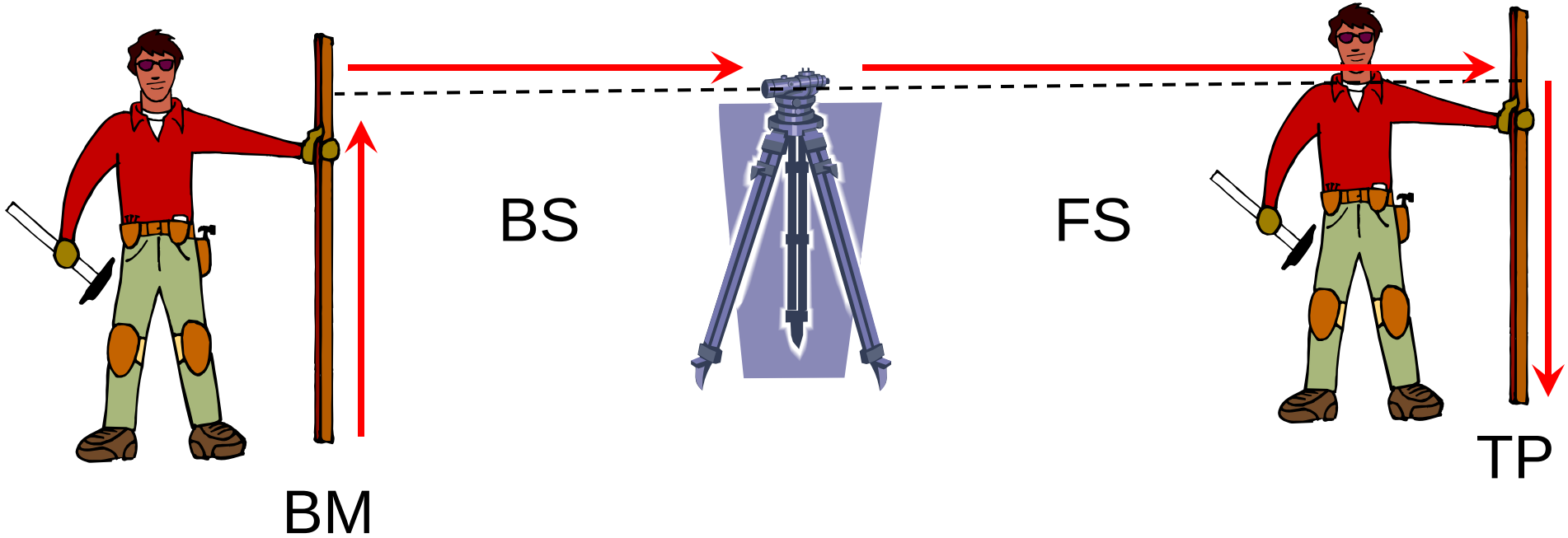
Bench Level Circuit



Backsights? Foresights? Who Can Understand this Stuff?

Backsights transfer elevations from a known elevation to the instrument

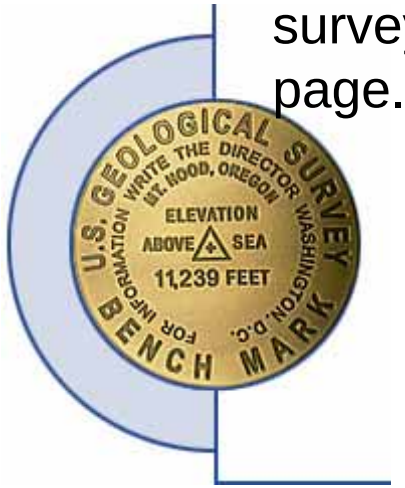
Foresights transfer elevations from the instrument to a point



Elevation 100.00

Descriptions of BMs & TBMs

- The purpose of a bench mark description is to assist someone else in finding the bench mark at sometime in the future.
  - Write the description in as much detail as needed.
  - When sketching the site in the field book include the bench mark location. Include a north arrow on the sketch.
  - Measure and record, in the description, the distances to building corners, fence corners, gates, culverts, etc.
  - When referring to a bench mark already described earlier in the survey use only the BM number and the field book number and page.



Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1				100.00

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Bench Mark 1 is top of 2” hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, FB 1 pp 56.

Write bench mark description in field book first.

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1	5.49			100.00

Bench Mark 1 is top of 2” hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, 1 FB pp 56.

Backsight the BM and record the rod reading here.

Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1	5.49	105.49		100.00

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Bench Mark 1 is top of 2" hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, FB 1 pp 56.

Calculate the HI for the first setup…

HI =

100 + 5.49 = 105.49

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1	5.49	105.49		100.00
TP 1	15.28		2.48	
TP 2	12.12		3.55	
TP 3	18.44		1.54	
TBM 1	5.28		3.99	
TP 4	2.86		19.14	
TP 5	3.11		14.94	
TP 6	3.51		8.69	
BM 1			11.79	

Bench Mark 1 is top of 2” hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, FB 1 pp 56.

TBM 1 is a Nail and Shiner set in base power pole VP-2345. Nail is set 1.5’ above the ground surface on NW side of Pole. Power pole has pink ribbon tied to it.

Complete the rest of the survey WITHOUT doing the math.

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1	5.49	105.49		100.00
TP 1	15.28		2.48	103.01
TP 2	12.12		3.55	
TP 3	18.44		1.54	
TBM 1	5.28		3.99	
TP 4	2.86		19.14	
TP 5	3.11		14.94	
TP 6	3.51		8.69	
BM 1			11.79	

Bench Mark 1 is top of 2" hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, FB 1 pp 56.

TBM 1 is a Nail and Shiner set in base power pole VP-2345. Nail is set 1.5' above the ground surface on NW side of Pole. Power pole has pink ribbon tied to it.

After completing the survey…Reduce the notes.

TP1 Elevation

105.49 – 2.48 = 103.01

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1	5.49	105.49		100.00
TP 1	15.28	118.29	2.48	103.01
TP 2	12.12		3.55	
TP 3	18.44		1.54	
TBM 1	5.28		3.99	
TP 4	2.86		19.14	
TP 5	3.11		14.94	
TP 6	3.51		8.69	
BM 1			11.79	

Bench Mark 1 is top of 2" hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, FB 1 pp 56.

TBM 1 is a Nail and Shiner set in base power pole VP-2345. Nail is set 1.5' above the ground surface on NW side of Pole. Power pole has pink ribbon tied to it.

New HI

103.01 + 15.28 = 118.29

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1	5.49	105.49		100.00
TP 1	15.28	118.29	2.48	103.01
TP 2	12.12		3.55	114.74
TP 3	18.44		1.54	
TBM 1	5.28		3.99	
TP 4	2.86		19.14	
TP 5	3.11		14.94	
TP 6	3.51		8.69	
BM 1			11.79	

Bench Mark 1 is top of 2" hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, FB 1 pp 56.

TBM 1 is a Nail and Shiner set in base power pole VP-2345. Nail is set 1.5' above the ground surface on NW side of Pole. Power pole has pink ribbon tied to it.

TP2 Elevation

118.29 – 3.55 = 114.74

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1	5.49	105.49		100.00
TP 1	15.28	118.29	2.48	103.01
TP 2	12.12	126.86	3.55	114.74
TP 3	18.44	143.76	1.54	125.32
TBM 1	5.28	145.05	3.99	139.77
TP 4	2.86	128.77	19.14	125.91
TP 5	3.11	116.94	14.94	113.83
TP 6	3.51	111.76	8.69	108.25
BM 1			11.79	99.97

Bench Mark 1 is top of 2" hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, FB 1 pp 56.

TBM 1 is a Nail and Shiner set in base power pole VP-2345. Nail is set 1.5' above the ground surface on NW side of Pole. Power pole has pink ribbon tied to it.

New HI

114.74 + 12.12 = 126.86

And so on…

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1	5.49	105.49		100.00
TP 1	15.28	118.29	2.48	103.01
TP 2	12.12	126.86	3.55	114.74
TP 3	18.44	143.76	1.54	125.32
TBM 1	5.28	145.05	3.99	139.77
TP 4	2.86	128.77	19.14	125.91
TP 5	3.11	116.94	14.94	113.83
TP 6	3.51	111.76	8.69	108.25
BM 1			11.79	99.97
				100.00
			Error =	-0.03

Bench Mark 1 is top of 2” hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, FB 1 pp 56.

TBM 1 is a Nail and Shiner set in base power pole VP-2345. Nail is set 1.5’ above the ground surface on NW side of Pole. Power pole has pink ribbon tied to it.

Distance traversed 1200’

Closure = 0.03/1.200= 0.025’/1000’

Check the closure by subtracting the starting elevation of BM1 from the ending elevation of BM1.

Smith Animal Waste System

Tract No. BR549 Field 7

Topcon AT-4G

Cooke Smith Skiles

Clear Sunny, Cool

Sta.	+ B.S.	H.I.	- F.S. or Grade Rod	Elev. or Planned Elev.
BM 1	5.49	105.49		100.00
TP 1	15.28	118.29	2.48	103.01
TP 2	12.12	126.86	3.55	114.74
TP 3	18.44	143.76	1.54	125.32
TBM 1	5.28	145.05	3.99	139.77
TP 4	2.86	128.77	19.14	125.91
TP 5	3.11	116.94	14.94	113.83
TP 6	3.51	111.76	8.69	108.25
BM 1			11.79	99.97
				100.00
			Error =	-0.03
	66.09		66.12	
		66.09		
		-66.12		
		-0.03		

Bench Mark 1 is top of 2” hub set during topo survey of site. Hub is designated Traverse Point 203 in original survey, FB 1 pp 56.

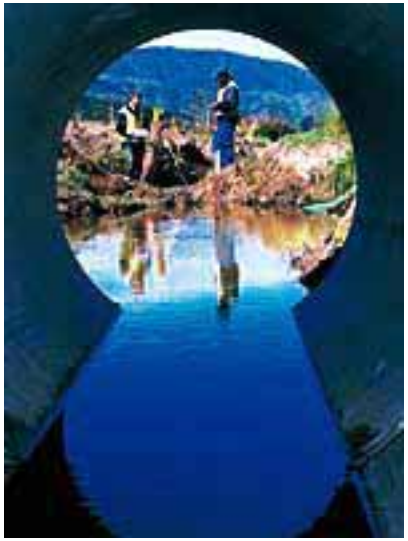
TBM 1 is a Nail and Shiner set in base power pole VP-2345. Nail is set 1.5’ above the ground surface on NW side of Pole. Power pole has pink ribbon tied to it.

Math check…Total the backsight rod readings then total the fore sight rod readings. Subtract the foresights from the backsights…

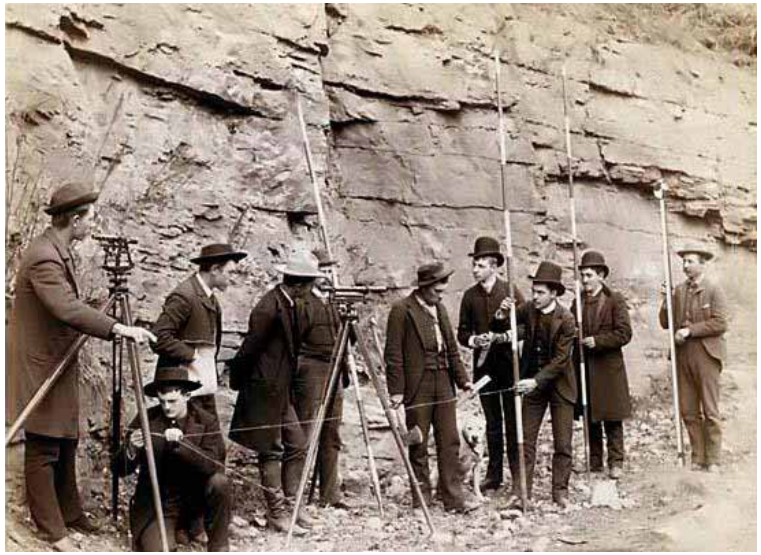
Should equal the original error.

Conclusion

Surveying is the foundation of the planning and design process for engineering practices. As with any foundation, if it is weak, it will affect the entire process. Practice your survey skills and you will have that strong foundation that you can build upon.



End



Exercise I

- Equipment needed:
  - 100’ tape
  - Field Book
  - Two Wire Flags
  - Calculator
- Procedure
  - On reasonably level ground and using a tape measure 100’ in horizontal distance. Remember to keep the tape tight while measuring the distance. Place a wire flags at the beginning and end of the 100’ course. Pace up the course counting your steps. Record the number of steps in the field book. Then pace back. Record in field book again.
  - Average the number of steps taken in both directions and divide 100 by the average number of steps.

Example

1st- 36 steps

2nd- 35 steps

36 + 35 / 2 = 35.5 average number of steps per 100’

100’ / 35.5 = 2.8ft per step

Extra Credit

- Layout another pacing course on a sloping area.
- Using the <u>BREAK TAPE</u> method, layout a 50’ or 100’ pacing course.
- Pace the course uphill twice and average the number of steps.
- Do the same downhill.
- Calculate your average step length going up slopes and your average step length going down slopes?

Exercise II

- Equipment
  - Hand Level, Abney level, or Clinometer
  - Jake Stick
  - Leveling Rod
  - Tape
  - Field Book
  - Calculator
  - Two flags
- Procedure
  - On sloping ground, set two flags into the ground 25’ apart. Use the Break Tape Method to measure the distance. Label the flags A and B, with A being the highest in elevation.
  - Utilizing a hand level, jake stick and leveling rod determine the difference in elevation between the two flags to the nearest 0.1’.
  - Record the rod readings on a field book sheet.
  - Subtract the rod readings to determine the difference in elevation.
  - Then determine the Slope and Grade of the ground between the flags.

Exercise III

- Equipment
  - Auto Level
  - Tripod
  - Leveling Rod
  - Field book page
  - Calculator
  - Two flags
- Procedure
  - Two flags will be placed in the ground by the instructors. A TBM with an elevation of 100’ will also be selected for you.
  - Do a <u>Bench Level Circuit</u> to determine the elevation of the ground at the flags. Close back to the TBM.
  - At least 3 turning points must be completed.
  - Each crew member will complete a level circuit in each crew position. Determine the vertical error in the survey.
  - Keep the field notes in the correct form.
  - Draw a sketch of the survey in your field book.
  - Pace the distance between the TWO FLAGS and determine the distance between using your personal step length from Exercise I.

NRCS Story Time

Remember the story of the big bad wolf and the three little pigs….

HEY WOLF!

Huff and Puff this!