

AREA: Agricultural Mechanics

UNIT: Surveying

COMPETENCY:

1. Determine the difference in elevation using a level.

JOB: # 9 Operating the transit.

SITUATION:

Students already know how to level the instrument

Students already know what field signals are.

Students already know how to use field notes.

Differential leveling is used to determine the difference in elevation between two points.

Students may need to profile level in the future for

installing septic tanks and drainage ditches.

Students can use differential and profile leveling in State Agriculture Mechanics Contest.

OBJECTIVES:

1. To demonstrate proper field signals.

2. To operate a transit to determine slope.

3. To use field notes.

MOTIVATION:

Review key points from previous lesson.

Tie key points to lesson.

When should differential leveling be used?

When should profile leveling be used.

State the objectives.

Move the students out to the laboratory to get the equipment.

Proceed to a chosen location and proceed with demonstration.

DEMONSTRATION:

Review demonstration on settling up the transit level.

Review hand single use.

Review reading the rod.

Demonstrate differential leveling.

Demonstrate profile leveling.

REFERENCES:

tripod - 4

levels - 4

rods - 4

field note forms

Resource Unit on Leveling and Land Measurement Practices

JOS - Profile Leveling.

JOS - Differential Leveling

STUDENTS PRACTICE:

Students differential level a predetermined area to determine the difference in elevation between two points.

Students profile level a predetermined staked out area to determine slope.

Students use proper field signals during leveling procedure.

Students accurately fill out field notes.

EVALUATION AND APPLICATION:

Students turn in field notes for grade - 50 points.

Students participation - 20 points.

Information included on Unit Exam.

Information included in notebook evaluation.

STUDENT INSTRUCTIONS


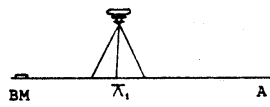
Carefully follow the steps of procedure listed below to determine the difference in elevation between two points. Record your findings on a field notebook page.

Equipment:

- Tripod
- Leveling instrument
- Rod

Materials:

- Pencil
- Field notebook

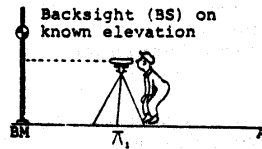
Steps of Procedure	Illustrations/Key Points/ Safety Practices
<u>A. Establishing a Bench Mark</u>	
1. Establish a Bench Mark.	a. Concrete well curb, corner of a road culvert, or any other permanent feature. If elevation is unknown, arbitrarily assign 100 ft. 
<u>B. Setting up Leveling Instrument</u>	
2. Set up and level the instrument to an accurate setting some distance away from the BM in the direction of survey. (Toward point A)	a. The distance from the instrument to the BM should not be so great as to make it impossible to read the rod accurately. Not more than 150 to 200 feet. 

Steps of Procedure	Illustrations/Key Points/ Safety Practices
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C. Taking a Backsight

3. Take a Backsight reading on the rod held on the Bench Mark by the rodman. Record the reading in the BS column of BM in the field notes. Use the field notebook page on page 53 to record your sightings.

a. After taking the reading check the bubble in the level tube to insure the instrument is level.



4. Determine the Height of Instrument. Record the Height of Instrument in HI column of λ_1 in the field notes.

a. To obtain Height of Instrument, the BS is added to the Bench Mark elevation.

$$BS + BM = HI$$

D. Moving Rod to New Location (TP)

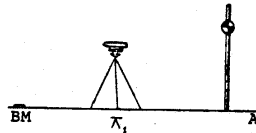
5. Give the "all right" signal to the rodman. At this signal the rodman will move to a new point along the route of survey.

a. DO NOT MOVE OR ADJUST THE INSTRUMENT AT THIS TIME.



6. The rodman moves toward point A, limited by distance and changes in elevation.

a. The rodman sets the rod on solid ground with the front face of the rod plainly visible to the instrument man.

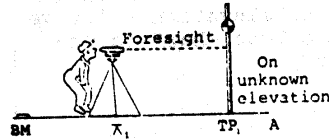


Steps of Procedure	Illustrations/Key Points/ Safety Practices
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E. Taking a Foresight

7. Take a Foresight reading on the new rod location. Record the reading in the FS column of TP₁ in the field notes.

a. The new rod location is known as Turning Point 1.



8. Determine the elevation of Turning Point 1. Record the elevation in the ELEV. column of TP₁ in the field notes.

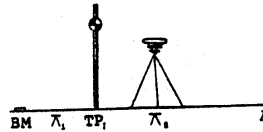
a. To obtain the elevation of TP₁, subtract the Foresight from the Height of Instrument.

$$HI - FS = ELEVATION.$$

F. Moving Tripod Level to New Location

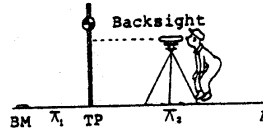
9. Move the tripod level to a new location in the direction of point A. The rodman remains at TP₁. Set the instrument to an accurate setting.

a. The rodman turns the rod around so that the front face of the rod is plainly visible to the instrument man.



10. Take a Backsight reading on the rod held at turning point 1 (TP₁). Record the Backsight reading in the BS column of TP in the field notes.

a. Recheck the bubble in the level tube.



11. A new Height of Instrument is determined. Record the Height of Instrument in the field notes.

a. The new Height of Instrument is determined by adding the Backsight to the elevation of the TP.

$$BS + ELEVATION = HI$$

Steps of Procedure	Illustrations/Key Points/ Safety Practices
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G. Counting Differential Leveling Procedure

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| 12. Repeat Steps 1 through 11 until Point A is reached and its elevation relative to the Bench Mark is obtained. | a. Record all sightings in the field notes. |
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STUDENT INSTRUCTIONS

Carefully follow the steps of procedure listed below to perform profile leveling. Record your findings on a field notebook page.

Equipment:

- Tripod
- Leveling instrument
- Rod
- Hammer

Materials:

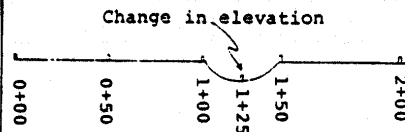
- Wooden stakes
- Field notebook
- Pencil

Steps of Procedure	Illustrations/Key Points/ Safety Practices
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A. Marking the Stations

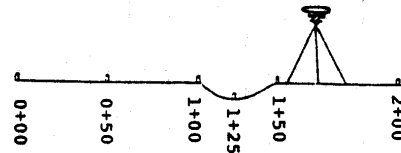
1. The line to be profile leveled must be marked off ("stationed") at intervals of 50 ft. or at each sharp change in land surface.

- a. Stakes should be set at each station.



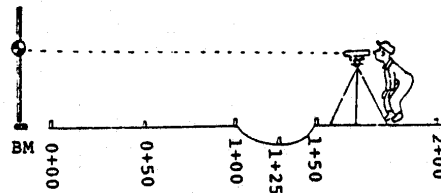
B. Setting up Tripod Level

2. Set up the tripod level and bring it to an accurate setting. Set the level approximately 150 to 200 feet from station 0+00 in the direction of survey.



C. Taking a Backsight

3. Take a Backsight on a Bench Mark to establish the Height of Instrument. Set up a field notebook page for profile leveling similar to the one shown on page 63 in the Reference Unit. Record the BS reading in the BS column of BM. Use the field notebook page on page 58 to record your sightings.



Steps of Procedure	Illustrations/Key Points/ Safety Practices
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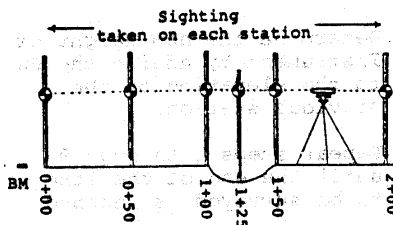
4. Determine Height of Instrument by adding the BS to the known elevation of the BM.

$$BS + \text{ELEVATION OF BM} = HI$$

D. Taking Foresight on Each Station

5. Take as many FS readings on as many stations on the line convenient to the position of the instrument. Record the rod reading on each station in the field notes.

a. The rodman moves to each station. The instrument remains in place.

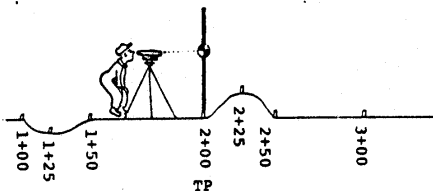


b. To determine the elevation of each station subtract the FS from the HI.

$$HI - FS = \text{ELEVATION}$$

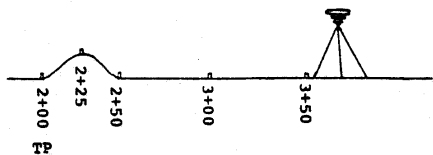
E. Moving Instrument to New Location

6. When it is necessary to move the instrument to a new position, use the rod reading on the last station as a TP. Record the TP in the field notes under the FS column of TP.



7. Move the instrument to a new location same distance down the line to be surveyed.

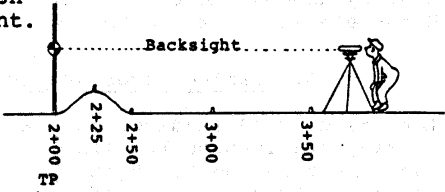
a. New location should be approximately 150 to 200 feet from TP in the direction of survey.



Steps of Procedure	Illustrations/Key Points/ Safety Practices
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F. Taking Backsight on TP

- 8. Take a BS on TP to establish the new Height of Instrument. Record the BS under the BS column of TP



- 9. Determine the new Height of Instrument by adding the BS to the elevation of the previous station.
- 10. Repeat steps 1 through 9 until the end of the line to be surveyed is reached.

$$BS + ELEVATION = HI$$

