

FIELD EXERCISE - LEVELLING I

1. AIMS

To familiarize students with the use of a tilting level, its accuracy and the check of the permanent adjustment (two-peg test).

2. EQUIPMENT

- 1 x Tilting level WILD NK2 and tripod
- 1 x Wooden, folding levelling staff with staff bubble
- 1 x Pocket tape
- 2 x Change spikes
- 1 x Hammer
- 1 x Linen or fibreglass tape
- 1 x Clip board
- 1 x Survey umbrella with steel base
- 2 x Ranging rods.

3. EXERCISE: PART A (Two-peg test)

This part is to be completed by the field party as a whole.

3.1 Drive the change spikes into firm ground so that they are approximately 50 m apart, and not more than about 2 m different in height. The smaller the height difference the better. Measure the distance between the spikes.

3.2 Carry out the two-peg test described in your textbook (W.S. Whyte; Revision Notes on Plane Surveying). Be careful to centre the circular bubble in setting up the level and even more careful to centre the tilting bubble, before each reading. Estimate the readings to the nearest mm. The distance between points B and 2 should just exceed the minimal focussing distance of your level (WILD NK2 = 1.6 m, ZEISS NI2 = 3.3 m). Book observations in field book. Do not adjust the instrument. Compare computed observation B1 with measured value. If the two values disagree by more than 3 mm, repeat two-peg test. Plot a sketch into your field book.

3.3 Check your staff by comparing its scale with your pocket tape. Lay staff flat down and align the zero of the tape with the zero of the staff. Fully extend pocket tape over full length of staff. Prepare a table in field book featuring a column 'reading on staff' and a column 'reading on tape'. Read each half-metre mark of the staff against the tape and all closest marks on both sides of joints. Draw sketch in field book and book measurements in prepared table, indicating the location of staff joints.

4. EXERCISE: PART B (Accuracy: Sighting distance 25 m).

This part has to be completed by each student.

4.1 Measure the distance (about 50 m) between the two spikes set during Part A.

4.2 Set the level up midway between the spikes and centre the circular bubble using the foot screws. Use survey umbrella on sunny or rainy days. Determine and book your personal eyepiece constant ten times.

4.3 Take and record (on field form) staff readings on both points, being careful to centre the telescope bubble using the tilting screw before each reading and to eliminate the slightest parallax. Estimate the readings to the nearest mm.

4.4 Lift the level, shift it about 0.5 m on a perpendicular to the straight line through the two spikes, set it up again, centre the circular bubble.

4.5 Each student should take four sets of readings and therefore repeat the above mentioned program (4.3, 4.4) four times.

5. EXERCISE: PART C (Accuracy: Sighting distance 50 m).

This part has to be completed by every student.

5.1 Remove one of the two changing spikes and drive it again into the ground at a distance of about 100 m from the other spike. Measure the distance between them and determine in the same time the mid-point for the level position.

5.2 Repeat program described in 4.2 and 4.5.

6. EXERCISE: PART D (Line Levelling).

This part is to be completed as a group effort.

6.1 Choose on your site three points forming an equilateral triangle with a side length of about 50 m. Drive in the two changing spikes in two of the triangle corners.

6.2 Level from the first spike to the second (instrument midway between), lift the instrument and set it up midway between the second and the third corner of the triangle. Take back sight to second corner, move then the spike from the second to the third corner and measure the foresight to the latter.

6.3 Lift your instrument again and set it up midway between the third and first corner. Level from the third to the first corner.

6.4 All members of the group must share the observing. Compute the misclose in the field. If the latter exceeds 3 mm, repeat 6.2 to 6.4.

7. REPORT

Each student uses his own observations for the following computations:

7.1 Calculate (from your set of 10 height differences  $\Delta h$  measured in Chapter 4) the standard deviation of one single observation of a height difference between the two spikes 50 m apart,  $S \Delta h$ .

7.2 Apply procedure of 7.1 on measurements in 5.

7.3 Comment on the differences between the height difference standard deviations for sighting distance 25 m and sighting distance 50 m.

7.4 Compute the differences 'reading on staff' minus 'reading on pocket tape' for the staff test in 3.3. Plot these differences against 'reading on staff' (on graph paper). Indicate location of joints. Comment on the result. Does your staff comply with the Australian Standard AS 1298-1980, which states that the error in length between any two points (at 20°C) shall not exceed 1.5 mm in case of 4 m staves?

J. M. RÜEGER,  
Senior Lecturer,  
School of Surveying.  
July 1983.