

GEOG1150. Cartography

Field Work Exercise

This fieldwork exercise is designed for students to familiarise field investigation techniques commonly employed in cartography and surveying. The students will be required to practise some simple field survey methods for horizontal and vertical positioning. Ground investigation methods for testing the accuracy of aerial photo interpretation will also be practised.

1. Using the theodolite to measure, as accurately as possible, the following positions as shown below. The Positions of Site A and Site B must be clearly marked on the attached topographic map.

To mark the positions A and B on the map, use the compass to locate yourself, while on the site A or B, on the attached copy of the topographic map of the area. You need to draw at least three straight lines along the compass directions to the identified targets and show your location by the intersection of the lines. You should check your results against that from GPS readings to quantify the positional uncertainty.

- a) The two sites where the triangulation measurements are practised

From the compass and map reading:

Site A: _____ E _____ N; Site B: _____ E _____ N

From the GPS reading:

Site A: _____ E _____ N; Site B: _____ E _____ N

Uncertainty:

Site A: E \pm _____ N \pm _____; Site B: E \pm _____ N \pm _____.

- b) Use the triangulation method to calculate the map coordinates of the island on the left (Note: aim at the top of the hill). To calculate the Easting and Northing coordinates, follow the steps below:

1. Calculate the distance between Site A and Site B from their map coordinates. Use the coordinates acquired from GPS to calculate the distance so that the uncertainty of the distance measurement can be quantified.

The distance between Site A and Site B = _____ m \pm _____ m.

2. Set the theodolite and locate the North accurately. Note you need to consider the difference between the magnetic and the true North in your later calculation.
3. Measure the angle between the line connecting Site A and Site B and the direction to the island at both Site A and Site B.
4. Calculate the distance between the island and Site A and Site B, respectively. See the appendix for the equation to use.
The distance between the island and Site A: _____ m
The distance between the island and Site B: _____ m
5. Calculate the map coordinates of the island:

Easting = _____ E, Northing = _____ N.

- c) What is the elevation is the Site B? To answer the question, first to measure the distance between Site B and the nearby corner of the coast, then measure the vertical angle between the horizontal and the sea level at the corner. Use the methods outlined in the appendix to calculate the elevation at Site B.

The elevation at Site B is _____ m above sea level.

- d) Levelling the route between Site C and the end of the paved road and draw the profile along the segment of the paved road on the drafting paper, with a vertical exaggeration of 20. Calculate the scale of the profile and clearly write it with the title.

2. With the guide of the teacher, exam the geomorphic map interpreted from the airphoto and evaluate the quality of the interpretation.

Appendix. Calculation of distance, map coordinates and the elevation

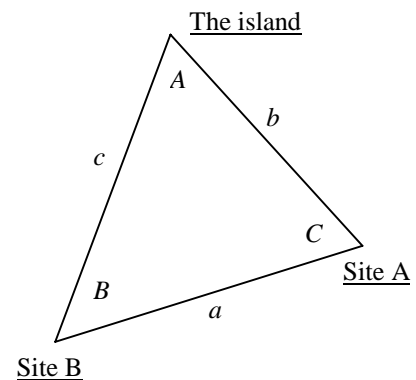
Calculation of distances between Site A and Site B to the island:

Refer to the figure on the right, there is: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Given B and C and a, b and c can be calculated as:

$$b = \frac{a \sin B}{\sin A} = \frac{a \sin B}{\sin(180^\circ - B - C)}$$

$$c = \frac{a \sin C}{\sin A} = \frac{a \sin C}{\sin(180^\circ - B - C)}$$



Calculation of the map coordinates of the island:

Refer to the figure on the right, there are:

$$\Delta E = b \cos \Delta C; \quad \Delta N = b \sin \Delta C$$

$$E = E_a + \Delta E; \quad N = N_a + \Delta N$$

Where b is known from the calculation of previous questions; E_a and N_a are the Easting and Northing of Site A; and ΔC can be calculated from the true North.

Calculation of the elevation at Site B:

$$h = a \tan \theta$$

where h is the height at Site B, a is the horizontal distance between Site B and the corner of the coast (measured on the map), and θ is the vertical angle between horizontal line and the sea level.

