

UNIVERSITY OF NEW SOUTH WALES

SCHOOL OF SURVEYING

29.001 SURVEYING I

Field Exercise: Theodolite 1 (Direction Measurement)

1. AIM

To familiarise students with scale reading theodolites (0.1'), its centring and levelling and use in measuring arcs of direction.

2. EQUIPMENT (Groups of 2 Students)

- 1 10" Theodolite ZEISS Th4 or WILD T16 or KERN K1-SE or ZEISS 020 or WILD RDS
- 1 Tripod
- 1 Plumb-bob
- 1 Peg
- 1 Hammer
- 1 Survey Umbrella with Steel Base (rain or sun)
- 1 Clip Board
- SUPERVISOR: 4 WILD Targets  
4 WILD GST 20 Tripods

3. EXERCISE

3.1 In main area indicated by your demonstrator, drive the peg firmly into the ground and mark a pencil cross on top of it.

3.2 Set the theodolite over the cross on the peg, level it and centre it, first using the plumb-bob, then, using the optical plummet. The base plate of the instrument's tribrach should never leave the tripod head more than a few millimetres. Get setting up and centring checked by your demonstrator.

3.3 Make the vertical axis truly vertical, using the plate level for this purpose. If the mean position of the bubble differs more than 3 divisions from the centre position, get the plate level adjusted by your supervisor.

3.4 Each student in the group will check (and adjust, if necessary) the levelling of the theodolite, will determine 5 times his personal eyepiece constant and will then carry out two arcs of direction to the 4 targets after having set the circle to the required position. The first direction in the first arc should have a circle reading between about  $0^{\circ}00'30''$  and  $0^{\circ}02'00''$ . For every new arc, the circle reading should be increased by  $360^{\circ}/(\text{expected number of arcs measured by the group})$ . Book on a field form. Compute "mean" and "reduced mean" immediately after completion of an arc.

3.5 When all students in the group have completed their two arcs, the "grand mean" and the "v'" must be calculated. The field form must then be shown to the demonstrator, who will indicate whether any student is required to repeat his work. ( $v' = (\text{grand mean}) - (\text{red mean})$ ).

3.6 All residuals "v" ( $v = v' - \frac{[v']}{t}$ ) and their squares "vv" must be calculated. Compute then the standard deviations of one single direction (in the reduced mean) Sd and the standard deviation of one adjusted direction (in the grand mean)  $\bar{Sd}$ . (The number of targets is denoted by t).

$$Sd = \pm \sqrt{\frac{\sum v^2}{(t-1)(s-1)}}$$

S = number of arcs  
t = number of targets

$$\bar{Sd} = \pm \frac{Sd}{\sqrt{S}}$$

3.7 Get the forms signed by your demonstrator, remove the peg from ground and return all equipment to the store.

#### 4. REPORT

No report is required; the field forms, however, need to be submitted by 17.00 hours of the day of the practical.

J. M. RÜEGER.

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