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 $360^{\circ}/$(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' = (grand mean) - (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) $S\bar{d}$. (The number of targets is denoted by t).

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

S = number of arcs
t = number of targets

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

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.

January, 1981

APPENDIX: FW THEODOLITE 1

DIRECTION MEASUREMENT

~~(VERTICAL ANGLE MEASUREMENT)~~

STATION NO.: TS 103

NAME: Applied Scieuce

Date: 12/3/76 Locality: UNSW Time: $10^{15} - 10^{55}$ Instrument Th4 No 81020a

Observer: Rüeger Booker: Rüeger Weather: sunny, strong wind easterly

Target	F.L.	F.R.	Mean (~~FL+FR~~)	RedMean (VertA)	Grand Mean (~~MeanVA~~)	v'	v	vv	(i)	(t)	Remarks: st.dev., time, ...
TS 131	0 00 18	180 00 12	00 15	0 00 00	0 00 00	0	+5	25			10^{15} Showground
TS 12	89 09 24	269 09 24	09 24	89 09 09	89 09 07	-2	+3	9			Medicin
TS 138	98 07 30	278 07 24	07 27	98 07 12	98 07 00	-12	-7	49			Library
TS 1	110 55 12	290 55 18	55 15	110 55 00	110 54 54	-6	-1	1			CE
						-20	0				
TS 131	90 00 18	270 00 06	00 12	0 00 00		0	+1	1			10^{25}
TS 12	179 09 24	359 09 24	09 24	89 09 12		-5	-4	16			
TS 138	188 07 12	8 07 00	07 06	98 06 54		+6	+7	49			
TS 1	200 55 12	20 55 12	55 12	110 55 00		-6	-5	25			
						-5	-1				
TS 131	180 00 12	0 00 24	00 18	0 00 00		0	-5	25			10^{35}
TS 12	269 09 18	89 09 18	09 18	89 09 00		+7	+2	4			
TS 138	278 07 06	98 07 18	07 12	98 06 54		+6	+1	1			
TS 1	290 55 06	110 55 06	55 06	110 54 48		+6	+1	1			
						+19	-1				
TS 131	270 00 12	90 00 18	00 15	0 00 00		0	-2	4			10^{45}
TS 12	359 09 24	179 09 18	09 21	89 09 06		+1	-1	1			
TS 138	8 07 18	188 07 12	07 15	98 07 00		±0	-2	4			
TS 1	20 55 06	200 55 00	55 03	110 54 48		+6	+4	16			
						+7	-1	231			

number of sets $s = 4$

number of targets $t = 4$

$$s_d = \pm \sqrt{\frac{[vv]}{(s-1)(t-1)}}$$

$$= \pm \sqrt{\frac{231}{9}}$$

$$s_d = \pm 5.1''$$

$$s_{\bar{d}} = \pm \frac{s_d}{\sqrt{s}}$$

$$= \pm \frac{5.1''}{\sqrt{4}}$$

$$s_{\bar{d}} = \pm 2.6''$$

$$v = v' - \frac{[v']}{t}$$