

UNIVERSITY OF NEW SOUTH WALES

SCHOOL OF SURVEYING

29.002 SURVEYING 1B

FULL TIME COURSE 1977

FIELD EXERCISE: TACHEOMETRY 11

1. AIM

To familiarize students with the methods of indirect contouring (spot heights) and detail survey by radiation, using vertical staff tacheometry (stadia).

2. EQUIPMENT

(Ask for the instrument you used in tacheometry 1)

- 1 Self reducing diagram tacheometer Wild RDS
- 1 RDS Metric and folding staff (with bubble)
- 1 Tripod Wild GST20

or

- 1 Scale reading Theodolite Zeiss Th4, Wild T16 or Wild T1
- 1 Metric folding staff (with bubble) or telescopic staff (with bubble)
- 1 Tripod Zeiss S2R or Wild GST20

and

- 1 Pocket tape
- 1 Ranging rod
- 1 30m steel tape
- 1 Survey umbrella (sun or rain)
- 1 Plumb bob
- 1 Clip board

3. EXERCISE

The contouring and detail survey in the area west of the CE Building, the limits of which are fixed by the fence along Oval Lane in the South, the s-shaped Library Road in the West and North (top of retaining wall) and the line U5-D49 in the East, shall be done by vertical staff tacheometry. Select the spot heights for contouring carefully, so that the contour lines (interval: 0.5 m) may be interpolated accurately afterwards.

Two instrument set-ups are needed to carry out the survey. Make sure that at least three of the following control stations are visible from both stations. U5, W20, D49, B50, G505. Survey first all detail points and secondly all spot heights from both station. Detail points are: buildings, roads, footpaths, fences, walls, retaining walls, manholes, trees, survey marks, hedges.

3.1 Follow this measuring program on all stations:

- (i) Set up theodolite, in an arbitrary position and level it carefully.
- (ii) Point telescope to a distant trig station as e.g. TS103, TS138, TS133 or TS128.
- (iii) Set horizontal circle to zero to this target (exactly).
- (iv) Measure the height of instrument above the ground and book it. All bookings are done on field forms "STADIA".
- (v) Set up your vertical staff (stabilized by a ranging rod) on three of the following control stations: U5, W20, D49, B50, G505. Record the horizontal circle reading (= direction) and the stadia readings (as described in (vi)). These observations determine the position of

your instrument station. Notice, that all observations are made only in face left, as major instrumental errors have been determined in the first "tacheometry" exercise.

- (vi) Survey now all detail points and spot heights in the following manner:
 - vertical hair into middle of staff. Horizontal clamp.
 - lower hair on 1.000 m mark on staff. Vertical clamp.
 - read lower hair, middle hair, upper hair. Do not touch slow motion screws anymore, until the next four steps are executed.
 - send staff man to next point
 - read direction
 - adjust altitude bubble (if necessary)
 - read zenith distance
 - sight to next point.
- (vii) Before you leave the station, measure again the height of instrument and sight again to the zero direction. Book both new readings. It is advisable, to repeat this check of the reference object several times during the work on a station. Book every time properly on your form.

3.2 All detail points and spot heights should be numbered continuously. All points must be depicted in a neat sketch in the field book covering the surveyed area.

3.3 See appendix for booking. Try to calculate all reductions in the field. Formulae:

Horizontal distance $H = (100.S + \Delta) \sin^2 z$
 $S =$ staff intercept $=$ upper hair $-$ lower hair
 $z =$ zenith distance $+ vertical circle index corr. i$
 Height difference $V = (100S + \Delta) \sin z \cos z$
 $\Delta =$ instrument constant (from graph, determined in first tacheometry field work)
 Reduced Level $= R.L. =$ Height of coll. $+ V - M$
 $M =$ middle hair (staff) reading
 Height of collimation $= R.L. of station +$ height of instrument.

Use pocket calculator for the computations.

See appendix for RDS booking.

These computations are a group work and must be shared by all group members.

4. REPORT/PLAN

Each student submits the usual report and the following plans:

- (i) Plot 1:250 in pencil on opaque cartridge paper with all original plots on it. As it is! No erasures, no adds, apart from group number and title (in pencil!).
- (ii) Final plan 1:250 in indian ink as described in 4.5.

4.1 Plot control points on an opaque cartridge paper, Scale 1:250, together with the coordinate grid lines (spacing 10 cm). The coordinates of the control points in the NSW Integrated Survey Grid, Zone 56/I are as follows:

	Easting	Northing	Elevation
U5	321 402.67 m	1 245 407.91 m	52.25 m
W20	321 384.79 m	1 245 440.38 m	50.98 m
D49	321 413.80 m	1 245 436.66 m	52.90 m
B50	321 362.61 m	1 245 495.09 m	45.48 m
G505	321 363.32 m	1 245 406.44 m	50.59 m

(All Elevations in NSW Standard Datum)

4.2 Determine the position of your instrument stations by graphical or computational means accurately on your plan. Explain the method employed in your report.

4.3 Plot details and spot heights.

4.4 Interpolate the 0.5 m contour lines (on superimposed tracing paper).

4.5 Prepare the final plan which is to show:

- (a) Title
- (b) Group number and your name.
- (c) North direction.
- (d) ISG Grid. Show only cross for intersecting, 25 m coordinate lines, i.e. one cross every 10 cm on the plan.
- (e) Scale - 1:250.
- (f) Grid datum.
- (g) Datum of reduced levels.
- (h) Dates of survey.
- (i) All control points in the area covered, i.e. your (two) stations + all UNSW Campus Network points (see 4.1).
- (j) All natural and artificial features with appropriate designation by name and legend (e.g. buildings, paths, fences, walls, trees, etc).
- (k) Spot heights with value stated to the nearest 0.1 metre and contours at 0.5 metre intervals.
- (l) Locality sketch.

This plan to be submitted must be in Indian ink on a transparent material, i.e. tracing paper or drafting film. It is obtained by tracing of the pencil drawings made on opaque cartridge paper (4.1, 4.2, 4.3) and the contour lines drawn on tracing paper (4.4).

J.M. RUEGER
Lecturer
June, 1977

27/6/77/JMR/100

APPENDIX FIELD WORK TACHEOMETRY II

STADIA FIELD NOTES

DATE _____

THEODOLITE NO _____

VERT. CIRCLE INDEX ERROR $i = +2'$

STA NO Ht of Instr	TARGET	STADIA HAIRS		CIRCLE F.L.		100 S + Δ	H	V	HEIGHT OF COLL.	R.L.	REMARKS
		Middle M	Lower Upper	HOR	VERT						
A 6	A 5			0° 00'					25.80	24.20	
1.605 m	A 7			172° 05'							
	1	1.276	1.000 1.552	221° 14'	87° 36'	55.2	55.1	+2.28		26.80	Cor. of Bldg
	2	1.199	1.000 1.380	114° 36'	92° 18'	38.0	37.9	-1.55		22.55	Light Pole
	3	1.383	1.000 2.765	123° 41'	93° 21'	76.6	76.2	-4.51		18.91	Spot height
	A 5			0° 01'							check

SELF REDUCING TACHEOMETER WILD RDS
(ZERO MARK OF SPECIAL STAFF ON INSTR. HEIGHTS)
DATE _____ RDS NO: _____

STA NO height of instr. ht of target	TAR- GET	HOR CIRCLE	H= (100 S + Δ)	h 100 h	C _n mult. const.	V= C _n +100h	R.L.	REMARKS
A 6	A 5	0° 00'					24.20	
	A 7	172° 05'						
h _i = 1.65	6	24° 34'	37.4	20.2	+0.1	+2.02	26.22	House Corner
	7	86° 30'	49.5	14.9	-0.1	-1.49	22.71	Spot height
h _t = 1.65	8	140° 58'	17.5	8.0	+0.2	+1.60	25.80	"
	9	175° 58'	11.7	14.5	-0.5	-7.25	16.95	"
	A 5	0° 00'						check

S = STAFF INTERCEPT BETWEEN LOWER + UPPER HAIR
h = " " " " LOWER + MIDDLE HAIR

C_n = multiplication constant of middle hair.