

# NATIONAL MAPPING PROCEDURES

## FIRST ORDER HORIZONTAL ANGLES USING WILD T3 THEODOLITE

### Time of Observation

Horizontal angles are normally read in the late afternoon as soon as the beacons are steady enough - generally during the hour before sunset. The period available for good first order work varies considerably, depending on time of year, locality, weather, etc. Cloudy or overcast conditions generally appear to give more ideal observing conditions for a longer period. Horizontal work usually stops when it is too dark to see. A skylined opaque beacon, particularly in a Westerly direction can be seen for quite some time after the sun has set.

### Targets

The best results are obtained from observations to opaque beacons. Observing to lights or hellos, except when absolutely necessary due to low lines or other conditions, is not advised.

### Reference Object (RO)

If possible the same RO should always be used, particularly if more than two lines are involved, otherwise a station adjustment becomes necessary.

### Theodolite Stand-Point

Care should be exercised in set ups. The Stand-point is chosen on the best position at a station, and 18" x 3" x 3" oregon pegs driven, with the tops then bored for the ferrules of the legs. When the ground is too stony, 15" x 1" internal diameter, pointed pipes are driven; in sand 36" x 3" x 3" pegs are used. A set up on solid rock can be quite satisfactory and on occasions *plaster of paris* is very convenient to use. Variations in weather conditions can affect the wooden tripod and it is well to remember to check all screws and bolts at regular intervals.

### Screens

To protect the instrument against sun, breeze, etc., light canvas screens, fitted to an aluminium or dural framework, should be used.

### Technique of Observations and General Notes

Due to the nature of the circles on the Wild T3 a system of double pointings is employed.

An arc of double pointings forms a zero and six zeros a set (see Annexure A). Six sets which divide the circle into 10° divisions are considered a minimum requirement (see Annexure B). The horizon is not closed, but sets are first initially swung right, then the second set initially swung left, etc. (see Annexure C).

It appears that this alternative swinging of sets can be important particularly if the instrument becomes stiff due to cold conditions causing the oil to become thick, or dry dusty conditions causing it to dry out. The variation between such sets on some old instruments, sometimes becomes more pronounced.

Range in a set of six zeros is seldom found to be over 4". Rejection of sets are seldom advisable even if there is a range of 7" or 8", but generally if there is any doubt, more observations should be taken.

It is desirable to spread the observations over two days, thereby obtaining a better mean result, under possibly different weather conditions. When the mean

result of the first night agrees within 1" with the mean result of the second night, the observer moves on to the next station, otherwise a third night's observing is done.

Point by Point Description of Actual Observing Method (assuming that there are two Stations)

We assume that the instrument has been set up and levelled, then for first set of six zeros starting on Face Left.

- 1 Bring selected R.O. between double wires and set approximately 05" on micrometer drum.
- 2 Using setting screw bring scale as close as possible into coincidence at  $00^{\circ} 00'$ .
- 3 Unclamp and swing instrument in a complete circle in a clockwise direction back on RO and reclamp, making sure that final movement is clockwise.
- 4 Bring beacon into centre of double wires with tangent screw, again making sure that final movement of screw is clockwise against pressure of spring.
- 5 Bring scales into coincidence with micrometer screw, again in a clockwise direction, and read.
- 6 Throw off the target with the tangent screw and take a fresh pointing and another micrometer reading.
- 7 Unclamp and swing on to the next station in a clockwise direction and repeat actions 4, 5 and 6.
- 8 Change face and swing back on to the target in an anti-clockwise direction and clamp horizontal circle.
- 9 Repeat previous procedure of taking two pointings and two micrometer readings remembering to make the final movement of tangent screw and micrometer screw in a clockwise direction.
- 10 Swing back on the RO in an anti-clockwise direction and repeat procedure of taking two pointings and two readings. This completes two zeros.
- 11 Set micrometer drum on approximately 25". The instrument is now on right face and reads approximately  $180^{\circ} 00'$ .
- 12 Move circle setting up  $60^{\circ}$  to  $240^{\circ} 00'$ .
- 13 Repeat previous procedures from 3 to 10. This completes another two zeros.
- 14 Move micrometer drum to approximately 45" and the circle setting up another  $60^{\circ}$  and repeat previous procedure. This completes one set of six zeros.
- 15 On the next set this procedure should be repeated but reversing the system of swinging clockwise from the RO, i.e., 3 would read : unclamp and swing instrument in a complete circle in an anti-clockwise direction, and re-clamp making sure than final movement is anti-clockwise; 7 would read : unclamp and swing on to the next station in an anti-clockwise direction etc.; 8 would read : Change face and swing back on to the target in a clockwise direction etc.

**Random Arcs**

Move the setting screw at random and read a round of angles to all the stations. The purpose of this is to ensure that the minutes have not been read consistently wrong (see Annexure A).

TWO OBSERVED SETS

ANNEXURE A

| AT STATION NM/F/161 $\Delta$ |    |      | Scale                         | DAY AND DATE SUN 23 SEPT. 1962 |    |                             | TIME STARTED 1650 |       |     |    |      |      |       |
|------------------------------|----|------|-------------------------------|--------------------------------|----|-----------------------------|-------------------|-------|-----|----|------|------|-------|
| OBSERVER                     |    |      | WEATHER COOL SUNNY S.E. WIND  |                                |    | TIME FINISHED 1705          |                   |       |     |    |      |      |       |
| RECORDER                     |    |      | VISIBILITY GOOD, SOME SHIMMER |                                |    | THEODOLITE WILD T3<br>29886 |                   |       |     |    |      |      |       |
| NM/F/161 (R.O.) VANES.       |    |      | NM/F/193 VANES.               |                                |    | NM/F/163 VANES              |                   |       |     |    |      |      |       |
| 10                           | 00 | 06.3 | 12.6                          | 153                            | 34 | 33.5                        | 06.9              | 54.3  | 226 | 12 | 59.4 | 58.6 | 46.0  |
|                              |    | 01.8 |                               |                                |    | 30.1                        |                   |       |     |    | 56.8 |      |       |
| 190                          | 00 | 02.5 | 04.3                          | 133                            | 34 | 31.1                        | 01.2              | 56.9  | 46  | 12 | 58.1 | 54.9 | 50.6  |
|                              |    | 25.6 |                               |                                |    | 53.2                        |                   |       |     |    | 18.4 |      |       |
| 250                          | 00 | 25.3 | 50.9                          |                                | 34 | 52.9                        | 46.1              | 55.2  |     | 14 | 19.9 | 38.3 | 47.4  |
|                              |    | 29.0 |                               |                                |    | 57.3                        |                   |       |     |    | 24.6 |      |       |
| 70                           | 00 | 29.0 | 58.0                          |                                | 34 | 57.2                        | 54.5              | 56.5  |     | 14 | 24.0 | 48.6 | 50.6  |
|                              |    | 46.2 |                               |                                |    | 14.3                        |                   |       |     |    | 40.1 |      |       |
| 130                          | 00 | 46.6 | 32.8                          |                                | 36 | 13.4                        | 27.7              | 54.9  |     | 14 | 39.8 | 19.9 | 47.1  |
|                              |    | 41.5 |                               |                                |    | 09.6                        |                   |       |     |    | 35.5 |      |       |
| 310                          | 00 | 41.9 | 23.4                          |                                | 36 | 10.4                        | 20.0              | 56.6  |     | 14 | 37.1 | 12.6 | 49.2  |
|                              |    |      |                               |                                |    |                             | 6)                | 34.4  |     |    |      | 6)   | 50.9  |
|                              |    |      |                               |                                |    |                             |                   | 55.73 |     |    |      |      | 48.48 |
| MEAN 00° 00' 00"             |    |      |                               | 143° 34' 55".73                |    |                             | 216° 13' 48".48   |       |     |    |      |      |       |

| AT STATION NM/F/162 $\Delta$ |    |      | Scale                          | DAY AND DATE SUN 23 SEPT 1962 |    |                             | TIME STARTED 1705 |       |     |    |      |      |       |
|------------------------------|----|------|--------------------------------|-------------------------------|----|-----------------------------|-------------------|-------|-----|----|------|------|-------|
| OBSERVER                     |    |      | WEATHER COOL, SUNNY, S.E. WIND |                               |    | TIME FINISHED 1720          |                   |       |     |    |      |      |       |
| RECORDER                     |    |      | VISIBILITY GOOD, STEADY        |                               |    | THEODOLITE WILD T3<br>29886 |                   |       |     |    |      |      |       |
| NM/F/161 (R.O.) VANES        |    |      | NM/F/163 VANES                 |                               |    | NM/F/193 VANES              |                   |       |     |    |      |      |       |
| 220                          | 02 | 13.3 | 26.4                           | 76                            | 16 | 06.8                        | 14.9              | 48.5  | 03  | 36 | 41.6 | 23.4 | 57.0  |
|                              |    | 13.1 |                                |                               |    | 08.1                        |                   |       |     |    | 41.8 |      |       |
| 40                           | 02 | 17.7 | 35.7                           | 256                           | 16 | 10.5                        | 22.1              | 46.4  | 183 | 36 | 46.0 | 31.5 | 55.8  |
|                              |    | 18.0 |                                |                               |    | 11.6                        |                   |       |     |    | 45.5 |      |       |
| 100                          | 02 | 35.3 | 10.9                           |                               | 16 | 29.4                        | 59.0              | 48.1  |     | 38 | 03.1 | 05.9 | 55.0  |
|                              |    | 35.6 |                                |                               |    | 29.6                        |                   |       |     |    | 02.8 |      |       |
| 280                          | 02 | 30.1 | 00.5                           |                               | 16 | 25.8                        | 52.3              | 51.8  |     | 36 | 59.8 | 59.7 | 59.2  |
|                              |    | 30.4 |                                |                               |    | 26.5                        |                   |       |     |    | 59.9 |      |       |
| 340                          | 02 | 51.6 | 45.4                           |                               | 16 | 48.7                        | 37.6              | 52.2  |     | 38 | 21.8 | 43.6 | 58.2  |
|                              |    | 52.8 |                                |                               |    | 48.9                        |                   |       |     |    | 21.8 |      |       |
| 160                          | 02 | 57.9 | 56.2                           |                               | 16 | 51.8                        | 43.5              | 47.3  |     | 38 | 27.0 | 53.6 | 57.4  |
|                              |    | 58.3 |                                |                               |    | 51.7                        |                   |       |     |    | 26.6 |      |       |
|                              |    |      |                                |                               |    |                             | 6)                | 54.3  |     |    |      | 6)   | 42.6  |
|                              |    |      |                                |                               |    |                             |                   | 49.05 |     |    |      |      | 57.10 |
| MEAN 00° 00' 00"             |    |      |                                | 216° 13' 49".05               |    |                             | 143° 34' 57".10   |       |     |    |      |      |       |

RANDOM ARCS

| AT STATION NM/F/162 $\Delta$ |    |    | Scale          | DAY AND DATE SUN 23 <sup>RD</sup> SEPT. 1962 |    |                | TIME STARTED |    |     |    |    |   |    |
|------------------------------|----|----|----------------|--|----|----------------|--------------|----|-----|----|----|---|----|
| OBSERVER                     |    |    | WEATHER        |  |    | TIME FINISHED  |              |    |     |    |    |   |    |
| RECORDER                     |    |    | VISIBILITY     |  |    | THEODOLITE     |              |    |     |    |    |   |    |
| NM/F/161 R.O. VANES          |    |    | NM/F/193 VANES |  |    | NM/F/163 VANES |              |    |     |    |    |   |    |
| 75                           | 52 | 10 | 20             | 219  | 26 | 38             | 16           | 56 | 292 | 06 | 04 | 8 | 48 |
|                              |    | 10 |                |  |    | 38             |              |    |     |    | 04 |   |    |
| 255                          | 52 | 08 | 16             | 39   | 26 | 34             | 8            | 52 | 112 | 06 | 01 | 2 | 46 |
|                              |    | 08 |                |  |    | 34             |              |    |     |    | 01 |   |    |
| MEAN 00° 00' 00"             |    |    |                | 143° 34' 54"                                 |    |                | 216° 13' 47" |    |     |    |    |   |    |

WILD T3 ZERO SETTINGS

1.

|         |     |     |     |       |    |
|---------|-----|-----|-----|-------|----|
| L. Face | 00° | 00' | 05" | Swing | R. |
| R. "    | 180 | 00  | 05  | "     | L. |
| R. "    | 240 | 00  | 25  | "     | R. |
| L. "    | 60  | 00  | 25  | "     | L. |
| L. "    | 120 | 00  | 45  | "     | R. |
| R. "    | 300 | 00  | 45  | "     | L. |

2.

|         |      |     |     |       |    |
|---------|------|-----|-----|-------|----|
| R. Face | 210° | 02' | 15" | Swing | L. |
| L. "    | 30   | 02  | 15  | "     | R. |
| L. "    | 90   | 02  | 35  | "     | L. |
| R. "    | 270  | 02  | 35  | "     | R. |
| R. "    | 330  | 02  | 55  | "     | L. |
| L. "    | 150  | 02  | 55  | "     | R. |

3.

|      |     |    |    |   |    |
|------|-----|----|----|---|----|
| L. " | 10  | 00 | 05 | " | R. |
| R. " | 190 | 00 | 05 | " | L. |
| R. " | 250 | 00 | 25 | " | R. |
| L. " | 70  | 00 | 25 | " | L. |
| L. " | 130 | 00 | 45 | " | R. |
| R. " | 310 | 00 | 45 | " | L. |

4.

|      |     |    |    |   |    |
|------|-----|----|----|---|----|
| R. " | 220 | 02 | 15 | " | L. |
| L. " | 40  | 02 | 15 | " | R. |
| L. " | 100 | 02 | 35 | " | L. |
| R. " | 280 | 02 | 35 | " | R. |
| R. " | 340 | 02 | 55 | " | L. |
| L. " | 160 | 02 | 55 | " | R. |

5.

|      |     |    |    |   |    |
|------|-----|----|----|---|----|
| L. " | 20  | 00 | 05 | " | R. |
| R. " | 200 | 00 | 05 | " | L. |
| R. " | 260 | 00 | 25 | " | R. |
| L. " | 80  | 00 | 25 | " | L. |
| L. " | 140 | 00 | 45 | " | R. |
| R. " | 320 | 00 | 45 | " | L. |

6.

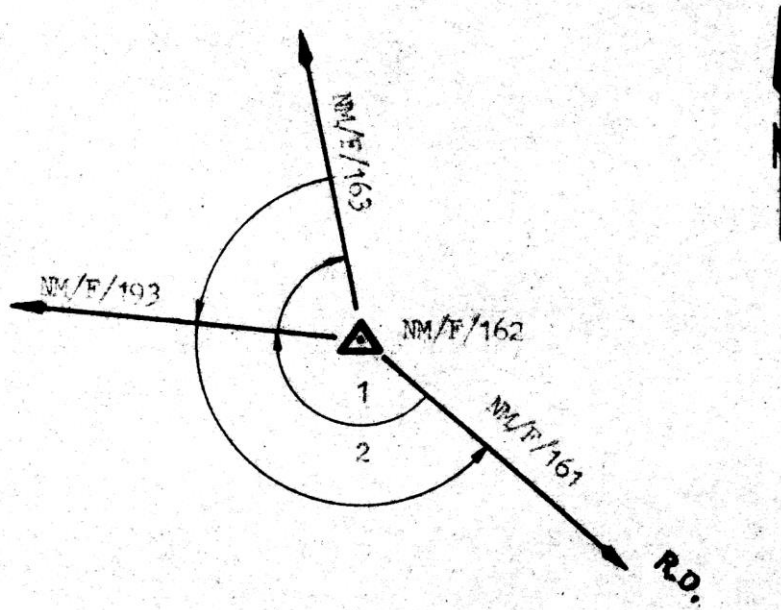
|      |     |    |    |   |    |
|------|-----|----|----|---|----|
| R. " | 230 | 02 | 15 | " | L. |
| L. " | 50  | 02 | 15 | " | R. |
| L. " | 110 | 02 | 35 | " | L. |
| R. " | 290 | 02 | 35 | " | R. |
| R. " | 350 | 02 | 55 | " | L. |
| L. " | 170 | 02 | 55 | " | R. |

ANNEXURE C

INITIAL SWING RIGHT

1 = First Zero

2 = Second Zero



INITIAL SWING LEFT

