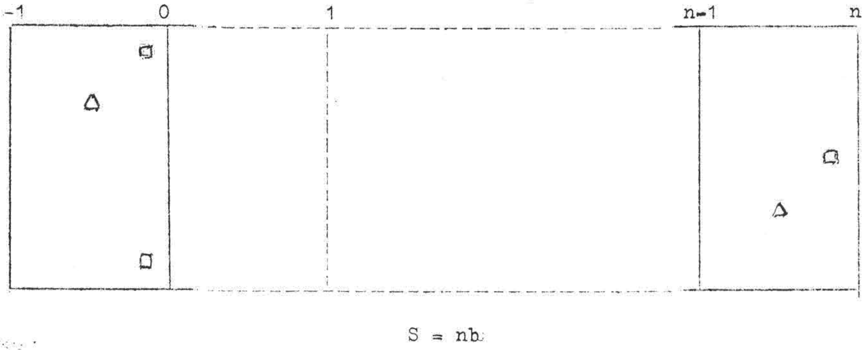

FIG. 14. The location of the control points in the strip consisting of the photographs $-1, 0, 1 \cdots n-1, n$. The triangles indicate planimetry control and the squares elevation control.

This means $n=4$.

For $c=150$ mm.

$$m_r = 0.0108\mu S \quad (29)$$

For $\mu=0.01$ mm.

$$m_r = 0.000108S \quad (30)$$

For $S=20$ km.

$$h = 8{,}600 \text{ meters}$$

and

$$m_r = 2.2 \text{ meters}$$

SUMMARY

The most effective aerial triangulation will be performed from comparatively few models. The flying altitude and the triangulation distance are mutually dependent and must be determined with respect to the tolerances of the final coordinates. These facts are of the greatest importance for the accuracy and economy of aerial triangulation.

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AUTHOR'S NOTE. Complete derivations of the fundamental expressions (1)–(2), (18)–(19) and (24)–(26) will be published in the near future.

*The Use of Astronomically Oriented Base Lines in Slotted Templet Triangulation**

J. VISSER,
United Nations,
P.O. Box 1555, Teheran, Iran

INTRODUCTION

IN MANY vast areas of the world no geodetic control whatever exists. For a first reconnaissance then, maps are often based on slotted templet triangulation, in which case a practical minimum of four control points, situated in the corners of a block, are required.

These control points are usually obtained by astronomical determination of latitude and longitude. This determination however,

* This paper was written during the time I was lecturing Photogrammetry in the International Training Centre for Aerial Surveys, at Delft, Netherlands.—The Author.

as is generally known, can be considerably falsified by the unknown deviation of the vertical. Under unfavorable circumstances this deviation can reach a value up to 60″ and thus cause linear errors as large as 2 kilometers. Therefore the distances between these astronomically determined ground-control points should not be taken smaller than about 100–200 kilometers, in order that no local deformation will be introduced.

Between these widely spaced astro-stations the scale and azimuth of an aerial triangulation can, as is known, be locally controlled by the use of *astronomically orientated base lines.*

The deviation of the vertical has practically no influence on the astronomical determination of an azimuth. The necessary distances can be obtained by means of a local triangulation (a chain along a river, for instance) plus a short base, or can be acquired directly, with the help of very modern instruments such as the Tellurometer, the Geodimeter, etc.

In order to reduce the effect of errors in point identification and also for strengthening the triangulation, azimuths and distances or more than one base line are usually measured. In fact then a local network of ground-control points is established of which the scale and azimuth are correct but its position with respect to the astrostations

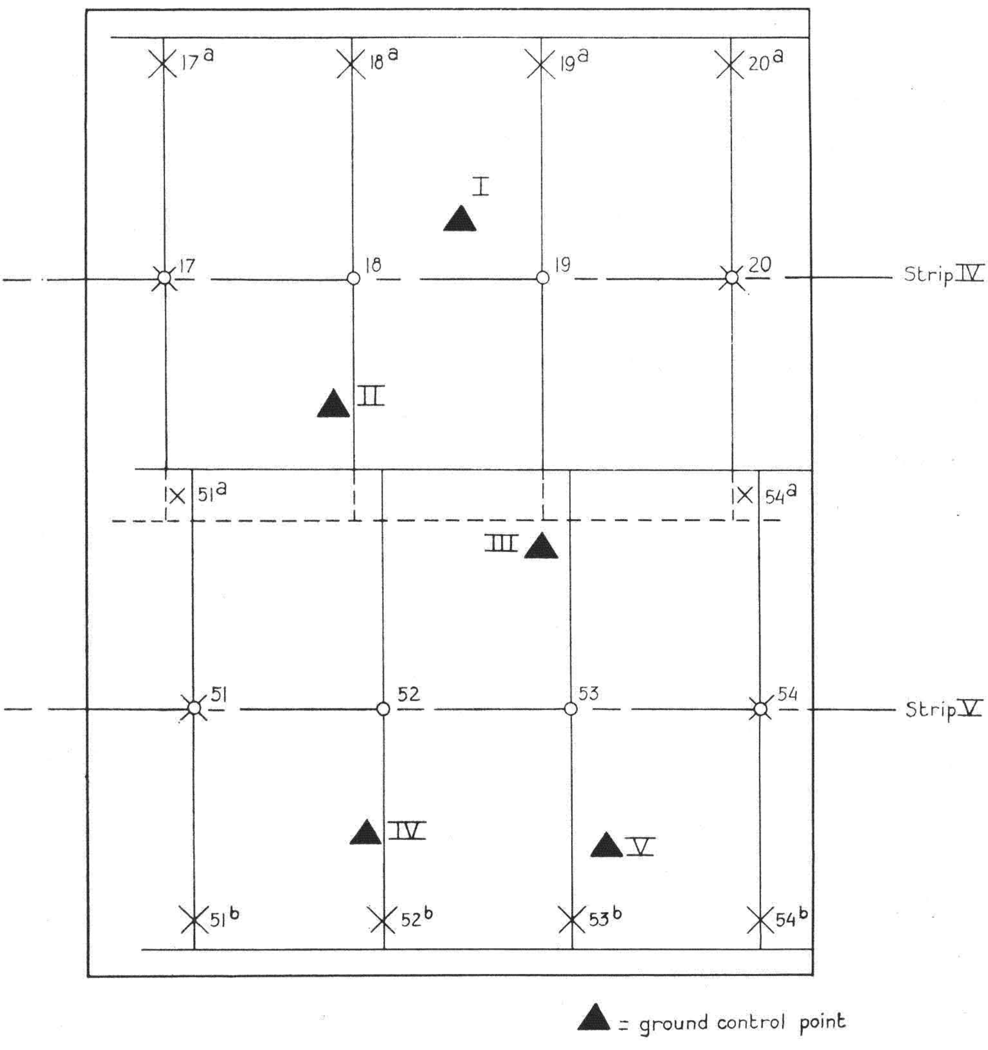

FIG. 1. The local lay-out.

or with respect to the other networks is completely arbitrary.

This true scale and azimuth of each of the local networks must be introduced and maintained during the successive stages of the layout of the slotted templet triangulation. In the following a description is given of a method, through which the true scale and azimuth are introduced and maintained in a *mechanical way.*

EXECUTION

1. A separate layout is made of the templets that cover the area of a local network. See Figure 1 (2×4 templets). For this purpose a "local" base-map is used on which all ground points (here I–V) are plotted with the correct scale and azimuth, but with a local origin for their co-ordinates. This local base-map should be made, preferably, of the same material as is used for making the templets.
2. The wingpoints and radial centers along the edges of the local base-map (17^a–20^a, 51^b–54^b, 51^a, 54^a and 17, 20, 51, 54) are pricked through to the local base-map. The templets are then removed. Circular holes (as for the usual radial centers) are punched in the base-map through the pricked points ($17^a \cdots 54$); studs are inserted and fixed to the base-map.

   In the next layout, that of the whole area between the four astro-stations, this local base-map will act as one (block-) templet. The connection with the surrounding normal templets will be effectuated by means of the previously mentioned studs, fixed along the edges of the block templet.
3. An approximate layout of the whole area is made, for instance, by laying out every second strip completely but every intermediate strip only partially.
4. The block-templet is rotated slightly in order to make the templet gridlines exactly parallel to those on the base-map of the large layout.

   In the next stages of the layout this established azimuth of the block-templet must be maintained; therefore only parallel shifts of the block-templet are allowed.
5. The block-templet must, therefore, be provided with a *parallel-guidance.* Employing the principles of the cross-slide system, this can be obtained in a

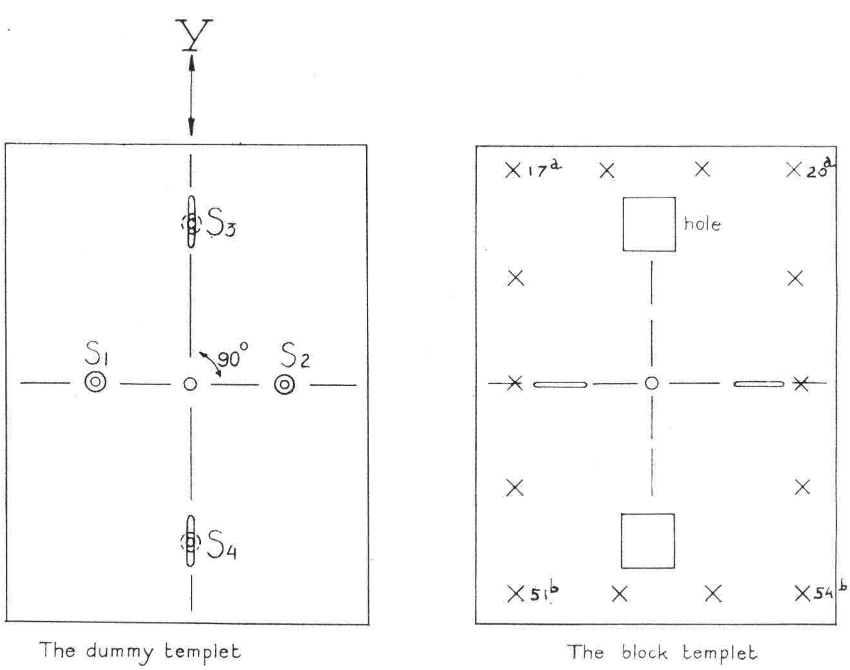

FIG. 2. The dummy templet and the block templet. Half the scale of Figure 1.

very simple way by using a second (a "dummy"-) templet that is constrained to move in y-direction only. The block-templet itself is placed over this dummy-templet, and can move only in x-direction with respect to the dummy-templet. See Figure 2. S_3 and S_4 are studs, fixed to the base-map of the large layout; S_1 and S_2 are studs, fixed to the dummy-templet. During the approximate layout (step 3) the block-templet is rigidly connected to the dummy-templet by inserting a stud in the central hole of the dummy-templet and placing the block-templet with its central hole over this stud while the slots of the block-templet are placed over the studs S_1 and S_2. (The studs S_3 and S_4 are not yet introduced in this step.)

After the approximate layout is made, the dummy- and block-templet together are carefully rotated (step 4) until their common y-axis is parallel to the y-axis of the base map. In this position the studs S_3 and S_4 are fixed to the base-map and the stud in the central holes is removed.

In the next and final layout the block-templet can move freely in x- and y-direction, while at the same time, its right scale and azimuth are being maintained automatically.

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