

## SECTION 21

## AERIAL SURVEY

### Sites to be photographed and surveyed

- 1** The route and location of Sites to be photographed and surveyed are defined on the Contract Drawings.

The area to be surveyed is generally within the Railtrack property boundary, except where the tracks do not abut earthworks or structures adjacent to the property boundary, the survey limit shall be 3.0 metres from the outer rail of the tracks. At level crossings the limit of the survey shall be 100 metres from the barriers unless shown otherwise on the Contract Drawings.

Locations and the extent of each Site to be digitally mapped are as indicated on the Contract Drawings. The precise extent of each Site to be mapped will be defined after the aerial photography has been flown. Individual areas may be increased or reduced in size without varying the total area to be mapped.

(21.001)

### Aerial photography generally

- 2** The route to be photographed follows existing railway lines from **(INSERT)** to **(INSERT)** via **(INSERT)**.

Continuous stereoscopic photography shall be carried out to cover the existing railway tracks and adjoining land extending a minimum of 100 metres on both sides of the centre line of the main tracks.

In addition, a number of sites along the route shall be covered by stereoscopic aerial photography to the extent indicated on Contract Drawings.

(21.002)

### Scale of photography

- 3** The nominal scale of the photography shall be 1:2000.

(21.003)

### Type of photography

- 4** Panchromatic aerial film shall be used, coated on a stable base.

(21.004)

### Copyright, ownership and storage of film negatives

- 5** All films exposed during the aerial photography shall become the property and copyright of Railtrack.

The original film negatives shall be retained by the Contractor until required by Railtrack and shall not be disposed of, or reproduced without the written consent of Railtrack. The original film negatives shall be delivered to Railtrack on written request.

(21.005)

### Camera and focal length

- 6** The camera shall be a 230 x 230 mm format metric survey camera with forward image movement compensation, fitted with a lens designed to give a residual radial distortion not exceeding 5 micrometres within 130 millimetres of the principal point.

The camera lens shall have a nominal focal length of 152 mm.

(21.006)

## Calibration

- 7** The camera lens unit to be used shall have been calibrated and certified within the last two years by the camera manufacturer or by a calibration centre recognised internationally or approved by the camera manufacturer.

The measured distortion shall fall within the limit defined by the manufacturer for the lens.

Two copies of the current calibration certificate shall be supplied to the Employer's Representative before commencement of flying.

If any damage liable to affect the calibration of the camera is suspected during the aerial photography, the camera shall be recalibrated.

(21.007)

## Photographic coverage

- 8** The routes and Sites shall be covered by approximately straight strips of near vertical photographs.

The forward overlap between successive exposures in each run shall be between 55% and 65%.

The lateral overlap (sidelap) between adjacent strips shall be between 15% and 35%, except where ground heights within the area vary by more than 10% of the flying height.

Where the ends of runs of photography join the ends of other runs flown in the same general direction there shall be an overlap of at least two stereoscopic models.

Crab shall not exceed 5°, nor create gaps in the stereoscopic coverage.

Tilt shall not exceed 2° except in isolated exposures where tilt up to 4° may be permitted, provided this does not create gaps in the stereoscopic coverage.

(21.008)

## Flying conditions

- 9** Photography may be taken at any solar altitude above 15°, but shall only be flown in conditions where the visibility does not significantly impair the tone reproduction in the negative.

Photography shall be substantially free from cloud, dense shadow or smoke. Isolated areas of cloud, dense shadow or smoke shall not be a cause for rejection of the photography provided full stereoscopic coverage of the ground is achieved with alternative exposures.

The flying conditions, exposure and processing shall be selected to ensure that critical railway detail such as toes of points can be surveyed by photogrammetry even where the railway tracks are in shadow.

(21.009)

**Metric quality of negatives**

- I 0** In any negative, the differential lengths between any pairs of fiducial marks shall not exceed 0.3% and the overall scale change shall not exceed 0.08%.

The original negatives, and diapositives produced from them, shall not contain residual y-parallaxes after relative orientation in excess of 20 micrometres anywhere in the model.

(21.010)

**Image quality of negatives**

- I 1** All processed negatives shall be substantially free from stains, discolouration, brittleness, blisters, bubbles, inclusions, coating lines, stress or static marks, bar marks, pin holes, abrasions, streaks, chemical marks, drying marks or scratches.

The density and contrast of all negatives shall be such that commercially available grades of paper, covering log exposure ranges of 0.6 up to 1.6 can be used to produce prints with detail in dark and bright areas of interest. Suitable dodging methods shall be permitted.

The fog density (emulsion only) of the negatives shall not normally exceed a value of 0.2 measured in an area clear of any exposure to light, except for film nominally rated at a speed in excess of 250 EAFS which shall not exceed 0.4.

Useful minimum shadow detail shall not have a density of less than 0.2 above base-plus-fog.

The maximum density in useful areas of the negatives shall not exceed 1.5 above base-plus-fog, other than in small areas where 2.0 above base-plus-fog shall be permissible.

All fiducial marks shall be clearly visible and sharp on every negative.

The camera panel of instruments recorded on the film shall be clearly legible on all processed negatives, although failure of instrument illumination during a sortie shall not be a cause for rejection of the photography.

(21.011)

**Documentation and annotation**

- I 2** The following information shall be provided as leaders at the start and end of each film, and on each film container.

- (i) project name or reference,
- (ii) film number,
- (iii) date of photography,
- (iv) nominal scale of photography,
- (v) camera type,
- (vi) the calibrated focal length of the lens unit.

The negatives shall be numbered in neat and legible type, approximately 3 mm high, and annotated with the following information on the contact prints.

- (i) producer's name,
- (ii) project name or reference,
- (iii) film number and photo number,
- (iv) date of photography,
- (v) altitude above mean sea level or ground level,
- (vi) nominal scale of photography,
- (vii) calibrated focal length of the lens unit.

(21.012)

**Products to be  
provided by the  
Contractor**

**I3** The Employer's Representative shall be provided with the following:

- (i) a copy of the flight plan for acceptance,
- (ii) two sets of semi-matt (not lustre) contact prints produced on an automatic dodging printer,
- (iii) one set of stable base diapositives made on an automatic dodging printer,
- (iv) one transparency and two paper copies of each index plot based on Ordnance Survey maps at 1:25,000 scale.

The index plot shall include:

- (i) the relative positions of all accepted exposures,
- (ii) the date and scale of photography,
- (iii) the camera type, focal lengths and serial number,
- (iv) exposure, strip and film numbers,
- (v) two copies of the camera lens unit calibration certificate.

A film report shall be included in the film container with each film and in the Technical Report specified in Section 25: Presentation of Survey Data and Information giving the following information:

- (i) producer's name,
- (ii) filter type and number producer's name,
- (iii) film number, run numbers and flight directions,
- (iv) date of photography and start and end time for each run,