A METHOD OF MAPPING THE VISIBLE AREA FROM A TOWER SITE BY COMPUTER

by

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INTRODUCTION

The cost of a fire lookout tower in construction and maintenance is very high and so the maximum use must be made of each one. Recently the viewing range at prospective tower sites has been investigated using a temporary portable tower. This method, although effective, takes quite a bit of setting up, and needs an experienced person with a good knowledge of the area to map the seen area. The method described here employs a computer programme developed in Canada which calculates from a gridded contour map, the areas directly visible and the distance below the line of direct sight of the unseen areas for the different tower sites and heights. The resultant map outputs form the basis for deciding on the optimum position and height of prospective lookout towers.

METHOD

A grid is first drawn on a 1: 100,000 scale Survey Corps Topography Map at half or one kilometre intervals with the tower site as the centre point. For tower sites with plantation protection in mind, the half kilometre grid is used in order to give a more intensive coverage although the range is reduced to only 18 kilometres (11½ miles). The kilometre grid is more suitable for the hardwood forest where a range of 37 kilometres (23 miles) is achieved.

The contour heights are extracted from the map at each grid point and read to the nearest 5 or 10 metres depending on the steepness of the country.

The kilometer grid is also drawn on an A.P.I. 40 scale map which shows the average canopy height and the presence of cleared paddocks. Where the canopy height is reasonably constant and there are only a few cleared areas, the contour heights are taken as the canopy height (usually 30 metres). Using this method of allowing for tree canopy height, the tower site contour height on the map is the height of a 30 metre tower, and a reduction must be made to this if the tower is sited in a cleared area.

Another method may be employed for canopy height correction where a large percentage of the area is cleared or the forest has distinct areas with a large variation of canopy height.

In this method the contour heights are taken as the ground level and the various canopy heights are added to each grid point.

The contour heights of the 2601 grid co-ordination are Transferred onto computer code sheets in sequence as shown in Figure 1.

The Tower site is usually placed in the centre of the grid in order to determine the best overall coverage. However, if one is interested in one particular direction only, the tower site may be crucially placed to give emphasis to the area of interest.

The computer in processing this data takes each point starting at grid reference 1, 1 and works along the top line to 1,51 and then the second line 2,1 to 2,51 and so on throughout. As the computer comes to each co-ordinate it draws an imaginery line to the tower site. As this line intersects the grid lines it calculates from the heights of the two nearest grid points the height at the intersection and whether or not it is an obstruction to the view.

The angle of the depression (O) is calculated to the top of the obstruction (Y) using the equation TAN O = $\frac{XY}{AX}$. From this the height above sea level of point (C) is calculated from angle ? in triangle ABC. If the height of this point (C) is greater than the elevation of the grid fount, the difference is the distance below line of sight. If it is lower than the grid height, the point is in direct view.

The programme is designed so that the print out shows in coded form, the maximum distances below the line of sight for each co-ordinate. A separate series of printouts are produced for each tower height. In order to facilitate decisions on optimum tower siting the printouts simply show those areas with distances below the line of sight greater than 20, 30 and 50 feet.

The extraction of the 2,601 spot heights and preparation of the computer code sheets takes about 3 days. It took about 2 days to make the overlay maps for the 3 different tower heights.

CONCLUSION

The seen area maps produced by this method have been reasonably comparable to the maps produced by eye from the temporary tower, but in some cases the visual estimate of the visible area 8 or 9 miles from the tower was indefinite in area and tended to be inaccurate in distance from the tower. Also by eye it is impossible to get any idea of how far below the line of sight an unseen area is. The computer program method also allows for the determination of optimum tower height for best results. However, it is felt that a combination of both methods provides the best method of checking for optimum tower siting. Both methods were successfully used to locate favourable sites and tower heights for two towers in the Kirup and Busselton division.

FIG. 1

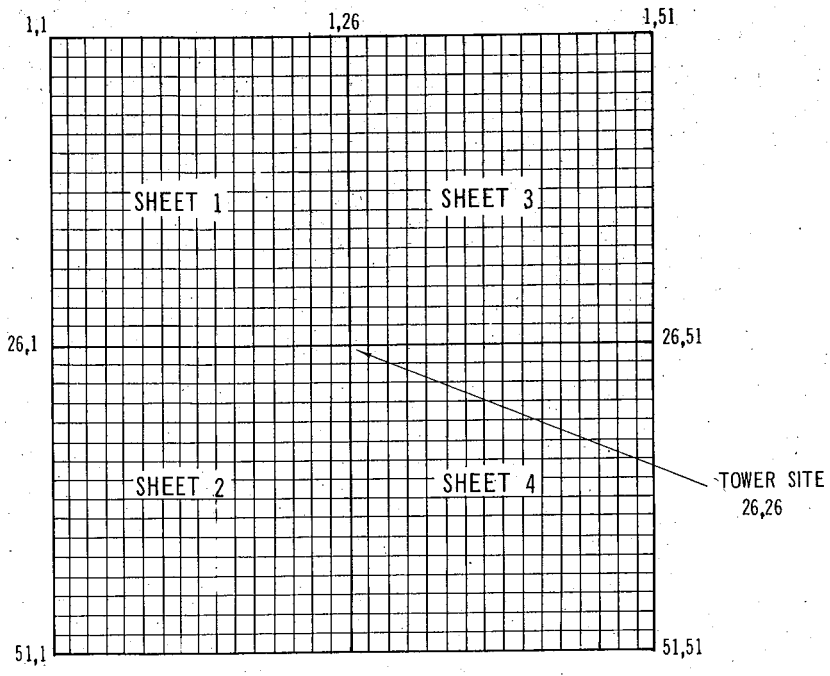

FIG. 2

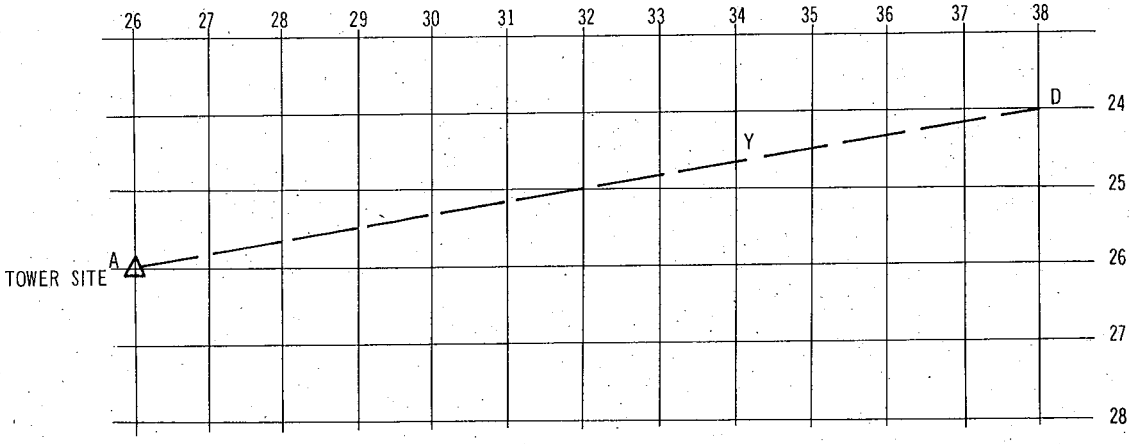

FIG. 3