A PLAIN MAN'S GUIDE TO MASTS & TOWERS

part 4

Loading

by A. S. Barraclough G3UDO *

So far we have looked at a number of factors related to selecting a suitable aerial mast or tower, such as the effect of height on aerial performance, losses in the feeder cable, aerial rotators, some aspects of getting planning permission and a selection of the various types of tower or mast that can be used for amateur radio aerials.

Well, assuming that you have managed to convince the XYL/OM, the neighbours and the local planning officer of your need to erect a mast, we should have a look at some of the 'nitty gritties' that are essential when selecting and finally installing your mast or tower.

The most important of these is probably wind loading; that is, what size of aerial or how many can be safely installed on a mast or tower and in what sort of wind conditions.

When the wind acts on the surface of the aerial, rotator and the mast itself, it generates a force which depends on the speed of the wind. This force must be allowed for when selecting a mast or tower to carry a particular aerial.

Most aerial manufacturers specify wind loading, but these may not be true values because sometimes they contain safety margins. This can sometimes lead to the selection of a rotator or tower that is too large, and more expensive, than it needs to be. It is quite a simple matter to calculate the wind loads on an aerial and it is worth doing as a check — if nothing else.

Horizontal aerials

The first thing then, is to work out the maximum surface area of the aerial. This is not the same as the area of the aerial viewed from the side or the end. To find the maximum area, area A, of a typical horizontally polarised aerial such as the Yagi shown in **Fig. 1** the first thing to do is find the area of the aerial as viewed from the end, area C; and from the side, area B.

Area B is the area of the boom (**Fig. 1**) which is found by multiplying its length L1 by its diameter D1. The ends of the element can be ignored unless there are traps fitted. In this case find the area of a circle equal to the diameter of the trap, multiply by the number of traps, and add this figure to the area of the boom.

Area C is the average area of a single element, including traps if fitted, as viewed from the end multiplied by the number of elements in the aerial. If the driven element is a folded dipole it counts as two. The average area of a single element is found by multiplying the average length of the element L2 by the diameter D2. The average length of element L2 $= \frac{L_1 + L_s}{2}$ (**Fig. 1**).

Fig. 2 shows a right-angled triangle whose sides AB and AC are drawn to represent areas C and B. The side BC then represents the maximum area A. This can be obtained by using Pythagoras (that Greek chap — remember?) Thus:

Area A = (area C)^2 + (area B)^2.

Alternatively, if you can draw the triangle to some suitable scale that represents area B and C, then a close approximation of area A can be got simply by measuring the side (hypotenuse) BC. So far all the areas have been worked out as if they were flat plates of equivalent size set at right angles to the air flow. However,

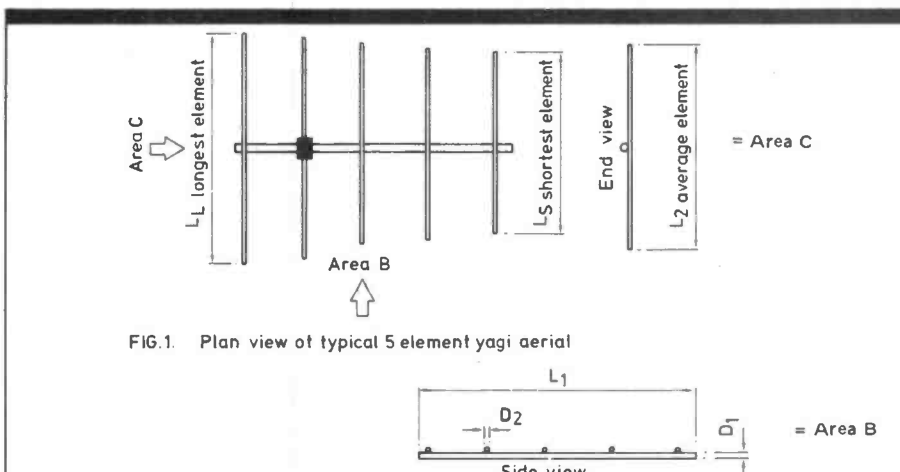

FIG.1. Plan view of typical 5 element yagi aerial

* Allweld Engineering