*Discussion on Paper No. 6617**

Structural analysis of guyed masts

by

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and

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Mr A. E. Goldstein (Partner, A. S. Joffe & Partners, Consulting Engineers) wrote that the Paper described a most useful and sophisticated programme. However, some points were not quite clear.

46. Did the expression for the flexural rigidity include a term for the shear stiffness of the truss? Since buckling was included, this effect could appreciably reduce the stiffness and increase buckling stresses;

47. Did the output give the amplified deflexion at the centre of each span in order that the design moments at mid-span could be calculated?

48. § 38 did not appear to be quite correct. Cohen and Perrin[2] gave figures for lift and drag on a cylindrical (guy) member which when translated to normal pressure gave results very nearly equal to $\sin^3 \phi$. (See Table 1.)

TABLE 1

Angle of incidence	Drag (from curves)	Lift (from curves)	Normal Pressure	Tangential Pressure	$\sin^3 \phi$
0	0·036	0	0	0	0
10	0·052	0·036	0·0083	0·004	0·0052
20	0·108	0·156	0·051	0·013	0·040
30	0·200	0·268	0·133	0·016	0·125
40	0·360	0·360	0·260	0·024	0·254
50	0·584	0·432	0·444	0·028	0·448
60	0·796	0·424	0·625	0·021	0·650
70	1·036	0·320	0·815	0·040	0·832
80	1·200	0·172	0·955	0·031	0·955
90	1·248	0	1·000	0	1·000

This expression seemed logical on physical grounds since the normal pressure was proportional to the square of the normal velocity component and also proportional to the number of air particles incident upon the guy. The net result would be to reduce the stiffness of the guys and increase deflexions. However, forces in the guys would not be much affected.

49. Since ice loading on the guys was considered for some cases, was a term for temperature included in formula for guy stiffness? This, of course, could easily be allowed for by adjusting the value of T_e.

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* Proc. Instn civ. Engrs, vol. 24, March 1963, pp. 373–386.

50. If the slope of the mast were appreciable the self weight of the mast would somewhat increase the guy tensions. Was this allowed for?

51. How many guys could be allowed for in the analysis?

52. Was it possible to make any allowance for the calculation of torsion in the mast due to eccentric wind loading?

53. It would be of considerable interest if the Authors could give some indication of the time required for a 1000-ft mast with five sets of stays.

The Authors, in reply, remarked that they would deal with the points raised in sequence.

55. Conventional beam-column theory was used for the mast, no allowance being made for shear deformation in the truss. Modern masts were very flexible and it was reasonable to neglect shear deflexion by comparison with flexural deflexions.

56. After completion of each analysis, the programme computed bending moments and stresses at any required point in a mast section by using exact beam-column formula (i.e. the magnification effect due to axial thrust was included).

57. In adapting a $\sin^2 \phi$ law for normal pressure on a cable, the Authors made use of an existing formula. From the analytical standpoint there was no reason why other laws should not be used. Indeed, as more precise wind data became available, it was desirable to make use of it. The general nature of the analysis allowed this to be done very conveniently.

58. Temperature effects had not been considered in the formulae; however, as Mr Goldstein had observed, these were easily allowed for.

59. The influence of mast self weight was implicitly accounted for in the stability functions, appearing in the form of a reduction in the effective stiffness of the mast sections.

60. Ten guys per staying point could be considered in the computer programme, with a maximum of 12 staying points.

61. Allowance for torsion and axial strain of the mast could be included at the expense of introducing two extra degrees of freedom at each staying point. This increased the size of the matrix to be inverted, and, since these effects were felt to have negligible influence on the behaviour of a normal mast, they were omitted.

62. EDSAC 2 took about one minute per loading case to analyse a typical 1000-ft mast. This assumed four iterations, which were normally sufficient to produce the accuracy required.