Technical Bulletin 00/16

Masts and Towers – standard nomenclature guidance to the identification and referencing of key elements of mast and tower structures

The contents of this Technical Bulletin are Advisory. The Bulletin is intended for use by Project Sponsors, Property Managers (PROMs), Establishment Works Consultants (EWCs), Works Services Managers (WSMs), Project Managers and Consultants engaged in the appraisal and inspection of Mast and Tower structures.

Note: This Technical Bulletin (TB) is a reissue of TB 95/20 under a new issue number only. The contents of the TB have not been updated for this reissue, but will be reviewed in due course.

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INTRODUCTION

1. This Technical Bulletin explains the DE Standard Nomenclature System for the referencing and naming of key locations and parts of a Mast or Tower.

2. The contents of the Bulletin are advisory and should not be interpreted as an instruction to carry out any works.

3. Works undertaken on a Mast or Tower will almost certainly require specific locations on the structure to be referenced. Without a common system this can be difficult and inefficient to achieve and therefore the potential for confusion and possible error exists.

4. There is no universally adopted Masts and Towers nomenclature system. Various organisations have, to differing degrees, adopted their own systems which they use on a unilateral basis.

5. This Bulletin describes the DE System recommended for use within MOD. It is recommended that the system is automatically adopted for all new structures and introduced into existing structures by Property Managers on an opportunity basis, ie at the next maintenance inspection or appraisal.

DESCRIPTION OF MAST AND TOWER TYPES

6. To assist with the definitions of the structures covered by this Bulletin, set out below are the category types of masts and towers and their descriptions to aid with their identification.

7. Self Supporting Steel Towers. Structures which can be grouped under this description are all free-standing having all structural members made from steel. They will not be reliant on any external struts or ties for their support. Refer to Fig 1.1.

8. The steel members may be made from standard or fabricated sections of any type, including circular hollow tube, hot rolled open sections and circular solid sections.

Fig 1.1 A typical self supporting steel tower
9. Steel towers are built to suit the requirements of the duty to be performed but the majority of structures are either square or triangular in plan, using four or three main legs respectively. Where the structure is triangular in plan the use of circular leg sections is most common.

10. In elevation a wide variety of shapes are employed to suit the circumstances, parallel sided, straight tapered and eiffelised.

11. These structures will be used to support equipment of all types, such as microwave dishes, floodlights, radar installations, sirens, UHF and VHF aerials. Their heights will vary from say 2 or 3 metres where they are used as mounting supports fitted to the roofs of buildings, up to 150 metres founded at ground level, with the majority falling into the range of 15 to 50 metres.

12. Self Supporting Timber Towers. The majority of this group of structures were built circa 1930/1940s. The structural members of these towers were made entirely in timber using galvanised steel bolts and leg splice angles or plates at the joints. All timber towers are self supporting and do not rely on any external struts or ties as part of the support mechanism. An illustration of such tower is given in Fig 1.2.

13. Due to the nature of the material, timber is cut into square or rectangular sections. The sectional shape does not lend itself to connections other than at right angles; Hence there are no triangular timber towers; all are square in plan.

14. The majority of timber towers are straight sided and tapered, but there are a very few structures which are eiffelised in elevation.

15. Timber towers have been constructed to heights of up to 73 metres, but the majority of structures are between 15 to 40 metres.

16. Self Supporting Hybrid Steel and Timber Towers. To all outward appearance this relatively new group of structures looks little different to other towers. The timber section of the tower usually forms the upper third of the structure, where Tx and Rx antennas are fitted. Access ladders and platforms within the timber section are also constructed using non metallic materials wherever possible.

17. This hybrid tower has evolved as an economical solution to the requirement of the Equipment Sponsor to only have non conductive materials adjacent to the antenna equipment.

18. Guyed Masts and Poles. All of these structures consist of a vertical mast or pole element, held in place with guy or stay wires.

19. The base is normally pinned. The vertical element may be formed using steel or aluminium lattice construction, usually incorporating climbing rungs integral with the structure or as a tube with bosuns chair access. These types are referred to as guyed masts. Refer to Fig 1.3.
20. The plan section of lattice masts can be either triangular or square, with the former being most common.

21. Guyed poles are formed using a vertical element constructed in steel, aluminium, glass reinforced plastic (GRP) circular hollow section, or solid timber (telegraph poles). The poles are usually pinned except for the solid timber which is cast in at the base or in a tabernacle and sometimes steadied using stays. A typical guyed pole is illustrated in Fig. 1.4

22. The most distinguishing features of this group are the guys, or stays, which are attached to the mast, or pole, and anchored at their lower ends to discrete foundations. The configuration of the guys will be determined by the design of the structure, but the most common plan arrangement is to provide three equally spaced sets of guy lanes, although some arrangements provide four sets.

23. Principally guys are constructed from the following:
   - Galvanised steel
   - Plastic impregnated steel
   - Stainless steel
   - 'Parafil' (or similar)
   - Prestretched Polypropylene

24. Termination of the guy ropes at the lower end will include a length variation mechanism to allow tensions to be adjusted from time to time. This is usually a turnbuckle with a length of chain for coarse adjustment.

25. At ground level, the anchors on which the guys are terminated are usually constructed in concrete. Climbing access up the mast can be built into the lattice framework. Access up poles is often by a bosuns chair attached through a pulley block mounted at the mast head.
26. The guyed masts in the MOD Estate usually do not exceed 50 metres tall, but there are a small number which are up to 274 metres tall. This guide is intended to incorporate the procedures to be adopted for all guyed masts up to 150 metres. Taller masts should be taken as a special case.

STANDARD NOMENCLATURE FOR MASTS AND TOWERS

27. The following guidance notes describe the general rules for establishing a standard nomenclature system for numbering/lettering the main elements of Masts and Towers. Specific examples are given and included in diagrammatic form.

28. **General.** Where given, directions are relevant to the plan viewed from the top.

29. Legs are designated by letters A, B or C for triangular structures and A, B, C or D for square structures.

30. Faces are designated by a number 1, 2 or 3 for triangular towers and 1, 2, 3 or 4 for square towers. Face 1 is the face between legs A and B and face 2 between legs B and C etc.

31. **Towers** Where the designated route of access is a leg (step bolts or ladder attached central to the leg and external to the tower), the leg is designated "leg A". See Fig 1.6.
32. Where the designated route of access is away from a leg "leg A" is determined as follows:

a. For towers with external access the climber stands facing the designated method of access as if to climb. The leg to his right is "leg A". See Fig 1.7

![Fig 1.7 External access systems](image)

b. For towers with internal access, the climber stands facing the access route as if to climb. He then, whilst still facing the access route, moves back until he is standing immediately outside the tower. The leg to his right is "leg A" unless there is then a leg immediately in front of him, in which case that is leg A. See Fig 1.8.

33. Typical configurations of internal and external mounted access systems for square and triangular towers are shown in Figs 1.6, 1.7 and 1.8.

![Fig 1.8 Internal access systems](image)
34. Towers are commonly constructed in panels. An elevation of a typical tower showing panel numbering is shown in Fig 1.9.

Fig 1.9 Elevation Typical Tower (Panel numbering indicative only)
35. **Masts.** Leg and face designations for masts follow the same rules as for towers.

36. Guys shall be designated by lane and level. Guy terminations shall be termed upper (U) and lower (L) and where there are intermediate terminations or insulators they shall be numbered from the ground up numerically.

37. Guy lanes shall be designated by a letter based upon the leg to which they are attached, i.e. Guy lane A is attached to "leg A". Where a guy is attached to the face of a mast, the guy takes the designation of the leg to its right. See Fig 1.10.

38. Site plans should show the bearing of Guy lane A, in degrees East of Magnetic North (EMN).

Fig 1.10  Guy lane designations
39. Where there is no designated access system, e.g. on a cylindrical mast, the following approach is to be adopted, see Fig 1.11:

   a. If one stay lane performs a dominant "backstay" function i.e. it directly opposes one or more directional antenna take-off loads, then this lane shall be defined as "lane A".

   b. If a. above is not applicable and there is a lane with special or additional anchorage for lowering the structure, then this lane shall be defined as "lane A".

   c. If neither a. nor b. is applicable, lane designation may be selected appropriate to the site.

40. Guy levels are numbered sequentially from the ground upwards with the lowest guy take-off point being "level 1", see Fig 1.12.

41. The complete designation for a guy includes lane and level as follows:
    GUY : LANE B : LEVEL 1 (B1)

42. Anchor blocks shall be designated by a lane and "anchor" position.

43. Anchor blocks are numbered numerically radiating outwards from the mast base as illustrated in Fig 1.12.

44. The complete designation for an anchor block includes the lane letter and anchor number as follows:
    ANCHOR : LANE C : ANCHOR 2 (C2)
45. In some instances a dual guy system may be encountered at various levels. The two guy wires are identified by standing at the back of the anchor position (looking at the mast) and designating the left hand side (LHS) and right hand side (RHS).

46. The complete designation for dual guys includes lane, level and side as follows:
   GUY : LANE C : LEVEL 4 RHS

47. **Antenna Blocks.** Anchor blocks provided solely for backstays for antennas supplementary to the primary stays shall be numbered as "antenna block" and numbered sequentially starting from A.

48. Top antenna radial elements performing a dual structural and operational role use lane designation A,B,C etc. Lane A being coincident or next clockwise position from lane A stays below (where applicable). See Fig 1.13

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Fig 1.13 Plan View of dual guy Designation

Fig 1.13 See note 48
CONCLUSION

49. The majority of mast and tower structures found on the MOD estate will be able to have their key elements identified by using the standard nomenclature system explained and depicted above.

50. There will be instances where the structure and its associated elements will differ from those shown in this Technical Bulletin. If a standard nomenclature cannot be designated for the structure, then further assistance can be sought from the subject contact point as given at the front of this TB.

RECOMMENDATIONS

51. Once the agreed nomenclature for any one structure has been established it should be clearly indicated on the structure and recorded in the property file.

52. Markings on the structures should be as follows:

53. **Masts.** All designated guy anchors should be identified by marking the upper surface of the concrete anchor with black paint using a stencil with a minimum letter height of 150mm.

   The stencil should be positioned so that the marking may be read easily when walking around the anchor position. See Fig 1.14.

54. Designated anchor block positions should also be marked in a similar fashion adjacent to or under the lane/anchor marking (see note 39 and 40).

55. Where masts have no visible anchor blocks (buried dead man anchor) the designated guy lane and position should be identified by securely attaching a suitable label to the guy terminations and marking the designation with an indelible marker.

Fig 1.14 Guy anchor marking
56. **Steel Towers.** All designated legs should be identified by marking the leg section surface with black paint via a stencil.

The size of stencil to use will be dependent on the size and type of leg to be marked. Position of the marking should be approximately 1.5m above ground level and should face outward on the tower face.

57. **Timber Towers.** Painting of timber sections is not advisable. The designated leg should be marked via a brass plate/letter secured with 50mm long brass screws. If vandalism and theft is considered to be a problem the position of any brass letters should be at a minimum height of 2.5m above ground level. The letters should face outwards from the tower face.

55. Records in the property files are recommended to be in the form of a line diagram drawing. Example drawings for a mast and a tower are shown in Figs 1.15 and 1.16 respectively.

**Bulletin Authorised By:-**

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NOTES:
1: Materials:-
Sizes and grades where known.

2: Bolts and Connection Details:-
Typical joint details
SS or DS

3: Protective System:-
Galvanising, P/T paint,
corrosion, bituminous point

Fig 1.15 Typical tower line diagram
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Fig 1.16 Typical mast line diagram

NOTES:
1: Materials:
Sizes and grades where known.
2: Bolts and Connection Details:
Typical joint details SS or BS
3: Protective System:
Galvanising, M/O paint, creosote, bituminous paint, etc.
4: Equipment Schedule Reference:

Member sizes, joint details, rest platforms and access system to be indicated on the elevation.