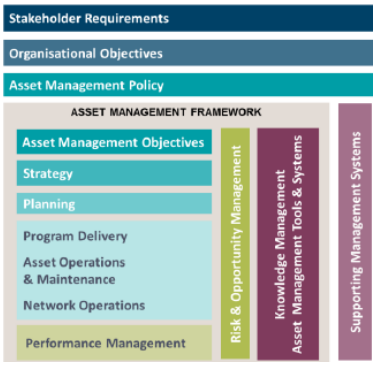
Telecommunications Structures

Design Standard (Technical Specification)



DOCUMENT HIERARCHY

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DOCUMENT CONTROL

Record of endorsement, approval, stakeholders, and notification list is provided in EDM# 45859083 appendix

RESPONSIBILITIES

Western Power's Engineering & Design Function is responsible for this document

CONTACT

Western Power welcomes your comments, questions, and feedback on this document, which can be emailed to standards.excellence@westernpower.com.au

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Revision Details

Version	Date	Summary of change	Section
0	5/4/2024	Initial release	
1	Xx/xx/xxxx		

1 Introduction

1.1 Purpose and Scope

This document provides the technical specification and design requirements for the design of telecommunications structures, which includes monopoles, self-supporting towers, and guyed masts.

2 Standard of Work

All work undertaken for Western Power shall comply with the relevant Statutory Codes and Regulations, Mandatory Codes and Standards, and the referenced Australian Standards listed below.

Standard	Description
AS 1170:2-2011	Structural design actions
AS 3995:1994	Design of steel lattice towers and masts
AS 4100:2020	Steel structures
AS 4676:2000	Structural design requirements for utility services poles
AS 4677:2010	Steel utility services poles
AS 3600:2018 (Amd. 2021)	Concrete structures
AS / ACIF S009:2020	Installation requirements for customer cabling (Wiring Rules)
AS 1269:2005	Occupational noise management
AS 1768:2007	Lightning Protection
AS 3000:2018	Electrical installations (known as the Australian / New Zealand Wiring Rules)
AS 1891:2020 (Amd. 2:2021)	Fall arrest systems
AS 1559:2018 (Amd 2:2021)	Hot-dip galvanized steel bolts with associated washers for tower construction
AS 2312:2014	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings.

3 Safety

All work undertaken for Western Power shall comply with the relevant Safe Work Australia Code of Practices.

Code of Practice
Code of Practice - Safe Design of Structures (October 2018)

4 Design Parameters of Structures

4.1 Wind Loading

All antenna support structures shall be designed with the following parameters:

- Design working life of 50 years
- Importance Level 4 as per AS1170, unless stated otherwise in the request for quotation.

Design parameters including wind region, terrain category and topographic multiplier shall be determined by the Contractor and supplied to Western Power with the Request for Quotation as detailed in the Scope of Work.

4.2 Serviceability requirements

All antenna support structures shall be designed to meet the following serviceability requirement:

- At a wind velocity of 27 m/s, the maximum angular rotation and vertical deflection shall not exceed 1.0 degrees.

4.3 Foundations

The Contractor shall design the foundations to suit the soil conditions and any physical restrictions for each installation.

- Foundations shall be designed for ultimate strength and serviceability limit states in accordance with the relevant Australian Standard AS1170, AS3600, & AS3995.
- Base plate and anchor bolts/plates shall be designed as per AS3600 and AS4100
- Design for flood level for a 1 in 100 years flood event

A site-specific Geotechnical investigation report shall be supplied by Western Power with the Request for Quotation as detailed in the Scope of Work.

4.4 Fatigue

The structure and its component members and connections shall satisfy the design requirement for fatigue in accordance with AS4100.

4.5 Antenna Loading

The antenna loading requirement shall be supplied to the Contractor with the Request for Quotation as detailed in the Scope of Work.

4.6 Facilities

All antenna support structures shall be designed with the following facilities:

4.6.1 Lightning protection

A vertical air terminal (finial) at the highest point of the structure complying with AS1768.

Suitable earthing point/s at the base of the structure for connection to a site earth system with a minimum of two separate earth points for poles and masts and one on each leg of towers. Holes shall be 14mm diameter.

4.6.2 Feeder cable hanger brackets

Feeder cable hanger brackets with the following specifications:

- spaced at a maximum of 0.8m centres;
- with a minimum of ten 19mm diameter holes at 45mm centres;
- lowest bracket fitted no lower than 2.4 meters above ground level; and
- continuous to the top of the structure.

4.6.3 Climbing facilities

As applicable;

- Poles shall be fitted with step bolts as specified below:
  - 400mm maximum spacing vertical;
  - 610mm maximum spacing horizontal;
  - uniform spacing over the length;
  - 16mm minimum diameter bolts;
  - 110mm minimum clear length; and
  - comply with AS1559
- Towers shall be fitted with an integrated fixed ladder system as specified below:
  - 400mm maximum spacing between rungs; and
  - Comply with AS1657
  - Comply with AS3995 – Angle of slope of rung ladders should not be less than 70 degrees (forward incline) to the horizontal

All antenna support structures shall be fitted with a fall arrest system complying with AS1891. It is encouraged to consider resistant to corrosive effects over time and ease of the inspection of attachment points prior to use as part of the design for the fall arrest system.

A maintenance guideline shall be provided to allow condition assessment of the fall arrest system by a qualified rigger.

The attachment point for the fall arrest system to the structure shall be suitable rated for the intended purpose and shall be fitted with a compliance plate.

4.6.4 Anti-climb

Anti-climb should be considered for all structures based on appropriate risk assessment. At a minimum anti-climb controls should be in place to restrict access to the fixed climbing facilities outlined above for un-authorized persons.

4.6.5 Antenna mounts

Antenna mount requirements are site specific and shall be specified by Western Power in the Request for Quotation as detailed in the Scope of Work.

The antenna mount shall be suitably rated for the intended load.

The antenna mount shall also be suitably rated for use as a winch point for lifting the intended antenna.

5 Surface Treatment

All surface of the structure shall be hot dip galvanised.

If painting is required, the required finish colour of the structure shall be specified by Western Power in the Request for Quotation as detailed in the Scope of Work.

6 Earthing

The specific site earth details shall be supplied by Western Power with the Request for Quotation as detailed in the Scope of Work.

Earthing shall comply with AS3000, AS3015 and AS1768

Underground earthing conductors shall be 70mm^2 annealed stranded copper conductor (ASC) buried 300mm below ground level.

Underground joints shall be made using one of the following copper connections:

[1st choice] Crimp joint (GroundLok)

[2nd choice] Crimp joint (2 x Burndy C-crimps)

Standard earth electrodes/rods shall be stainless steel, 15mm in diameter and 3m in length.

Deep earth electrodes/rods shall be stainless steel, 15mm in diameter and 20m in length.

Earth electrodes/rods and inspection pits shall not protrude above ground level.

All metallic above ground structures shall be directly connected to the earthing system with a minimum of two lengths of 120mm2 ASC conductor with black PVC insulation.

Metal fences shall be earthed at every second support post, each corner post and each gate post using a UN6 standard medium duty 2-piece pipe clamp.

The connection of the conductor to the above ground structure shall be made using a standard single hole M12 tinned copper cable lug and a M12 stainless steel bolt and nut.

Mast and Monopole Structures shall have a minimum of one earth rod, while Self Supporting Towers shall have one a minimum of one rod for each structure leg.

The maximum allowed impedance of the earthing system – excluding Substation sites shall be 10 Ohms. The maximum allowed Substation site impedance value will be detailed in the Scope of Work.

7 Cable Support Structures and Gland Plates

All cable ladder, support poles and fixings shall be galvanised steel.

Cable ladders shall be 450mm wide NEMA 12B or similar.

All cable ladder and support poles must be electrically continuous and bonded to the site earthing system. Bonds shall be by insulated 70mm2 stranded copper conductors with black PVC insulation.

8 Design calculations and drawings

The structural design calculations shall be carried out or checked by a Chartered Professional Engineer (CPEng) as recognised by Engineers Australia or equivalent. All calculations and drawings shall be signed by the structural engineer and submitted to Western Power's Representative for review. Any necessary revisions shall be similarly submitted.

The calculations shall establish the adequacy of all structural elements and the structure as a whole including all necessary components, connections, and foundations to meet the design criteria.

Calculations shall clearly indicate the sources of formulae and assumptions used and shall demonstrate to the satisfaction of Western Power's Representative that each part of the structure and foundations will not exceed ultimate stresses and deflections under the most adverse load combination. Deflection from applied load, temperature and other reasonable causes shall not cause any damage to the individual members, components, fittings, connections and finishes to the structure.

The Contractor shall note that any review or approval by Western Power's Representative of structural calculations and drawings shall not absolve the Contractor from full responsibility for complete and satisfactory design, documentation, fabrication, and construction.

The Contractor shall allow three (3) weeks for Western Power's Representative to review the first issue, and major revisions, of all design documents and a further 1 week for any review of minor revisions.

8.1 Design Deliverables

The following Design Deliverables shall be provided for review:

i) (Optional) 3D model in SPACE GASS or PLS CAD format

ii) Foundation design calculations with sketches

iii) Connection drawings and calculations

iv) Base Plate calculations

v) Detailed design drawings showing

   A) all dimensions,

   B) bolts and hole sizes,

   C) steel grades,

   D) and bolt and nut grades

vi) Foundation details including

   A) Foundation dimensions

   B) Rebar cage detail

   C) Concrete cover

   D) Concrete grade

9 Documentation

The Contractor shall supply the following documentation:

9.1 Prior to Fabrication

- Inspection Test Plans (ITP's) for Fabrication

9.2 Prior to Construction

- Steel Mill Certificate
- Welding Certificate
- Galvanising Certificate

9.3 As Built Documentation

- Structural Design Certificate
- Foundation design drawings showing
  - Foundation dimensions
  - Rebar cage detail
  - Concrete cover
  - Concrete grade
- Structure detailed design drawings
  - all dimensions,
  - bolts and hole sizes,
  - steel grades,
  - and bolt and nut grades
- Antenna mount design drawings
- Site Earthing Report
- Fall Arrest system maintenance guideline
- Structure Loading/Analysis Report
- Guy wire tensions (if applicable)
  - Foundation design calculations with sketches
  - Connection drawings and calculations
  - Base Plate calculations