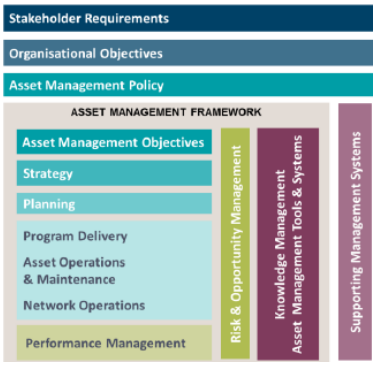
Substation Buildings

Design Standard



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RESPONSIBILITIES

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

CONTACT

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Contents

Revision Details

Version	Date	EDM Version	Description
0	November 2017		First issue
1	May 2023		Changed to AMS format and completed a full review
2	February 2024		Standard Online Update

1. Introduction

This Engineering Design Instruction (EDI) outlines the general requirements for various architectural and structural engineering aspects to be considered and included in the design of Switchroom and Relay Room buildings.

1.1. Purpose and Scope

This EDI applies to Switchroom buildings accommodating the MV switchboards and Relay Room buildings accommodating protection panels and batteries in all greenfield substations, as well as new switchboards and relay panels installation in major brownfield projects.

The scope of this Engineering Design Instruction is limited to prefabricated concrete wall panel and transportable buildings, which are commonly used at substations.

1.2. Acronyms

Acronym	Definition

1.3. Definitions

Terms and definitions used in this document

Term	Definition
ACM	Asbestos Containing Material
AEP	Annual Exceedance Probability
AS	Australian Standard
BAL	Bushfire Attack Level
EDI	Engineering Design Instruction, describes in detail a particular type of design. This is the “how” to implement a design with clear boundaries defined
EDM	Enterprise Document Management
FRP	Fibre Reinforced Plastic
FRL	Fire Resistance Level as defined in the National Construction Code (NCC)
GPO	General Purpose Outlet
HMR	Hazard Management Register
HV	High Voltage
NCC	National Construction Code of Australia
OAP	Operational Asset Performance – Transmission Area

RRST	Rapid Response Standby Transformer
SiD	Safety in Design
SEQT	Safety Environment Quality and Training
SFAIRP	So Far As Is Reasonably Practicable
VESDA	Very Early Smoke Detection Apparatus
VRLA	Valve Regulated Lead Acid

1.4. References

References which support implementation of this document

Table 1.1 References

Reference No.	Title

2. Supporting Documentation[1]

3. Compliance[2]

This EDI complies with the latest revision of higher- level Western Power technical documentation such as Network Standards and Functional Specification.

This Engineering Design Instruction should encompass all requirements of the relevant Australian Standards which are current at the time of issue. These relevant Australian Standards are listed in Table 3.1 below. A period will be set when the standard needs to be reviewed. If significant changes occur on an Australian Standard which affects safety, then an out of cycle review can be completed.

Table 3.1: Standards and Guidelines

Standard Number	Standard Title
AS 1170	Structural Design Actions, Parts 0-4
AS 1163	Structural Steel Hollow Sections
AS 1214	Hot-dip Galvanised coatings on threaded fasteners (ISO metric coarse thread series)
AS 1252	High Strength Steel Bolts with Associated Nuts and Washers for Structural Engineering
AS 1554	Structural steel welding
AS 1597	Precast reinforced concrete box culverts

[1] See Western Power Internal Document
[2] See Western Power Internal Document

Standard Number	Standard Title
AS 1657	Fixed platforms, walkways, stairways, and ladders- design, construction, and installation
AS 2067	Substations and high voltage installations exceeding 1 kV a.c.
AS 2159	Piling design and installation
AS 2312	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS/NZS 3000	Electrical installations
AS/NZS 3500	Plumbing and drainage, Parts 0-4
AS 3600	Concrete structures
AS 3610	Formwork for concrete
AS 3678	Structural Steel – Hot rolled plates, floor plates and slabs
AS 3679	Structural Steel – Hot rolled bars and sections
AS 3735	Concrete structures for retaining liquids
AS 3745	Planning for emergencies in facilities
AS 3850	Prefabricated concrete elements, Parts 1-3
AS 3959	Construction of buildings in bushfire-prone areas
AS 3996	Access covers and grates
AS 3999	Bulk thermal insulation - Installation
AS 4100	Steel Structures
AS 4291	Mechanical properties of fasteners made of carbon steel and alloy
AS 4586	Slip resistance classification for new pedestrian surface
AS 4600	Cold-formed steel structures
AS 4671	Steel reinforcing materials
AS 4678	Earth-retaining structures
AS/NZS 4859	Material for thermal insulation of buildings-General criteria and technical provisions
	CODE OF PRACTICE – Excavation
	CODE OF PRACTICE – Managing the risk of falls at workplaces
	CODE OF PRACTICE – Safe design of structures
	National Construction Code
	National Code of Practice for Precast, Tilt-up and Concrete Elements in Building Construction

4. Functional Requirements

This Engineering Design Instruction is intended to be used by Substation Engineering staff and by companies completing outsourced design work for Western Power, as it outlines the Western Power requirements pertaining to building design for transmission substations.

5. Safety in Design[3]

The Safety in Design (SiD) process shall be adhered to in all design processes for designing the substation buildings. Any potential risks that may cause harm, affect the operation and maintenance of assets, or impact the environment or construction activities shall be identified during the design stages.

All projects are required to have a SiD Hazard Management Register (HMR) and these risks shall be registered in the HMR and eliminated or minimised so far as is reasonably practicable (SFAIRP).

6. Overview of the Main Design Elements

The following elements shall be considered when designing a substation building:

- Safety-in-Design – Section 5
- Architectural design – Section 8
- Structural design – Section 9
- Fire resistance – Section 10
- Building services – Section 11

7. General Requirements

7.1. General[4]

The designer shall consider the following for designing substation buildings:

- Local government approval

  The designer shall provide information such as building construction material, size, height, and elevation drawings to seek all relevant permits and approval.

- Building template drawings

  The designer shall read the building template drawings alongside this design instruction. The template drawings shall be the base of any project-specific building design.

- Concrete or transportable building

  The type of building construction shall be decided before the detailed design.

  The following shall be considered in choosing the building type:

  a. Project location (remoteness)
  b. Aesthetics
  c. Durability
  d. Commissioning and testing
  e. Transport and delivery

[3] See Western Power Internal Document
[4] See Western Power Internal Document

f. Cost

g. Project schedule

Refer to Technical Specification - Transmission Substation Transportable building for the design, fabrication, transport, and delivery requirements of a transportable building.

- Energy efficiency

  The building shall have a minimum R-value of 5.1 for the ceiling/roof and 2.8 for the external walls of the transportable.

- Switchboard arc venting

  The switchboard arc venting shall be towards the substation, away from public spaces. The external lights, A/C units, doors, and roof access shall clear the arc vents for safe access. Refer to the Technical Position Paper on MV switchboard arc venting.

- The Switchroom/Relay Room shall be sized for the ultimate arrangement. Refer to the EDI – Substation Layout.

7.2. Site investigation[5]

Site investigations including, but not limited to, hydrology, geotechnics, topography, contamination, bush fire threat, traffic and access, existing underground services, and overhead lines shall be carried out before building design.

The upper Switchroom/Relay Room floor level shall be a minimum of 300mm above finished site level.

In cases where the existing substation finished site level is at or below groundwater table, the upper Switchroom/Relay Room floor level shall be a minimum of 300mm above groundwater table.

Refer to EDI-Substation Earthworks, Roads and Drainage for designing the site elevation.

Refer to Technical Specification-Transmission Substation Transportable Buildings for transportable building floor level.

7.3. Building location[6]

The EDI -Substation Layout guides the positioning of buildings in a substation. In addition, the designer shall consider the following from civil design and construction points of view:

- Check that the building fits in the proposed location, considering that an extended excavation area may be required to construct the building foundation.
- Assess construction access, including the crane and truck access, to deliver and install the prefabricated concrete panels and transportable building.
- Check that switchboards, relay panels, and other electrical equipment can be delivered. The equipment access door should be close to the access road to allow the unloading of the switchboards onto the platform.
- Check the levels of the adjacent buildings, foundations, cable trenches, roads, retaining walls, fences, and transmission poles to avoid undermining. Where excavation undermines adjacent foundations,

[5] See Western Power Internal Document
[6] See Western Power Internal Document

the affected foundations shall be underpinned or protected by appropriate shoring solutions to eliminate the excavation risk.

- Location of underground services.
- Check safety clearances with specific consideration of nearby overhead lines. Refer to the Safety and Maintenance Clearances requirements.
- Check that overhead lines do not interfere with building installation and cranage of the prefabricated panels or transportable building.
- Fire separation between the Switchroom/Relay Room building and transformers.
- Check clearances and space where an RRST is adjacent to the building.

8. Architectural Design

8.1. Switchroom

8.1.1. Space requirements

The Switchroom shall house switchboards, primary cables and LV protection panels and shall be designed as a minimum according to the switchboard manufacturer drawings and include the following requirements:

- Adequate working space shall be provided around the switchboards such that there are:
  a. a minimum of 1.0m space at the back of the switchboards to the wall.
  b. a minimum of 1.0m space at either end of the switchboard to the adjacent wall.
  c. sufficient space in front of the switchboards to replace one board if required.
- A fire-rated separate compartment shall be provided for primary cables.
- The height of the Switchroom shall allow for a ceiling-mounted cable ladder over the switchboards with sufficient working space to run the secondary cable to the Relay Room.
- The equipment landing platforms shall be sized to have sufficient space for switchboard panel delivery without removing handrails.

8.1.2. Safe access/egress and working space

The room layout shall be designed to provide sufficient space for each compartment to ensure the installation, operation and maintenance of all switchboards and protection panels can be carried out safely, providing an unimpeded emergency safe escape path.

Equipment layout shall be such that, even when removable parts or doors are open, at least 600mm of space is maintained for egress.

No point on the floor must be more than 20 m from an exit.

Each compartment/area shall have at least two safe exits, diagonally opposite where possible, except for a compartment like a Relay Room less than 5.0 m long. Internal doors shall swing out towards the escape route.

Where there is a Switchroom cable basement, two individually separated accesses/exits to the switchyard shall be provided with a minimum height of 2.0m. Overhead cable ladders, structural beams, equipment, or ceiling-mounted services shall not reduce the egress path height.

The designer shall consider the following in designing the egress path:

- Positioning of the switchgear, relay panels and electrical equipment with doors open.

- Position of a transformer in the switchyard in relation to the exit path.
- Position of cable trays
- Position of cables in the basement
- Position of the access doors with respect to transformers (fire hazard)
- Section safety clearance

8.1.3. Switchroom cable basement[7]

The cable basement shall be designed as a non-confined space.

The basement shall have natural ventilation through fire-rated louvred openings on the walls or access doors.

The HV cables installed on the floor can be excluded from the required height subject to providing sufficient space to step over or between the HV cables.

The basement shall be water and vermin proofed by sealing all cable entries and construction joints.

All penetrations for HV cables through the basement walls must be sealed with an approved cable sealing system. Approved systems include Hauff Technik, Roxtec and Filoseal or equivalent products. The sealing system manufacturer must be consulted when the seals are selected to ensure they will be appropriate for the cables used. The type of seal must be specified in the design drawings.

All the cable entries shall be sealed according to Substation HV Power Cables and Terminations EDI.

The designer shall use a proper sealing system based on the following:

- Cables bedding details (direct buried or conduits)
- Size and quantity of the cables and conduits
- Cables and conduits' angle of the approach to the building

The designer can find the details of HV cable installation in the cable rating study report and substation cable layout.

8.2. Relay Room

8.2.1. Space requirements[8]

Relay Room building shall house protection, communication and SCADA equipment, batteries, battery chargers, AC and DC distribution boards, 415V AC and 110 DC change-over boards, air conditioner control panel and a working desk.

Equipment layout shall be such that, even when removable parts or doors are open, at least 600mm of space for egress is maintained.

The equipment landing platform shall be sized to have sufficient space for the largest equipment delivery without removing handrails.

VRLA batteries are only prone to hydrogen gas discharge in the event of over-charging or overheating. Therefore, the risk of excessive hydrogen build-up is considered low. On this basis, VRLA batteries can be

[7] See Western Power Internal Document
[8] See Western Power Internal Document

located in the Relay Room but provided that adequate design measures are implemented to ventilate any potential hydrogen gas discharges naturally.

AS 2676.2 shall be used to determine the minimum ventilation rates based on cell count and total installed voltage; a further 100% safety margin shall be considered in the sizing of the vents. All types of batteries, including but not limited to 110 V VRLA, 230 V, 50 V, 48 V communications, and 230 V security system batteries, shall be considered in the ventilation calculation.

Natural ventilation paths may allow airborne particles (dust, pollen, etc.) to enter the space; therefore, to limit the ingress of particulates, stainless filter mesh with an aperture of about 50µm to 60µm shall be used to intercept these particles. Allowance for the free area of the filter mesh shall be considered in the total required vent area.

A natural ventilation arrangement comprising no less than two outlet vents at a high level (fitted up to the underside of the ceiling) located on different walls to overcome the effect of the wind direction and one inlet vent at a low level (the bottom of the vent to be between 300mm to 500mm above the finished floor level) enable hydrogen gas to disperse naturally and leave the room.

Refer to EDI-DC SYSTEM for more information on VRLA battery functional requirements.

The relay Room shall have a separate unisex toilet and wash basin.

8.2.2. Safe egress and working space

Similar principles outlined in Section 8.1.2 for the Switchroom apply to the Relay Room.

8.2.3. Amenities

A separate room for a unisex toilet and wash basin shall be incorporated into the Relay Room layout considering the following:

- The toilet shall be accessible from outside of the Relay room and not be accessible from outside of the substation security fence for security purposes.
- Potable water shall be supplied from the Water Corporation water main or non-potable water from a plastic food-grade water tank with a minimum of 10000 litres capacity fed from the building roof with a pressure pump.
- A sewer connection to the Water Corporation sewer main complying with AS 3500.3 or a site septic system approved by the Local Government Authority Health Department shall be provided.
- A water tap shall be provided outside the Relay Room building toilet (inside the security fence) for maintenance.
- The toilet shall have natural ventilation.

8.3. Security

8.3.1. General requirements

The Switchroom/Relay Room building shall be secured to minimise the risk of unauthorised entry and designed to be intruder-resistant.

All building doors shall be secured against forced entry.

All ventilation louvres shall be secured with a grille installed inside the building.

8.3.2. External doors

The external doors shall be constructed of a minimum 50 mm thick solid core with metal clad and swing outwards.

All doors and hardware shall be sealed against weather ingress and fitted with panic bars and self-closing mechanisms except for the fixed leaf in double and amenity doors.

All door frames and jamb cavities shall be grouted with cement mortar.

Western Power keying system shall only be used for lockable door hardware.

8.3.3. Internal door

The internal doors shall be constructed of a minimum 50mm thick solid core with metal clad and fitted with an emergency panic bar.

Internal doors must not have locks.

More details for the internal and external doors and required hardware and furniture are provided on the template drawings.

8.4. Roofing

The roofing system consists of metal roof cladding, drainage, and ceiling.

The design of the roof sheeting shall comply with AS 1562.

8.4.1. Roof drainage

The roof sheeting shall have enough slope to prevent water ponding.

The roof drainage system shall be designed according to AS 3500.3 and consist of gutters, down pipes with sumps at the base and a proper stormwater drainage system. An ARI (Average Recurrence Interval) of 20 years with a five-minutes duration of rainfall intensity shall be used to design the roof drainage system. An ARI of 100 shall be used for box gutters.

Overflow pipes must be provided for the gutter system.

8.4.2. Roof access

An appropriate fall restraint system shall be designed to allow safe access to the roof for maintenance, complying with the CODE OF PRACTICE, Managing the risks of falls at workplaces and AS 1891 requirements.

The layout of the roof access and anchor points shall be provided on the design drawings.

8.5. Material

8.5.1. Material requirements

The construction materials shall align with the fire resistance requirements, design life and aesthetics specified by Western Power, NCC and Local Government.

8.5.2. Material limitation

All materials used for building construction shall be free from asbestos and ACM.

Timber and combustible materials shall not be used due to the risk of fire.

9. Structural Design[9]

Substation buildings can either be transportable buildings or prefabricated concrete wall panel buildings. This document covers the structural requirements for prefabricated concrete panel buildings.

The design requirements for the transportable buildings are covered in the Technical Specification- Transmission Substation Buildings.

9.1. General

The Switchroom/Relay Room building shall be designed of prefabricated concrete wall elements per AS 3850 and all other relevant Australian Standards.

The building design requires two different stages. The first stage shall be done by the designer who designs the building for in-service requirements. The second stage, the erection design, shall be done by the construction contractor.

9.1.1. In-Service Design

The designer shall design prefabricated concrete elements to withstand all applicable loads for their final position as part of the permanent structure. The following shall be considered:

- Prefabricated concrete wall panels are load-bearing elements supporting the roof and suspended slab and resisting soil pressure, wind, and earthquake loads.
- Roof bracing is required to transfer the lateral loads to the supporting cross walls.
- The limitations of the transport, lifting and erection on sizing the panels.
- Location of doors, arc ducts and any other openings in positioning the panel joints.
- Limiting the amount of the moment transfers into panels by using structural pin connections.

9.1.2. Erection Design

The Erection design includes, but not be limited to, the following:

- Temporary storage of the panels in the factory
- Lifting design and rigging configuration
- Strongbacks design, if required
- Transport
- Crane size and mobility
- Lifting layout, including the possible crane position, panel location and all site restrictions
- Safe work method statement
- Temporary bracing design and layout
- Construction sequence

[9] See Western Power Internal Document

The Construction Contractor shall provide the erection design following AS 3850 and the NATIONAL CODE OF PRACTICE FOR PRECAST, TILT-UP AND CONCRETE ELEMENTS IN BUILDING CONSTRUCTION for WP structural engineer's review.

9.2. Building stability

The building shall be designed such that it is not prone to progressive collapse following a fire. Structural redundancy, such as bracing, shall be incorporated into the structural system to ensure the building is robust enough.

All load paths shall be considered and determined before commencing the detailed design.

9.3. Loading criteria

Substation buildings shall be designed to withstand the applicable loads. This section provides guidelines for determining the appropriate loads and load combinations.

9.3.1. Design life of structural components

The design life in this document refers to the ability of the structural works to maintain functionality and operate safely and effectively. All substation buildings shall be designed to withstand all applicable loads to ensure the building achieves, at a minimum, the required design life.

Designers shall ensure that all structural components of the substation buildings have a design life of 50 years.

9.3.2. Importance level

All substation buildings shall be designed with an importance level of 4, following the relevant Australian Standards.

9.3.3. Annual probability of exceedance

- Ultimate limit states

  The annual probability of exceedance for wind and earthquake loads shall be 1/2500
- Serviceability limit states

  The annual probability of exceedance for the wind and earthquake loads shall be 1/500

9.3.4. Load types

Substation buildings shall be designed to withstand the following applicable loads per AS 1170 Parts 0 to 4:

9.3.4.1. Permanent loads

The permanent loads shall be calculated following AS/NZS 1170.1, including the self-weight of the structure, foundation and electrical equipment with all ancillaries and act as a vertical load.

9.3.4.2. Imposed loads

The imposed floor load shall be 10 kPa for Switchroom, 5 kPa Relay Room and 3 kPa for the cable basement.

The Switchroom floor shall be designed to the specific deflection limitation provided by the switchgear manufacturer.

9.3.4.3. Wind loads (W)

The wind load shall be calculated following AS/NZS 1170.2 based on the annual probability of exceedance provided in this document. The site wind speed shall be calculated per AS/NZS 1170.2, and parameters provided in Table 9.1.

Table 9.1: Wind load parameters

Description	Value
Regional wind speed	Based on the site location
Directional Multiplier factor (M_d)	1.0 for region A and 0.95 for region B
Climate change multiplier (M_c)	1.0 for region A and 1.05 for region B
Terrain Category factor	2
Shielding Multiplier factor (M_s)	1.0

9.3.4.4. Earthquake loads (E)

The earthquake loads shall be calculated following AS 1170.4 and load parameters provided in Table 9.2.

Using an equivalent static analysis method is acceptable for calculating the seismic forces.

Table 9.2: Seismic load parameters

Description	Value
Hazard Factor(Z)	Based on the site location
Earthquake Design Category	II
Structural ductility factor(μ)	2
Structural performance factor (S_p)	1

The site sub-soil classification shall be obtained from the geotechnical investigation report for the particular site.

9.3.4.5. Other loads

Any other load that might be considered appropriate, such as, but not limited to, maintenance/construction loads, temperature, vibration, fatigue, soil pressure, and compaction-induced forces, shall be considered in the detailed design.

9.3.5. Load combinations

The load and resistance factors shall be per relevant Australian Standards, such as AS 1170, AS 3600, and AS 4100. The load combination shall suit the structure's functionality while incorporating the load and resistance factors outlined in relevant Australian Standards.

10. Fire Resistance

10.1. General[10]

Fire protection is a significant part of the Switchroom/Relay Room building design to protect the assets from any possible effects of a fire hazard.

A fire risk assessment shall be carried out per AS 2067 in the design process. Refer to EDI-Oil Containment and Fire Protection.

AS 2067 considers the Switchroom/Relay Room building a class 8 building per the National Construction Code (NCC). Therefore, provisions of building fire protection, including type C fire resistance construction, shall be implemented as a minimum in the design process unless otherwise stated in this document.

Bushfire Attack Level (BAL) shall be determined per AS 3959 and the building construction requirements shall be provided to the corresponding BAL.

10.2. Fire risk assessment

The following origin of fire hazards can compromise the safe operation of the Switchroom/Relay Room building:

- Power transformers that contain combustible liquid
- Switchboards, which may fail and explode
- Cables that may catch fire and spread
- Bushfire and the surrounding neighbouring building

10.3. Fire protection

10.3.1. Protection from transformers

Provisions of minimum fire separation between the power transformers and Switchroom building/Relay Room shall be implemented per AS 2067:2016 Table 6.1 and Figures 6.2(A) and (B) in the design process.

A barrier rated to FRL of 120/120/120 shall be installed between the transformers and the building where fire separation cannot be achieved.

10.3.2. Compartmentation and separation

All compartments in the Switchroom building (Switchroom and cable basement) shall be fire separated by construction having an FRL of not less than 120/120/120. The following shall be considered in the fire separation design:

- Steel structures in the cable basement supporting the suspended slab and switchboards, including the columns, beams, and brackets, shall have an FRL level of 120/-/-
- All openings in the suspended slab for switchboard cable termination, which are accessible from the basement, shall have an FRL of -/120/90
- All external and internal doorways shall be self-closing and have an FRL level of -/120/30

[10] See Western Power Internal Document

- All services and cable ladders passing through walls and floors between the compartments shall be protected to have an FRL level of -/120/90
- Roof steel structure shall have an FRL level of 60/-/-
- The Switchroom/Relay Room building ceiling shall have an FRL level of 30/30/30

11. Building Services

11.1. Electrical requirements[11]

The following services shall be designed and installed in the building:

- Lighting and power supplies

The design of internal, external, and emergency lighting shall be per the EDI-Substation Lighting and EDI-Substation AC Auxiliary systems.

All light switches shall be located inside/outside the compartment immediately adjacent to the entry door on the latch side.

All light fittings shall be positioned to ease the maintenance and replacement of bulbs without the need for any outages or permit requirements.

All cabling shall be installed in conduits cast in precast concrete wall panels or suspended concrete slab floor.

Roof space shall be used for wiring.

- GPOs
- Fire detection; VESDA system

The fire detection system shall be designed per EDI-Oil Containment and Fire Protection.

- Door alarms and swipe card access

All external doors shall be fitted with the following:

d. A concealed magnetic proximity switch.

e. A swipe card reader.

f. An electric mortice lock configured as fail-secure. Egress from inside shall always be allowed via the panic bar, except in the amenity room. Override access from outside shall be provided via a key system.

Internal doors must not be fitted with locks.

11.2. Air Conditioning[12]

The room air conditioning shall be designed per Functional Specification-SUBSTATION BUILDINGS-AIR CONDITIONING.

11.3. Cable ladder, trays, and handrails

FRP cable ladder shall be designed for secondary cable installation within the substation buildings.

[11] See Western Power Internal Document
[12] See Western Power Internal Document

FRP handrails and stair treads shall be used for buildings, where required.

12. Earthing[13]

The Switchroom/Relay Room building shall be earthed per EDI-Substation Earthing Design.

13. Building Signage and Labelling

13.1. Labelling[14]

Substation buildings shall be labelled per EDI-Substation Labelling and Numbering.

13.2. Evacuation diagram

An evacuation diagram shall be designed for the substation buildings.

The evacuation diagram shall be posted adjacent to the phone (in the Relay Room), entry, and emergency exit doors.

Each evacuation diagram shall have the correct orientation in relation to the direction of the egress and its location to the 'YOU ARE HERE' point.

The evacuation diagram shall indicate the location of emergency exits, the path of travel (coloured green), emergency equipment, telephone, hazards, and procedure to be followed in case of emergencies in the substation and any other required information regarding local emergency facilities and resources.

The evacuation diagram shall comply with AS 3745 requirements.

14. Documentation and Drawings[15]

The designer shall provide calculations, loading, and assumptions, including digital files of the software used for substation building design.

Template and example drawings of substation buildings can be found in the Register - Substation Design Drawings - EXTERNAL Version. This Register is provided to external consultants as a reference for Substation Standards and Template drawings.

[13] See Western Power Internal Document
[14] See Western Power Internal Document
[15] See Western Power Internal Document

Appendix A: Approval Record and Document Control[16]

[16] See Western Power Internal Document