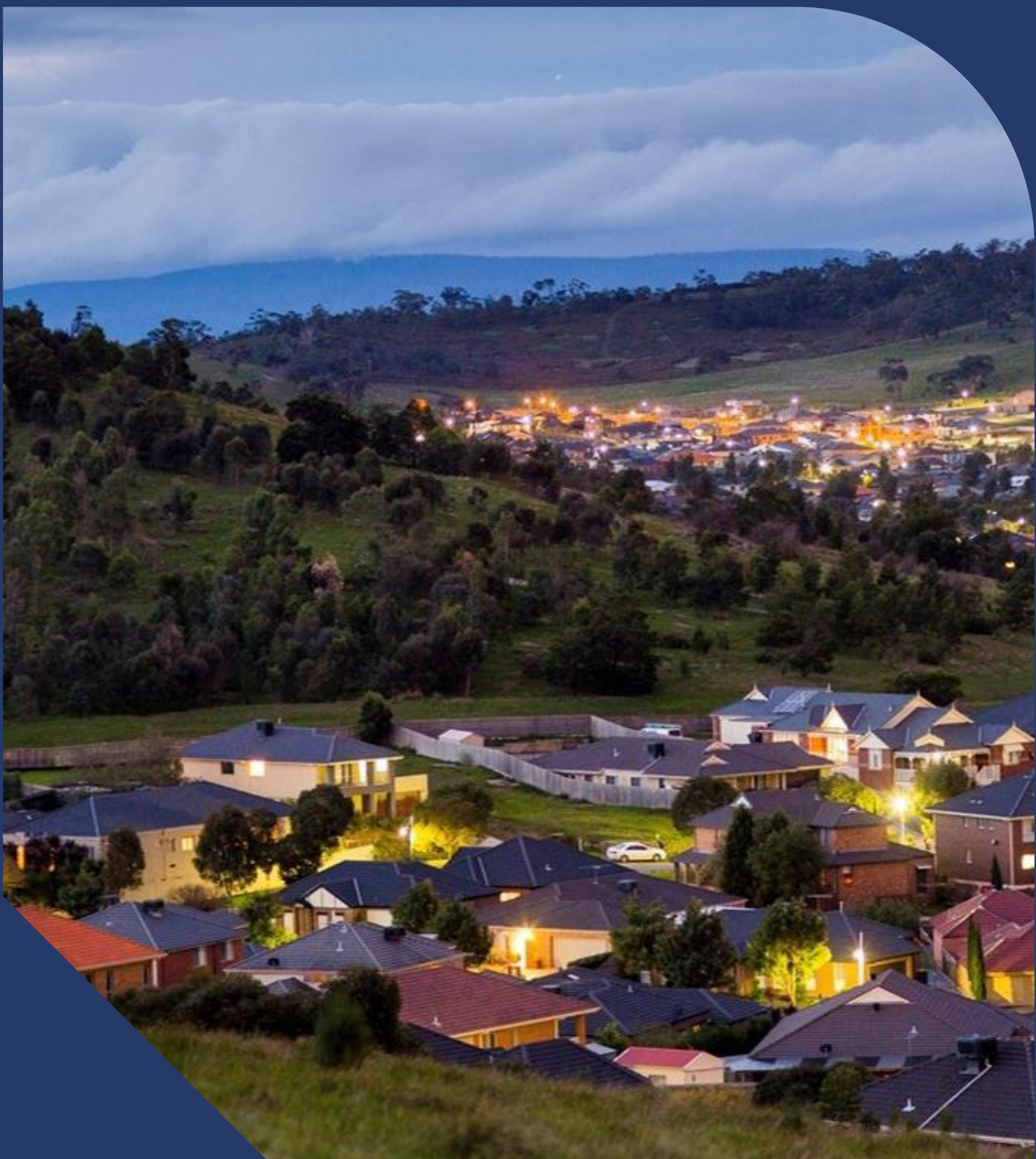
Sub-transmission Towers, Insulators and Ground Wires

AMS – Electricity Distribution Network



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1. Executive Summary

This document defines the asset management strategies for sub-transmission towers, insulators and ground wires supported by steel lattice structures within AusNet's electricity distribution network.

Sub-transmission towers support either single-circuit or double-circuit lines composed of three phase conductors per circuit. The towers are electrically insulated from the live conductors using insulators. In AusNet's distribution network, there are 481 sub-transmission towers, approximately 2,600 insulator strings and 146 km of ground wires. Most of the tower fleet (85%) consists of ex-132kV towers originally built between Yallourn and Melbourne in 1924 and 1932 with the balance being purpose built 66kV structures built from 1938 to 2012. Many of the insulators have been replaced since 2012 due to past failures, with over 93% of the insulator fleet now being of polymeric type and in good condition.

In the previous EDPR period, approximately 23 kilometres of steel ground wire along the YPS-WGL/MOE #2 66kV line was replaced due to its corroded condition, with the rest of the fleet evenly distributed in C2, C3 and C4 condition.

Over half the population of the tower fleet are in C4 condition or better (i.e. 45% in C3 and 55% in C4), while under 1% of the fleet is in C5 condition. Over the past ten years, there have been no major failures in the sub-transmission fleet.

During the last EDRP period Fall Arrest System (FAS) was installed on 210 tower structures, and the plan is to install FAS on remining 258 tower structures in the next EDRP. This will ensure the Occupational Health and Safety Regulation are met as well as follow the risk management philosophy of minimising personnel risks to "As Low As is Reasonably Practicable".

1.1 Asset Strategy Summary

1.1.1 Steel Lattice Towers

1.1.1.1 Inspection

- Continue to carry out Condition Assessment Inspections using ground patrols, structure climbing and other techniques such as UAV's Inspections.
- Continue to include the testing of existing bitumen paint on tower legs providing ground level corrosion protection as part of corrective and scheduled maintenance programs.
- Continue to replace corroded or damaged steel members, bolts and Anti-Climbing Devices as part of corrective and scheduled maintenance programs.
- Continue implementing the tower safe access program, including installation of fall arrest systems on structures and maintain compliance with Occupational Health and Safety standards, which requires to provide the highest possible level of safe working environment for AusNet employees and contractors when working at heights.

1.1.1.2 Replacement

- Investigate options for replacement of structures nearing end of life, such as standard distribution line constructions using concrete or steel poles.

1.1.1.3 Emergency Restoration

In the event of a tower failure, possible options are to use temporary poles or Emergency Restoration Structures (ERS). Poles, if practicable would be preferred as ERS erection is expensive, requires trained personnel for construction and the associated guys have a large footprint which may not be feasible at all locations.

1.1.2 Insulators

1.1.2.1 Inspection

- Inspect insulators in accordance with the criteria established in the Asset Inspection Manual 30-4111.
- Trial non-intrusive inspections, i.e. Thermal and Corona surveys on polymeric strings to identify incipient failure modes.

1.1.2.2 Maintenance

- Replace insulators in accordance with the condition criteria established in the Asset Inspection Manual 30-4111.
- Install polymeric insulators in place of defective items.

1.1.3 Ground Wires

1.1.3.1 Inspection

- Inspect ground wires in accordance with the criteria established in the Asset Inspection Manual 30-4111.
- Trial non-intrusive inspections, i.e. use Smart Aerial inspection and Processing (SAIP) to identify incipient failure modes.

1.1.1.1 Maintenance

- Replace ground wires in accordance with the condition criteria established in the Asset Inspection Manual 30-4111.
- Replace like-for-like, i.e. steel or Aluminium conductor steel-reinforced (ACSR) ground wires for spans that are in need to replacement.

2. Introduction

2.1. Purpose

The purpose of this document is to outline the inspection, maintenance, replacement and performance of the sub-transmission assets supported by steel lattice towers in AusNet Service's electricity distribution network.

This document summarises the key strategies used to manage these assets and maintain the reliability, safety and security of the distribution network. This document informs the reader of AusNet's asset management decisions and the basis for these decisions.

In addition, this document forms part of the Asset Management System for compliance with relevant standards and regulatory requirements. This document demonstrates responsible asset management by outlining economically justified outcomes.

2.2. Scope

Included in this strategy is the steel lattice sub-transmission tower infrastructure, the associated insulators and bare steel ground wires that are owned by AusNet's. The sub-transmission fleet consists of steel lattice towers, the footings, steel legs and cross-arms; the insulator strings including the fittings and hardware; and finally, the steel ground wires that provide lightning protection.

Excluded from this strategy are assets relating to the phase conductors and their hardware, which are used in these towers. These assets are covered in AMS 20-52 Conductors.

2.3. Asset Management Objectives

The high-level asset management objectives are outlined in *AMS 01-01 Asset Management System Overview*.

The electricity distribution network objectives are stated in *AMS 20-01 Electricity Distribution Network Asset Management Strategy*.

3. Abbreviations and definitions

TERM	DEFINITION
AMS	Asset Management Strategy
ERS	Emergency Restoration Structures
SAIP	Smart Aerial inspection and Processing
ACSR	Aluminium conductor steel-reinforced conductor
OOS	Out-of-Service
SECV	State Electricity Commission of Victoria
YPS	Yallourn Power Station
WGL	Warragul Zone substation
MOE	Moe Zone Substation
PHM	Pakenham Zone Substation
ACDs	Anti-Climbing Devices
CA	Condition Assessment
PoF	Probability of Failure
CoF	Consequence of Failure
STIPS	Service Target Performance Incentive Scheme
DNSP	Distribution Network Service Providers
HBRA	High Bushfire Risk Area
LBRA	Low Bushfire Risk Area
UAV	Unmanned Aerial Vehicle

4. Asset Description

4.1 Function

Sub transmission towers provide structural support for the attached conductors and provide safe electrical and physical clearances between conductors and the ground and other structures.

Insulators provide the mechanical connection between the live conductors and structure while providing safe electrical and physical clearances between conductors and tower structure.

The steel ground wires provide earthing to the sub-transmission fleet, which provides increased protection against lightning strikes during storm events.

4.2 Population

4.2.1 Population Considerations

The population profile for Sub-Transmission Towers, Insulators, and Ground Wires, is crucial for effective lifecycle management. This profile includes detailed data on the quantity, types, locations, and specifications of these assets within the electrical distribution network.

A comprehensive understanding of the population profile allows asset managers to:

- **Identify critical assets**: Determine which towers, insulators, and ground wires are essential for maintaining the integrity and reliability of the network.
- **Allocate resources efficiently**: Plan and allocate maintenance resources effectively by knowing the exact number and location of assets.
- **Risk management**: Assess and manage risks associated with different assets.
- **Optimise maintenance schedules**: Develop optimised maintenance schedules based on the distribution and condition of assets.
- **Enhance reliability and safety**: Ensure that all components, including towers, insulators, and ground wires, meet the required standards for reliability and safety.
- **Support strategic planning**: Inform long-term strategic planning and investment decisions.

4.2.2 Geographic Impact Areas

The AusNet's electrical distribution feeds electricity to 802,000 customers across eastern and north-eastern Victoria, and in Melbourne's north and east. This region encompasses a diverse range of geographic locations, each with specific environmental impacts on poles. Understanding these impacts is essential for effective asset management within the AusNet's electrical distribution network.

Notable examples include:

- **High Wind Areas:** High wind areas, particularly in elevated regions and open plains, subject sub-transmission towers and insulators to significant stress and fatigue.
- **Corrosive Areas**: Coastal areas and industrial regions where salt and pollutants are prevalent can cause corrosion of metallic components in sub-transmission towers and ground wires.
- **Bushfire Areas**: Bushfire-prone areas, common in many parts of Victoria, pose a risk of fire damage to sub-transmission infrastructure.

4.2.3 Population Profile

4.2.3.1 Population of Steel Lattice Towers

AusNet's has 481 steel lattice towers majority of which were originally designed for operation at 132 kV. Majority of these structures are currently operating at 66 kV, with a couple supporting 22kV feeders while some are currently Out-of-Service (OOS).

These towers were the first of their kind built by then State Electricity Commission of Victoria (SECV) as part of the electrification of the state of Victoria in the early 1920s.

There are 212 towers located on the Yallourn Power Station (YPS) to Warragul (WGL) to Moe (MOE) #1 66 kV and YPS-WGL-MOE #2 66 kV lines which are in service at 66kV. There are 84 towers on the Warragul to Pakenham (WGL-PHM[1]) line section operating at 22kV supplying Gumbuya World in Tynong, and the balance from Tynong to Narre Warren are out of service.

Significant work on the towers along the YPS-WGL-MOE lines were completed in the 2011 to 2013, replacing corroded members and bolts as well as assuring the footings and legs were in serviceable condition; while the insulators along the OOS WGL-PHM line were replaced to prevent failures which may result in a conductor drop.

Full circuit descriptions are found in Appendix 1.

These galvanised steel lattice towers support either single or double-circuit lines composed of three phase conductors per circuit. Ground wires located at the peaks of the structure protect the phase conductors from lightning strikes, while insulators electrically insulate the structure from the live conductors.

The main components of the steel lattice tower are:

- The tower footing;
- Tower legs;
- Cross arms
- The main and redundant members;
- The nuts and bolts, and;

Ancillary items such as anti-climbing devices (ACDs), fall arrest systems, ladders and signage Figure1 shows Tower 297 on the Narre Warren to Pakenham line. This tower is a double circuit structure with single conductor per phase.

Figure 1: Typical 132kV tower.

4.2.3.2 Population of Insulators

The AusNet's sub-transmission network supported by steel lattice towers has 2,445 composite insulator strings and 180 porcelain disc strings. Figure 2 below shows grey porcelain insulators account for 6.7% of the population and polymer type insulators account for 93.3% of the population.

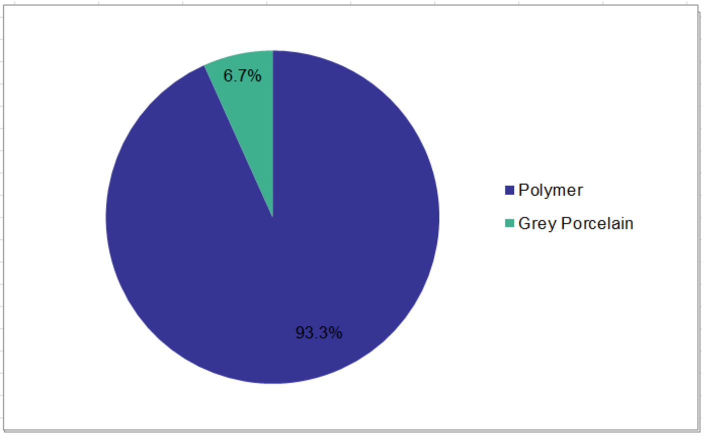

Figure 2: Insulators by type.

AusNet's' current policy is to install polymeric insulators due to their economic and operational advantages. The polymeric designs are cost effective relative to disc strings, lighter weight and do not require washing.

4.2.3.3 Population of Ground Wires

There are approximately 146 kilometres of steel or ACSR ground wires strung on the sub-transmission fleet supported by steel lattice towers. The ground wires were installed when the line was originally built to protect the line against lightning strikes that may can cause an outage.

4.3 Age

4.3.1 Age Considerations

An in-depth understanding of the age profile of sub-transmission towers, insulators, and ground wires is crucial for effective asset management and lifecycle planning. Knowing the age distribution of these assets helps in predicting their remaining useful life and planning maintenance, upgrades, or replacements accordingly.

- **Sub-Transmission Towers**: The age profile of steel lattice towers can indicate potential structural weaknesses due to material fatigue and corrosion. Older towers may require more frequent inspections and maintenance to ensure their structural integrity and safety. Proactive management can prevent failures and extend the operational lifespan of these critical components.
- **Insulators**: As insulators age, their insulating properties can degrade due to environmental factors such as pollution, moisture, and temperature fluctuations. By monitoring the age profile, asset managers can identify insulators nearing the end of their effective life and schedule timely replacements to maintain network reliability and safety.
- **Ground Wires**: Ground wires are essential for lightning protection and voltage stability. Over time, these wires can corrode or suffer mechanical damage. Understanding their age profile enables targeted inspections and maintenance, ensuring the ground wires continue to perform their protective function effectively.

4.3.2 Age Profile

4.3.2.1 Age Profile of Steel Lattice Towers

The oldest steel lattice towers in the sub-transmission network are 100 years old in 2024, significantly more than the original expected life of a tower. The main reason for the structures' longevity is the benign environment where most structures are located.

Exceptions to the benign environment are for the two tall towers used in a span at San Remo providing supply to Phillip Island.

Figure 3: San Remo Tower

As can be seen in Figure 4, 57.4% of towers have an age of 95 years, 38.3% of towers have an age of 87 years, 1.0% of towers have a service age of 47 years, 1.9% are 21 years of age and 1.5% are 11 years of age.

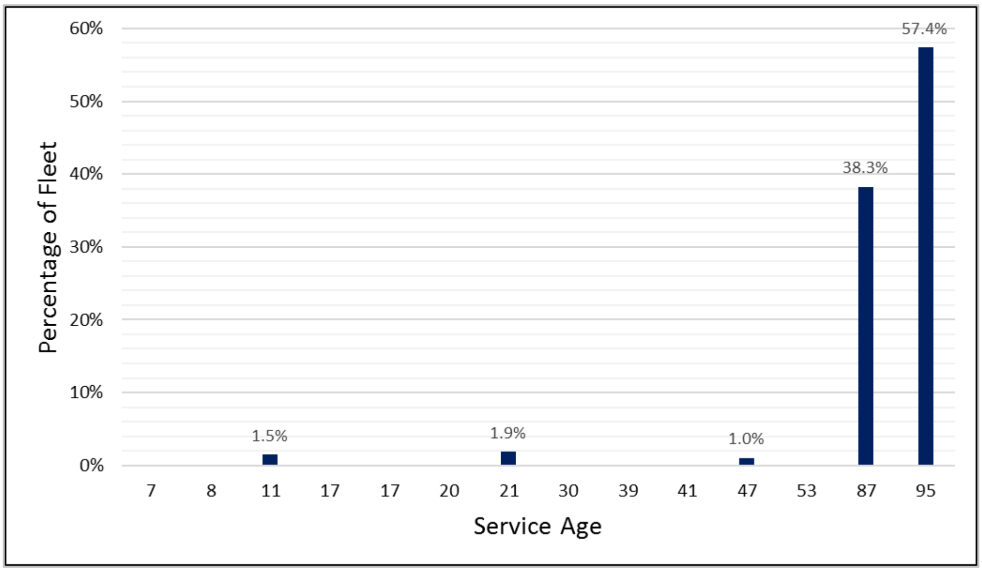

Figure 4: Service age of the steel lattice towers.

4.3.2.2 Age Profile of Insulators

The original porcelain insulators on the lines have largely been replaced with Polymeric types, which now make up over 93% of the total.

Figure 5 shows the age profile of AusNet's' sub-transmission insulators on steel lattice towers.

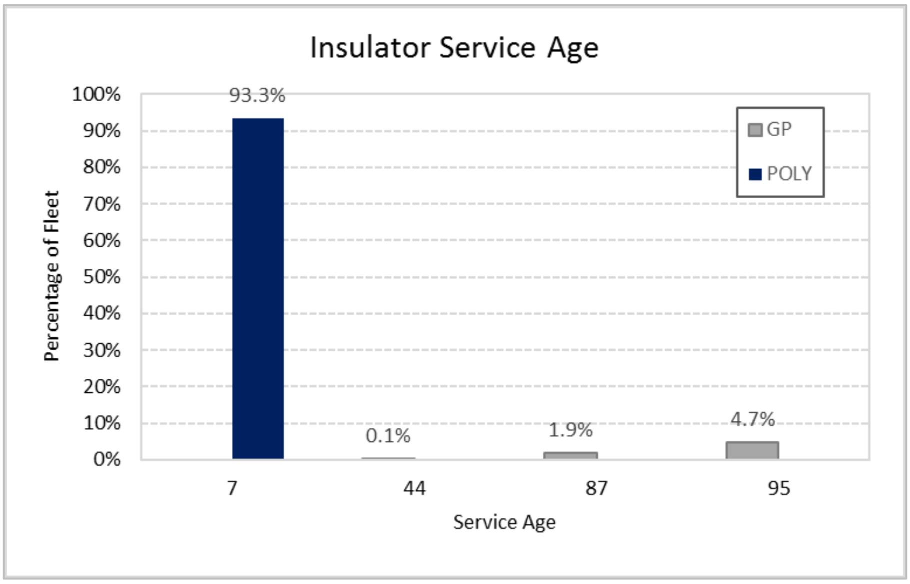

Figure 5: Service age of tower insulators

As depicted in Figure 5, 4.7% of the insulators population have a service age of 95 years, 1.9% has a service age of 87 years and 0.1% has a service age of 44 years. These strings are the original grey porcelain discs used on the towers when they were constructed.

A recent project, *74316512: YPS-NRN* [2] *66 kV line upgrade* has replaced the majority of the older sub-transmission insulators on steel lattice towers. This project has seen the polymeric type insulators replace the grey porcelain disc type insulators in 2012. Currently 93.3% of the insulator fleet are polymer type insulators and have a service age of 7 years.

4.3.2.3 Age Profile of Ground Wire

The ground wires that were installed when the tower line was built are still in-service on the sub-transmission fleet and follow the age profile of the tower structures as shown in Figure 4, except sections that have been replaced on the YPS-WGL/Moe No 2 line.

[2] **YPS-NRN 66kV** line is the in-service portion of YPS-ERTS-PMMS 2

5. Asset Risk

AusNet maintains a risk management system designed in accordance with AS ISO 31000 Risk Management – Guidelines to ensure risks are effectively managed to provide greater certainty for the owners, employees, customers, suppliers, and the communities in which we operate.

The risk of each asset is calculated as the product of probably of failure (PoF) of the asset and the consequence of failure (CoF) of the asset. The risk is then extrapolated into the future as the PoF and CoF are forecast to change.

In the distribution network, AusNet aims to maintain risk. Risk mitigation activities required to achieve this over time include replacement, refurbishment and maintenance activities which are developed based on current risk and extrapolated risk.

The approach and detailed methodology of the risk assessment process are described in AMS -01-09. Section 5.1, 5.2 and 5.3 in the document describe the considerations and methodologies to determine PoF, Cof, and the risk mitigation measures that are unique to Sub-transmission Tower assets.

5.1 Probability of Failure

There are four categories taken into consideration when determining the likelihood of a functional failure of an asset: asset service life, asset utilisation/duty factor, location, and the measured or observed physical condition of the asset. The four categories are assessed using machine learning or health scores to calculate the probability of failure or the remaining useful life of the asset.

The physical condition of an asset is the single most important category in predicting likelihood of failure. Using FMEA/FMECA techniques, dominant failure modes are identified, and this guides the determination of which measurements or observations are to be taken for monitoring the condition of the asset.

5.1.1 Failure Modes

Understanding failure modes is an important tool that supports measuring the criticality of assets, especially when assessing the risk of potential failures and their potential impact on the overall system. By identifying and analysing the various ways in which an asset can fail (including the root causes and mechanisms of failure), asset managers can better predict and mitigate risks. This understanding allows for a more accurate assessment of the probability of failure (PoF) and the consequence of failure (CoF), which, as noted above, is a core aspect of how AusNet approaches determining asset criticality for sub-transmission towers, insulators, and ground wires

5.1.1.1 Specific Failure Modes

As noted above, assessing failure modes and utilising the detailed information about each mode plays a crucial role in various aspects of Asset Management Planning. Understanding failure modes enhances the effectiveness of risk management efforts and ensures the optimal performance and reliability of assets within the electrical distribution network. Some notable Failure Modes for for sub-transmission towers, insulators, and ground wires are detailed below.

Steel Lattice Towers

- Structural Fatigue and Stress: Repeated stress from high winds, heavy loads, or aging can lead to metal fatigue and structural failure. The significance of this mode is critical for maintaining the integrity and stability of the towers, ensuring they can support the conductors and withstand environmental stresses. Example: Regular inspections and stress analysis can predict and prevent failures. Towers showing signs of stress can be reinforced or replaced before failure occurs, thus maintaining network reliability.
- Corrosion of Metallic Components: Exposure to salt, pollution, and moisture can cause corrosion, weakening the metal and leading to potential collapse or reduced electrical performance. The significance of this mode is corrosion can significantly reduce the lifespan of towers, impacting network reliability. Example: Implementing protective coatings and regular maintenance schedules can mitigate corrosion effects. Identifying areas prone to corrosion allows for targeted preventive measures, ensuring longevity and performance.

- **Foundation and Ground Stability Issues:** Soil erosion, seismic activity, and ground movement can compromise tower foundations, leading to instability and potential collapse. The significance of this mode is ensuring stable foundations is critical for the overall structural integrity of towers. **Example:** Regular geotechnical assessments and foundation inspections can identify potential issues early. Reinforcing foundations in vulnerable areas ensures stability, particularly in seismically active regions.

Insulators

- **Insulator Degradation:** Environmental factors such as UV radiation, pollution, and extreme temperatures can degrade the materials used in insulators, leading to electrical failure. The significance of this mode is insulator failure can result in electrical faults, outages, and potential safety hazards. **Example:** Regular testing and replacement of insulators in high-risk areas prevent failures. Using more durable materials in insulators can enhance longevity and reliability.
- **Electrical Flashover:** Contaminants like dust and pollution can cause electrical flashovers, leading to insulator failure and network disruptions. The significance of this mode is that flashovers can cause widespread outages and equipment damage. **Example:** Implementing regular cleaning schedules and using insulators with better contamination resistance can mitigate this risk, ensuring consistent performance.

Ground Wires

- **Corrosion of Ground Wires**: Exposure to environmental elements such as moisture and pollution can corrode ground wires, reducing their effectiveness in providing earthing and protection against lightning. The significance of this mode is corrosion can lead to reduced network protection and reliability. Example: Regular inspections and the use of corrosion-resistant materials can extend the lifespan of ground wires, ensuring they provide adequate protection.
- **Lightning Strikes and Electrical Surges**: Direct lightning strikes or electrical surges can damage ground wires, potentially leading to outages and equipment damage. The significance of this mode is protecting the network from lightning strikes is crucial for maintaining continuous service and preventing damage. Example: Installing advanced lightning protection systems and ensuring proper grounding can minimise damage from lightning strikes, maintaining service continuity.

5.1.2 Probability of Failure Assessment

Assets are evaluated using methodologies detailed in AMS 01-09. The results determine parameters for calculating probability of failure (PoF) and remaining life.

5.2 Consequence of Failure

All assets fulfil a function that enables delivery of electricity to customers. This means that failure of an asset has the potential of resulting in failure to supply customers with energy. There is also a possibility that the failed asset could injure an employee or member of the public or negatively affect the environment.

The cost resulting from this failure (cost of failure) is viewed through three lenses: safety, environment, and customer/reputation for all asset classes. Table 1 is a summary description for each lens.

Table 1: Consequence Lenses

Consequence Lenses	Descriptions
SAFETY	Failure of primary equipment and/or comms asset resulting in injury or death of an employee or member of the public
ENVIRONMENT	Bushfire damage or environmental waste resulting from comms system or subsystem failure

Consequence Lenses	Descriptions
CUSTOMER AND REPUTATION	Loss of supply to customers
	Impact on energy market
	Breach of regulatory obligations

The Cost of failure associated with any of the consequence lenses is the product of the cost of consequence and likelihood of consequence. Refer to AMS 01-09 for methodology of calculating consequence of failure.

5.2.1 Safety

The Safety lens incorporates all potential health and safety effects that could impact the public and employees. It includes the possibility of injury, incapacity, and/or death.

Line easements traverse both public and private land where public access to the easement is not restricted. In many instances, easements are shared or located next to other infrastructure such as roads, railway lines, pipes and fences. Functional failures of structures can present health and safety risks to members of the public, AusNet's employees and/or AusNet's contractors accessing the line easements.

Line workers performing structure climbing activities are exposed to risks associated with working at heights and electrical clearances which are heightened under failure conditions. Tower functional failures may also present risks to members of the public, particularly with towers adjacent to roadways, railway lines and public areas such as car parks or parks and gardens.

There have been no instances of major insulator failures adjacent to roads or railways.

5.2.2 Environmental

The Environmental lens covers consequences relating to the environment which includes bushfire, contamination, and pollution

The majority of towers are located in high bushfire risk areas; however the towers are in cleared easements that separate them from immediate proximity to vegetation. This is addressed by the Bushfire Mitigation Plan – Electricity Distribution Network, BFM 10-01. Less than 1% of AusNet's towers are located in low bushfire risk areas.

Whilst failures of electricity distribution lines may cause a fire ignition; historically the circuits supported by these towers have not been involved in any bush or grass fire ignitions. Relative to other distribution lines assets, this fleet presents a significantly lower bushfire risk.

5.2.3 Customer and Reputation

The community and reputation financial costs arise from customers not being supplied with energy and the energy market not dispatching the cheapest generators.

The Service Target Performance Incentive Scheme (STPIS) provides financial incentives for Distribution Network Service Providers (DNSP) to maintain and improve the reliability of service performance. Performance targets are set based on historical performances of individual DNSP; thus, providing financial rewards for DNSPs beating their targets and financial penalties for failing to meet targets.

Due to the looped nature of sub-transmission lines, this fleet of sub-transmission towers and insulators don't attract any STPIS penalties.

5.3 Risk Treatment

Risk mitigation activities, or treatments, are required to maintain risk by targeting reduction of PoF or CoF depending on the nature of the risk. Mitigation measures include asset replacement, asset refurbishment, inspections, testing or system redesign, and are achieved through capital projects or operational expenditure. Risk treatment options are described in Section 7 of AMS 01-09.

Capital replacement is a major component of asset risk management. The prerequisites for replacing an asset are:

- replacement of the asset will result in a material risk reduction
- risks can't be feasibly managed through maintenance or refurbishment
- monetised risk exceeds the replacement cost meaning that it is economic to replace the asset

6. Performance

In the context of asset management for sub-transmission towers, insulators, and ground wires, assessing asset performance is a vital tool for effective lifecycle management. Performance information provides a comprehensive understanding of how these assets behave under various conditions, enabling asset managers to make informed decisions that enhance the reliability, safety, and efficiency of the electrical distribution network.

Performance data helps identify trends and patterns in asset behaviour, which are crucial for making strategic decisions regarding maintenance, upgrades, and replacements. Understanding how sub-transmission towers, insulators, and ground wires perform over time allows for proactive management, reducing the risk of unexpected failures. The assessment employed by AusNet involves analysing failure trends and any significant impacts resulting from failure, which provides valuable insights into the health and reliability of these assets.

No major failures have been experienced in the tower fleet. However, during the past couple of years, some of the direct-buried steel legs which were excavated to assess their condition against corrosion have been found to require refurbishment.

In relation to insulators, there have been eight separate steel insulator pin failures over the last eleven years due to decreased strength caused by corrosion that resulted in the conductor span dropping to the ground. Although these incidents didn't result in any third party injury or property damage, the risks associated with these events warranted the replacement of the original insulators with more reliable and corrosion resistant polymeric insulators in the YPS-NRN 66 kV line upgrade project. Since the major insulator replacement project has been completed, no insulator failures have occurred.

There has been no major failures attributed to the steel ground wires used in the sub-transmission fleet, although a couple of maintenance works have been completed recently to assure the physical integrity of the spans.

6.1 Condition Assessment

6.1.1 Condition Assessment Protocol

Condition assessments are a critical element of lifecycle management for sub-transmission assets. These assessments provide vital information on the current state and performance of towers, insulators and ground wires, enabling informed decision-making regarding maintenance, repair, and replacement.

Condition assessments involve a systematic evaluation using specific benchmarks and a rating scale to describe the health and performance of sub-transmission assets. AusNet employs a standard approach to condition assessments that employs a 5-point rating scale to assign systems a condition rating score.

The AusNet 5-point rating scale assessment protocol follows these high level scoring criterion:-

- Condition 1 (C1): A rating of Condition 1 indicates a system, or subsystem is in very good condition, typically with no visible defects and optimal functionality. These system or subsystems require minimal maintenance and are expected to have a long remaining service life. The standard AusNet Condition scoring card benchmarks the remaining useful life of Condition 1 (C1) at 95%.
- Condition 2 (C2): A rating of Condition 2 reflects good condition, typically with minor wear and tear, requiring routine maintenance to maintain performance. The standard AusNet Asset Condition scoring card benchmarks the remaining useful life of Condition 2 (C2) at 70%.
- Condition 3 (C3): A rating of Condition 3 signifies average condition, typically where the asset shows moderate wear and may require significant maintenance or minor repairs to prevent further deterioration. The standard AusNet Asset Condition scoring card benchmarks the remaining useful life of Condition 3 (C3) at 45%.
- Condition 4 (C4): A rating of Condition 4 indicates poor condition, typically with major defects, necessitating immediate repairs or partial replacement to ensure safe operation. The standard AusNet Asset Condition scoring card benchmarks the remaining useful life of Condition 4 (C4) at 25%.
- Condition 5 (C5): Finally, a rating of Condition 5 represents assets in very poor condition, typically with critical failures or end-of-life status, requiring urgent replacement to avoid safety hazards and operational disruptions. The standard AusNet Asset Condition scoring card benchmarks the remaining useful life of Condition 5 (C5) at 5%.

The condition scoring methodology outlined above provides high-level scoring criteria that can be universally applied across all systems and subsystems within AusNet's electrical distribution network. These scoring criteria offer a broad framework for assessing the general condition and remaining life of systems, ensuring consistency and comparability across asset management activities.

6.1.2 Asset Specific Monitoring Considerations

To accurately evaluate the condition of each specific asset within a given asset class, it is also essential to further refine the benchmarks associated with condition scoring. Each asset class, such as sub-transmission towers, insulators, and ground wires, has unique characteristics and operational requirements that necessitate more detailed benchmarks.

Developing these more granular benchmarks may involve considerations such as:

- **Customising Indicators:** Identifying specific indicators of wear, degradation, and performance relevant to each asset type. For instance, sub-transmission towers may be evaluated based on structural integrity and corrosion levels, while insulators may be assessed for dielectric strength and mechanical stability.
- **Detailed Inspections:** Conducting thorough inspections tailored to the asset class, incorporating both visual assessments and technical measurements. Example: Detailed inspections for sub-transmission towers might include ultrasonic testing for internal structural flaws and drone surveys for external corrosion, providing comprehensive condition data. The Asset Strategies section of this asset class plan provides information on the inspection strategies for this asset class.
- **Historical Data Analysis**: Assessing historical performance and maintenance data to establish norms and thresholds for each condition score. This helps in predicting future performance and planning proactive interventions. Example: Analysing historical failure data for insulators can help establish condition thresholds that predict future degradation patterns, guiding proactive replacement strategies. The Performance section of this asset class plan details trends analysis for the asset class.
- **Environmental Factors:** Considering the impact of local environmental conditions, such as exposure to coastal salt air for insulators or tree growth near overhead lines, which can influence asset condition.

6.1.3 Asset Class Specific Condition Considerations

The key assessment tool used for the management of the tower fleet and insulator fleet is the Condition Assessment (CA) surveys, also known as Detailed Inspections, that are undertaken on a regular basis. During the CA surveys, visual inspection of the tower components is carried-out following the procedures stipulated in the Asset Inspection Manual (30-4111) Section 3.14: Tower Lines.

The Asset Inspection Manual document contains photographs of the various components along with the various condition stages in relation to corrosion and/or wear, wherein each stage is assigned a numeric scale from C1 to C5 where C1 is “as new” condition while C5 is “worst condition”.

The CA surveys for insulators rate the condition of the disc insulators’ steel pins against corrosion while for the composite insulators the Asset Inspection Manual will be revised to follow the ratings used for transmission insulators.

The results of these inspections are recorded to track the rate of deterioration while components that are defective, i.e. loose nuts, plate wear/corroded, missing pins, extremely corroded members, bolts, insulators that require replacement, etc. are flagged for rectification by raising ZB Notifications (Condition-based Maintenance Activities) in SAP with appropriate priority ratings given in the same document.

If the process to replace a particular component is straight forward, the item is replaced following the priority ranking that is consistent with the asset’s risk of failure. If however, the work requires some engineering analysis to assure the safety and security of the structure, or if it involves considerable expense, the work will be done as a project-based activity.

6.2 Performance Analysis

6.2.1 Steel Lattice Towers

To give a comprehensive condition rating for each tower, the criticality of each major component is given a weighting related to its contribution to the tower’s structural integrity.

The condition rating for the legs and members are given equal weighting because these transmit the loads from the conductors and the structure’s self-weight into the ground. Bolts and nuts are given lesser weighting due to the presence of multi-bolted joints on the structure which allows for some redundancy.

Although age is not a major contributor in the asset’s strength compared to the amount of corrosion and wear the components has suffered, it is still considered in the analysis as the age also relates to the design standard and philosophy/methodology at the time the structure was built.

The condition rating codes used for towers are shown in Figure 6

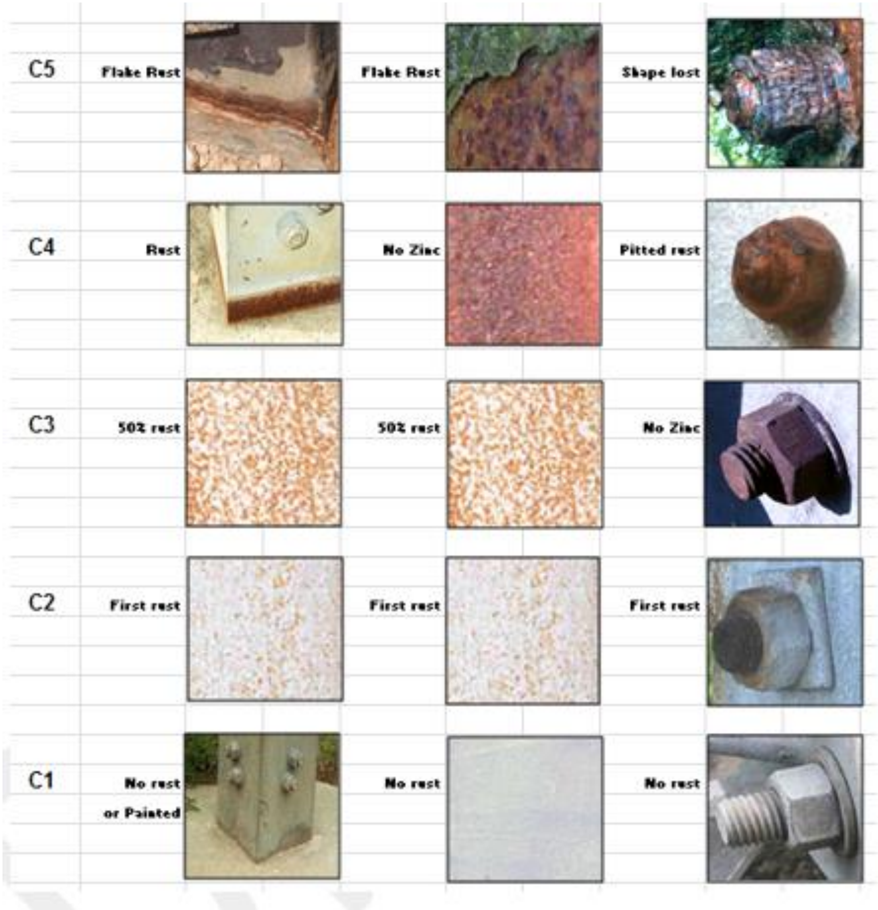

Figure 6: Condition codes for legs, steel members and bolts

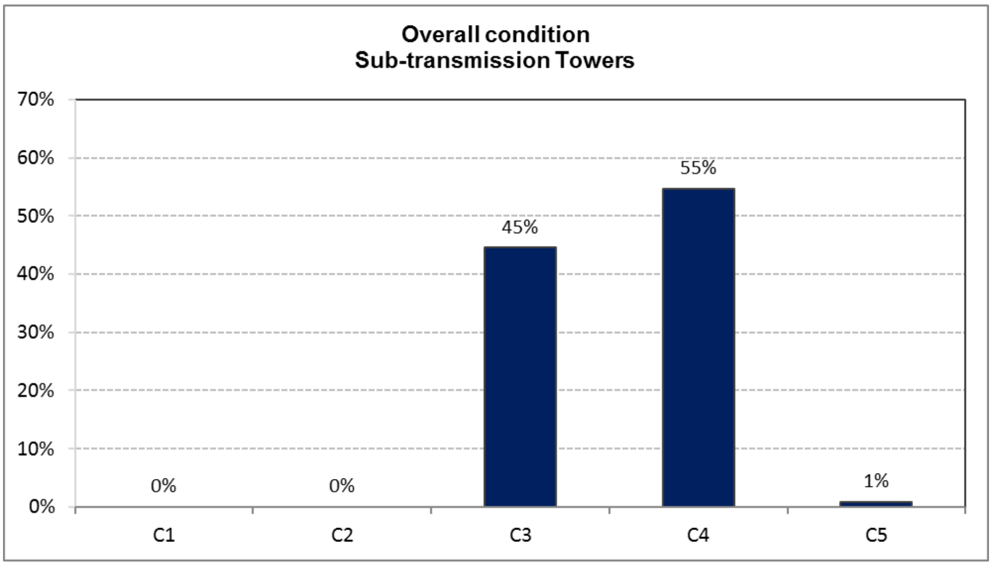

Figure 7: Condition scores of the sub-transmission towers population

At present, approximately 45% of the tower fleet are at C3 condition, 55% at C4, and only 1% at C5 as shown in Figure 7. The towers at C5 are still structurally adequate to support the gravity loads coming from the conductors as well as the wind acting on the conductors and itself. However, these structures will have to be monitored on a regular basis with some level of refurbishment or replacement required on certain components, i.e. bolts and members which have started to lose sectional area to assure its reliability and public safety.

6.2.2 Insulators

The majority of the insulator strings along the sub-transmission fleet are polymeric strings with only a few towers still retaining the original disc strings.

Similar to the towers, the key assessment tool used for the management of the insulator fleet is the Condition Assessment (CA) surveys. The CA surveys rate the condition of the disc insulators' steel pins against corrosion.

The same process is followed for defect recording and management of insulator strings as with the steel lattice towers, with the rating scale as shown in Figure 8.

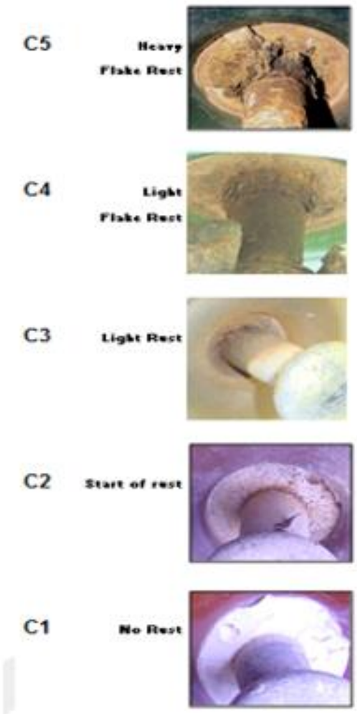

Figure 8: Condition codes for the disc insulator pins and polymeric insulators.

To obtain the condition rating for a disc insulator, the steel pin is rated against corrosion and the amount of pollution on the disc is assessed during the time of inspection. The worse score is taken as the over-all condition for the string as it is the limiting item in its performance.

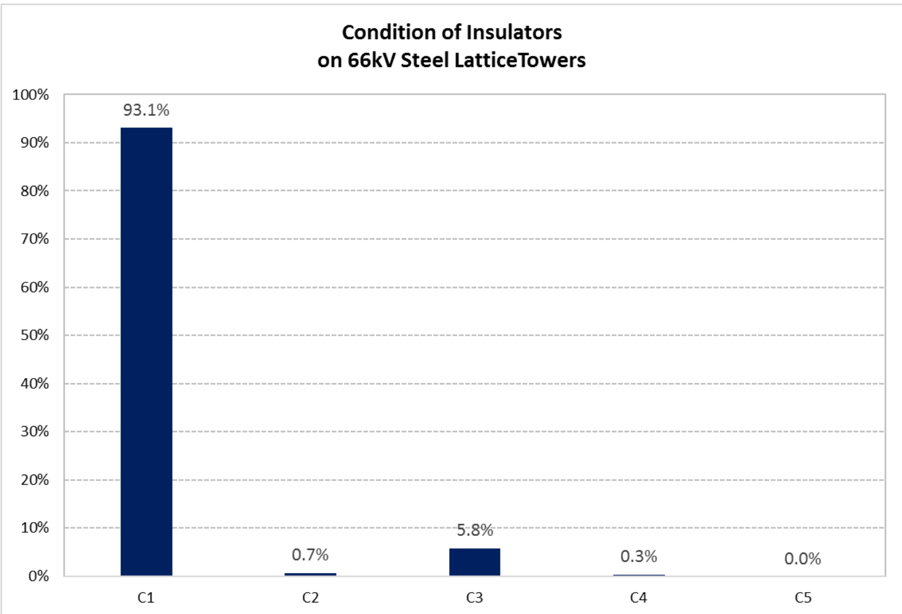

Figure 9: Insulator condition on 66kV lattice towers

As most of the insulators on the YPS to NRN[3] 66kV line have been recently replaced, 93.1% of the fleet are in C1 condition, with 0.7% at C2, 5.8% at C3, and 0.3% at C4. The reliability and safety of the lines have improved with the added benefit of cost savings. This is due to less maintenance due to the self-cleaning properties of the polymeric insulators, which do not require regular washing.

6.2.3 Ground Wire

The steel ground wires along the line has seen an average service life of more than eighty years. As such, 25% are in C2 condition, 25% in C3, 31% in C4 and 19% of the fleet have become C5, which is the worst condition.

These spans will require regular inspections with some sections to be replaced in the coming EDPR period to mitigate the risk of failure.

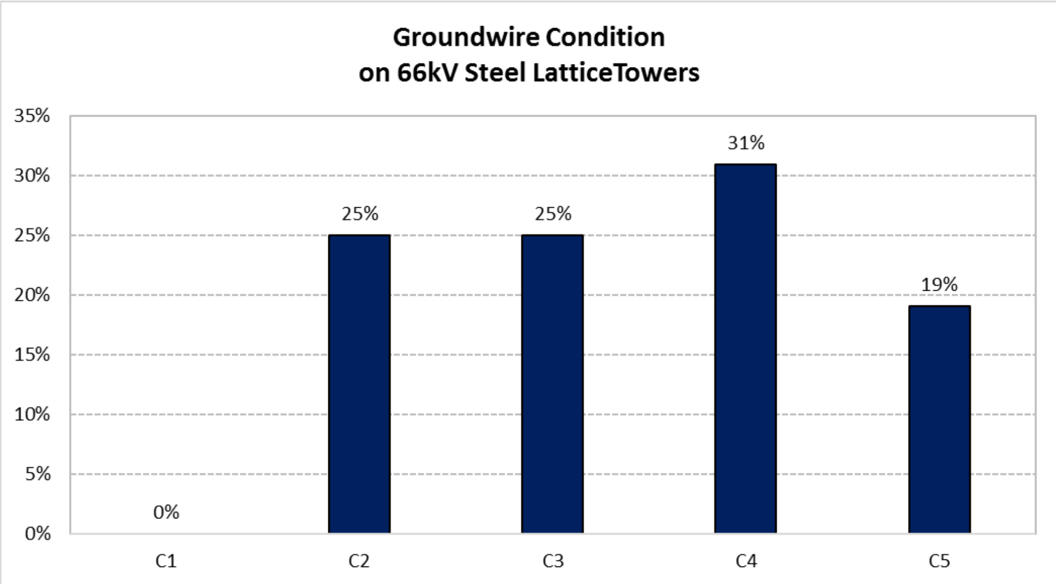

Figure 10: Steel ground wire condition

[3] **YPS-NRN 66kV** line is the in-service portion of YPS-ERTS-PMMS 2

6.3 Performance Profile

The following ZA (Condition-Based Maintenance) and Work Order analysis takes into account all work created from 2011 to 2019. It excludes any work orders related to conductors and focuses on sub-transmission towers and insulators only. A total 3,111 NOTIs and work orders were analysed, the breakup of the work orders shown in Figure 11.

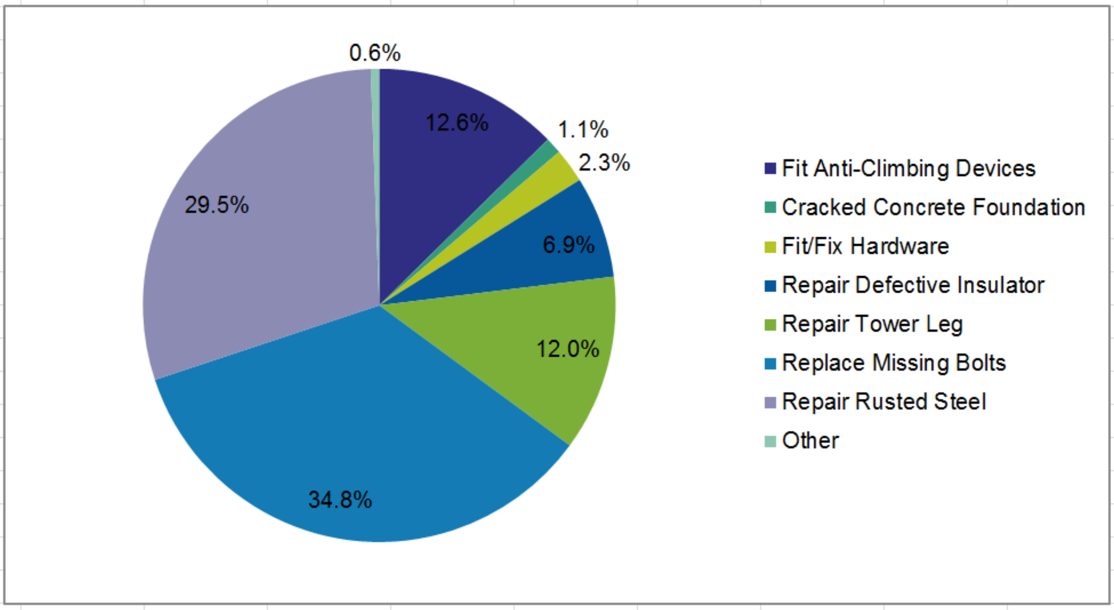

Figure 11: Work orders by percentage of total.

Figure 11 shows that the majority of the ZA Notifications over the last nine years have been based around replacing missing bolts, repairing rusted steel, fitting anti-climbing devices and repairing tower legs. The 'Other' description includes painting tower legs as part of the ground level corrosion protection system program, repairing damaged steel, repairing hot spots, washing insulators and installing/replacing sub transmission cross arms.

7. Related Matters

7.1 Regulatory Framework

7.1.1 Compliance Factors

7.1.1.1 Regulatory and Legislative Reference

Effectively managing compliance obligations specific to legislation and policies is a core element of Asset Class Planning and supports the sustainable operation and management of Network Assets. Ensuring adherence to relevant laws, policies and codes helps prevent legal and regulatory breaches, which can lead to significant penalties, operational disruptions, and reputational damage.

Note: further to the above, Section Nine (9) provides a quick reference table for the legislative and regulatory laws, acts, and policies that are of material consideration for this Asset Class (with links to the reference material).

7.1.1.2 Technical Standards and Procedures

Effectively managing compliance with technical standards and operational procedures is an important element of Asset Class Planning. Adhering to these standards ensures that the assets are designed, constructed, maintained, and operated in a manner that meets industry best practices, enhances safety, and ensures reliability. Compliance with technical standards helps prevent asset failures, reduces risks, and ensures interoperability within the electrical distribution network. For example, ensuring that all components of various asset types are installed and maintained according to Australian Standards can prevent unplanned failure and operational faults, enhancing network reliability.

7.2 External Factors

7.2.1 Technical Factors

Understanding and managing the technical factors that can directly impact the lifecycle planning for Network Assets across all the AusNet Asset Classes is a core element of effective asset management. These factors encompass various design, engineering, and technical performance considerations that directly impact the ability to manage and maintain these assets efficiently. Ensuring that Network Assets meet specific technical performance standards is vital for maintaining the reliability and safety of the electrical distribution network. For example, selecting construction materials with appropriate durability and weather resistance is essential to prevent faults and ensure consistent performance under varying environmental conditions.

Targeted Activities (Technical Factors)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	**Tower Safe Access** The original design of the sub-transmission towers did not consider the provision of adequate electrical clearance for tower access. This lack of electrical clearance exposes the line worker to the risk of a flashover event once he has reached the conductor level while climbing along the tower leg. The presence of this hazard will require administrative controls such as having a safety observer to prevent inadvertent movement while on the tower leg. As per the hierarchy of risk mitigation, this solution is not preferable. Further, while the electricity industry has an excellent record with no recorded fall from a tower by a worker on duty, the general construction industry in Victoria has a very poor record. A fall from an elevated position on a tower could result in severe injuries or possible fatality to a worker. WorkSafe recommends the use of elevated work platforms (EWPs) as the safest method to access the towers (Level 2 control under the hierarchy of controls as per Regulation 205 of the Occupational Health and Safety (Prevention of Falls) Regulations 2003). However, where this is not practical, the next level recommended is a permanent fall arrest system which is a Level 3 control. In response to the WorkSafe recommendations, the EWP option was considered but found impractical for AusNet Services due to the majority of these structures being located in country/mountainous areas inaccessible by EWPs. For multi-circuit easements, the use of an EWP is further constrained as there is restricted clearance between adjacent circuits. This constraint poses a safety risk and therefore requires continuous outages of the lines to undertake condition assessment inspections and other activities. Consequently, AusNet Services adopted a Level 3 control instead, and a program to address this risk has been initiated in 2016. This program complies with the Occupational Health and Safety laws, which have been introduced for employers to provide a safe working environment for workers climbing up to a level greater than 2 metres above ground and improves the overall productivity of the workforce by reducing the time for tower access. The program includes providing a central ladder on the tower body and installing fall arrest systems.
02	**Tower Corrosion – above and under ground** As with all steel structures exposed to the environment, towers are susceptible to corrosion over their service life. Issues with above ground corrosion are not wide spread but can be attributed to localised pollution sources such as power stations and specific industries. In New Zealand during 2001, a tower of similar design and foundation arrangements to that of this fleet of sub-transmission towers suffered a footing failure. On investigation this failure was attributed to the below ground metal fatigue and corrosion of the legs where they were joined to the footing stubs at a nominal depth of 2 metres. AusNet's commenced a program in 2010 to check the direct buried steel leg condition for 19 towers. This program included towers along the YPS-WGL-MOE #1 and #2 lines. The remainder of the towers along these lines are targeted for buried steel inspection over the coming years. If required, corrosion issues will be rectified to prevent further section loss by the application of an ultra-high built epoxy coating system. Circulating currents may also pose a risk to tower legs closely located to zone substations. Intrusive inspection of the tower legs is recommended to ensure the tower legs in these critical locations are not deteriorating/losing their cross sectional area.
03	**Extreme Winds** The frequency of exposure to extreme winds is regional and depends on the geographic location of the structures. Additionally, the potential of a tower failure due to extreme winds would identify the towers as having inadequate strength to withstand the downdraft winds. No spares are held for this fleet of sub-transmission towers. The plan for management of a tower failure is to utilise the transmission network emergency restoration system. The emergency restoration system will then be replaced by a concrete pole.

REF	DETAILS OF MATERIAL CONSIDERATIONS
04	**Insulator Corrosion** Although most of the original disc insulators have been replaced by polymeric strings, there are still some of the original disc-type insulators in service. These strings are monitored during condition assessment inspections so the risks associated with a failure due to decreasing strength are managed.
05	**Pollution on Disc Insulators** Unlike polymeric insulators which have the capacity to self-clean pollution, disc insulator strings must be washed when pollution levels are too high to reduce electrical tracking and potentially a flashover event. This is especially true for suspension strings as the underside of the sheds aren't washed so the steel pins can have residual moisture in the pollution that could lead to oxidation.
06	**Ground Wire Corrosion** The steel ground-wires of the sub-transmission line have been in service for more than 90 years old and 19% of the fleet had degraded to C5 condition. One span along the YPS-WGL-MOE #2 line had suffered several strand breakages that were repaired in 2019 by installing patch rods. Samples of ground wires along high-risk areas, i.e. road and rail crossings will be collected, analysed for corrosion damage and tested mechanically to determine its residual life and understand the urgency for replacement. The optimal time to replace the steel ground-wire is when the cable still has enough tensile strength to be used as a "draw wire" for the new ground wire.

7.2.2 Environmental Factors

7.2.2.1 Environmental Management

Effectively managing obligations specific to environmental management is a core element of Asset Class Planning and supports the sustainable operation and management of Civil Infrastructure. Ensuring adherence to relevant environmental laws and standards helps prevent legal and regulatory breaches, which can lead to significant penalties, operational disruptions, and reputational damage.

Targeted Activities (Environmental Factors)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	The sub-transmission line network is exposed to varying levels of corrosivity depending on environmental factors. The two factors which have the greatest impact on levels of corrosivity include salt deposition experienced in coastal regions and air pollution caused by emissions from heavy industry. In order to manage the effects of corrosion in a prudent manner corrosivity classifications are assigned to line assets. There are a total of three corrosivity zones including severe, moderate and low.
02	**Asbestos in the Corrosion Protection System** In 2011 it was identified that, the existing corrosion protection system that was used by the State Electricity Commission of Victoria (SECV) contained asbestos. Tests conducted on hundreds of towers forming the Victorian electricity transmission network confirmed that coatings used pre-1965 have a high probability of containing asbestos. Consistent with the AusNet's' asbestos management strategy, all existing coatings for the tower legs will be tested for the presence of asbestos prior to removal as part of the on-going corrosion protection program for tower legs. If the existing coating is found to contain asbestos, it will be removed, handled and disposed-off appropriately

7.2.3 Stakeholder/ Social Factors

7.2.3.1 Social Factors

Understanding social factors is essential for the effective management of critical network infrastructure assets. Social factors, including community expectations, public safety, and environmental impacts, play a significant role in shaping asset management strategies. Ensuring that these social considerations are addressed helps build public trust, maintain social license to operate, and enhance the organisation's reputation. For instance, ensuring that maintenance activities for Civil Infrastructure do not disrupt local communities or pose safety risks is crucial for maintaining public support and compliance with social responsibilities.

7.2.3.2 Stakeholder Factors

Understanding the requirements of stakeholders with a direct interest in the assets associated with the Sub-transmission Towers, Insulators and Ground Wires asset class is an important aspect of effective asset management. Key stakeholders, including customers, regulatory bodies, and industry partners, have specific expectations that influence asset management strategies and operational decisions. Ensuring clear communication and alignment with these requirements helps maintain regulatory compliance, enhance service reliability, and build robust partnerships. For example, customers expect reliable infrastructure and timely responses to issues, which requires minimal disruption during maintenance activities of Civil Infrastructure. Similarly, regulatory bodies impose standards that must be adhered to, such as safety requirements for buildings and environmental systems, to avoid legal penalties and ensure operational legitimacy.

7.3 Internal Factors

7.3.1 Training and Competency Factors

Effective training and competency development is a core element of asset class. Ensuring that asset managers, engineers, operational staff, and field personnel possess the necessary skills and knowledge is crucial for maintaining the reliability, safety, and efficiency of the asset network. Competent staff can effectively perform inspections, maintenance, and repairs, preventing asset failures and minimising downtime. Continuous training helps in keeping up with technological advancements, regulatory changes, and best practices, thereby enhancing overall asset management performance.

7.3.2 Resource Management Factors

Resource Management is a core element of asset class planning for Network Assets. Proper oversight ensures that the management of AusNet's resource bases meets stringent quality and performance standards, which is essential for preventing asset failures, managing risks, and maintaining compliance with regulatory requirements. Effective resource management contributes to cost efficiency via activities such as leveraging the expertise of specialised in-house skills and contractors while avoiding hidden costs associated with inefficiencies and non-compliance.

There are three sub-categories of consideration for this factor, which are:

- Resourcing strategies
- Outsourcing
- Supply Chain Management

7.3.3 Economic Factors

Economic factors significantly influence the lifecycle management of network assets, impacting financial stability, investment decisions, and overall network performance. Major contracts being tendered, such as those for infrastructure development, maintenance, and technology upgrades, can materially affect asset management. These contracts involve substantial investments, requiring rigorous management to align with long-term asset goals, mitigate risks, and control costs. Effective contract management ensures that service providers deliver value, supporting the network's reliability and performance while maintaining financial health.

Material developments and significant commercial agreements also play pivotal roles in the economic landscape of asset management. Commercial agreements, including customer service agreements, dictate service levels, performance metrics, and penalties, impacting operational priorities. Regular reviews of these agreements ensure adaptability to changing economic conditions, customer expectations, and regulatory landscapes. Additionally, planned renewal programmes and changes to asset types and purchasing strategies must be evaluated for their financial impact to ensure efficient resource allocation. By addressing these economic factors, AusNet can manage financial risks, optimise investments, and support robust lifecycle models, aligning financial planning with operational goals and regulatory requirements.

7.3.4 Safety Factors

Safety is a paramount concern in the management of electricity distribution network assets, as outlined in ESMS 20-01. Effective asset management planning and activities are crucial for protecting employees, contractors, the public, and the environment from potential hazards associated with electrical infrastructure. Ensuring adherence to safety regulations and standards through diligent asset management helps prevent accidents, minimise risks, and maintain the integrity of the network.

Targeted asset management activities include conducting regular safety audits and risk assessments, maintaining a robust Bushfire Mitigation Plan, providing ongoing safety training and competency assessments, regularly reviewing and updating emergency response plans, engaging with the community to raise awareness about electrical safety, and adopting new technologies and practices to enhance network safety. By integrating these safety-focused activities into asset management planning, AusNet can effectively minimise safety risks "as far as practicable," as outlined in the Electricity Safety Act 1998 and reflected in ESMS 20-01.

Targeted Activities (Safety Factors)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	**Tower safe access** AusNet's is mandated by the Occupational Health and Safety Regulations to provide a safe work environment to its employees both staff and contractors. As the towers in the sub-transmission fleet were constructed using old design standards, towers along certain lines lack the appropriate safety clearance between the line worker and the live conductors. To address this hazard, the tower safe access program was initiated during the last EDPR period wherein a ladder was installed along the centre of the tower body and a cable fall arrest system was installed along the access path of 210- steel lattice towers. A major driver for the installation of the fall arrest system is to provide safety to lineworkers during tower inspections and maintenance/replacement works. The plan is to install fall arrestor system on 258 towers, evenly split across each year in the next EDRP.

7.4 Future Developments

7.4.1 Technology and Innovation Factors

Effectively managing the process of tracking future technology developments and innovations is a core element of asset class planning. Staying informed about technological advancements ensures that asset management practices remain up-to-date, efficient, and competitive. Innovations can lead to improved materials, better monitoring systems, and enhanced maintenance techniques that increase the reliability, safety, and longevity of critical infrastructure. For example, advancements in diagnostic tools for detecting early signs of wear and the development of advanced materials for asset components can significantly enhance their performance and maintenance. For technology and innovation, this is a process that looks to existing technologies, processes, or practices that have been proven in the market and have already been taken to market.

7.4.2 Research and Development Factors

Effectively managing the process of investing in research and development (R&D) and seeking funds for R&D activities is a core element of asset class planning. R&D investment ensures that the organisation stays at the forefront of technological advancements, develops innovative solutions to emerging challenges, and enhances the reliability, safety, and efficiency of its assets. For example, developing new materials with improved structural properties for buildings or advanced monitoring systems for environmental systems can significantly extend their lifespan and reduce maintenance costs. Research and development is the process of researching and investing in an idea, process, practice, or technology that has not been realised in the market yet; it is a step before tracking innovation and technology because the investment to build and take the item to market still needs to be proven.

7.4.3 Continuous Improvement

Continuous Improvement (CIP) is a critical lynchpin process in the overall application of asset management, particularly for managing Sub-transmission Towers, Insulators and Ground Wires. CIP ensures that asset management practices remain effective, efficient, and adaptive to changing conditions and emerging challenges. By consistently seeking ways to enhance processes, technologies, and strategies, organisations can maintain high levels of performance, reliability, and safety.

Best practice asset management promotes a culture of continuous improvement, encouraging organisations to regularly evaluate their asset management systems, identify areas for enhancement, and implement changes. This iterative process involves monitoring performance, analysing data, and applying lessons learned to refine practices. By focusing on CIP, organisations can ensure that their asset management activities remain dynamic, resilient, and aligned with best practices and strategic objectives. This approach not only enhances the overall efficiency and effectiveness of asset management but also supports long-term sustainability and success. **CIP differs from technology and innovation as well as R&D because it involves the ongoing enhancement of existing processes and practices based on real-world feedback and performance data, rather than the development and introduction of new technologies or the exploration of unproven ideas.**

8. Asset Strategies

8.1 New Assets

A strategic asset strategy for the introduction of new assets provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the aspects of asset upgrades or changes, detailing the conditions under which new assets may be introduced into the network. This is not a like-for-like replacement but rather a strategic change or upgrade to a different type of asset to enhance reliability, improve efficiency, and incorporate advanced technologies. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for integrating new assets into the AusNet network.

8.2 Inspections and Monitoring

A strategic plan for inspections and monitoring provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the ideal framework and objectives for conducting inspections and monitoring activities, such as enhancing reliability, improving efficiency, and incorporating advanced technologies. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for establishing comprehensive inspection and monitoring protocols within the AusNet network.

Targeted Activities (Inspection and Monitoring Strategies)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	**Steel Lattice Towers** • Initiate intrusive inspection of tower leg conditions of towers outside of zone substations • Trial the use of Remotely Piloted Aerial Systems, eg UAVs to undertake condition assessment • Implement the use of SAP mobility solutions for the online recording of condition assessment data.
02	**Insulators** • Inspect insulators in accordance with the criteria established in the Asset Inspection Manual 30-4111 • Trial non-intrusive inspections, i.e. Thermal and Corona surveys on polymeric strings to identify incipient failure modes.
03	**Ground Wire** • Inspect ground wires in accordance with the criteria established in the Asset Inspection Manual 30-4111 • Trial the use of Smart Aerial Inspection and Processing (SAIP) on the ground wires to identify defective sections and determine the condition of the fleet.

8.3 Maintenance Planning

A strategic plan for maintenance provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the ideal framework and objectives for conducting maintenance activities, such as enhancing reliability, improving efficiency, and incorporating advanced technologies. It serves as a roadmap that guides the decision-making process for establishing comprehensive maintenance protocols within the AusNet network. This involves creating a structured approach to regular maintenance activities to ensure optimal performance and longevity.

Targeted Activities (Inspection and Monitoring Strategies)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	**Steel Lattice Towers** • Continue to include the testing of existing bitumen paint on tower legs into the ground level corrosion protection system works scope of works. • Continue to replace corroded or damage steel members, bolts and Anti-Climbing Devices as part of corrective and scheduled maintenance programs. • Continue ground level corrosion protection system works at a rate of 4-towers per year. • Continue implementing fall arrest systems on tower structures and maintain compliance with Occupational Health and Safety standards. The plan is to install fall arrestor system on 258 towers, evenly split across each year in the next EDRP.
02	**Insulators** • Replace insulators in accordance with the condition criteria established in the Asset Inspection Manual 30-4111 • Install polymeric insulators in place of damaged or corroded grey disc porcelain-type insulators.
03	**Ground Wire** • Replace corroded ground wires in accordance with the condition criteria established in the Asset Inspection Manual 30-4111 • Install steel ground wires where sections are to be replaced

8.4 Renewals Planning

A strategic asset strategy for renewals and replacements provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the aspects of asset refurbishments or like-for-like replacements, detailing the conditions under which existing assets may be renewed or replaced within the network. This process ensures continued reliability and efficiency, manages obsolescence, and maintains adequate spares. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for renewing or replacing assets within the AusNet network.

Targeted Activities (Renewal Strategies)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	**Steel Lattice Towers** • Install emergency restoration systems in place of a failed tower and • Replace the emergency restoration systems with concrete or steel poles • Perform structural modelling of existing structures to assist with the development of asset reinforcement/replacement programs.
02	**Ground Wire** • Replace very poor condition and poor condition, high consequence, steel ground wire on the YPS-WGL/MOE #2 66kV line

8.5 Decommissioning

A strategic asset strategy for decommissioning provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the aspects of safely and efficiently removing assets from service, detailing the conditions under which decommissioning may occur. It ensures that the process is conducted in a way that minimises disruption, manages environmental impacts, and complies with regulatory requirements. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for decommissioning assets from within the AusNet network.

9. Legislative References

NO.	TITLE	LINK
1	Electricity Safety Act 1998	https://content.legislation.vic.gov.au/sites/default/files/2024-06/98-25aa083-authorised.pdf

10. Resource References

NO.	TITLE	LINK
1	Asset Inspection Manual	30-4111
2	Asset Management System Overview	AMS 01-01
3	Electricity Distribution Network Asset Management Strategy	AMS 20-01
4	Bushfire Mitigation Plan – Electricity Distribution Network	BFM 10-01
5	Electricity Safety Management Scheme	ESMS 20-01

11. Appendices

Appendix 1: Full circuit descriptions of sub-transmission towers

Circuit Acronyms	Full Circuit Descriptions
CBTS-BWN-ERTS	Cranburne Terminal Station to Berwick North to East Rowville Terminal Station 66kV line
CLN ZONE SUBSTATION	Clyde North Zonesubstation
HPS-WOTS	HPS to Wodonga 66kV line
MBTS-MYT	Mount Beauty to Myrtleford 66kV line
MWTS-MFA	Morwell Terminal Station to Maffra 66kV line
MWTS-YPS 1	Morwell Terminal Station to Yallourn Power Station #1 66 kV line
MYT-BRT	Myrtleford to Bright 66kV line
RUB-KLK	Rubicon to Kinglake 66kV line
TGN-MFA	Traralgon to Maffra 66kV line
TTS-KLK	Thomastown to Kinglake 66kV line
TTS-KLK & EPG2	Thomastown to Kinglake & Epping 66kV line
WANG - MYT	Wangaratta to Myrtleford 66kV line
WGI-PHI	Wonthaggi to Phillip Island 22kV/ 66kV line
WN-MYT	Wangaratta to Myrtleford 66kV line
YPS-ERTS	Yallourn Power Station to East Rowville Terminal Station 66kV line
YPS-ERTS-PMMS 2	Yallourn Power Station to East Rowville Terminal Station to PMMS #2 66kV line
YPS-WGL-MOE 1	Yallourn Power Station to Warragul to Moe #1 66 kV line
YPS-WGL-MOE 2	Yallourn Power Station to Warragul to Moe #2 66 kV line
YPS-YC 1	Yallourn Power Station to Yallourn C #1 66kV line
YPS-YC 2	Yallourn Power Station to Yallourn C #2 66kV line

12. Schedule of revisions

ISSUE	DATE	AUTHOR	DETAILS OF CHANGE	APPROVED BY
1	08/01/2015	J Stojkovski	First Issue	J Bridge
2	24/10/2019	F Lirios	Review and update for EDPR 21-25, and added ground wires	P Ascione
3	31/01/2025	P Kilevics	Update for EDPR 26-31	

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