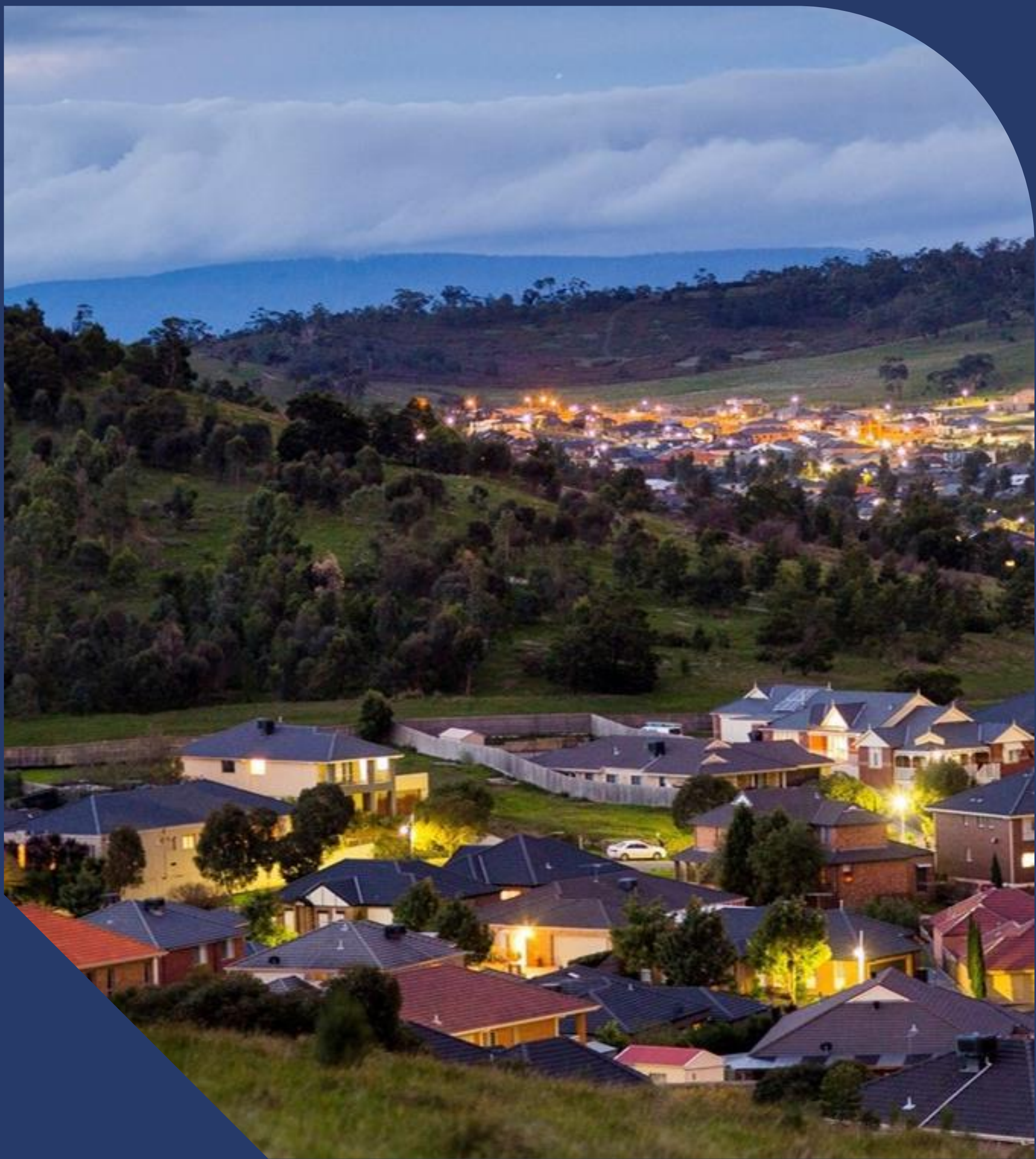
AusNet

Cross Arms

AMS Electricity Distribution Network



AusNet

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Table of contents

1. Executive Summary

This document is part of the suite of Asset Management Strategies relating to AusNet's' electricity distribution network. The purpose of this strategy is to outline the inspection, maintenance, replacement and monitoring activities identified for economic life cycle management of crossarms in AusNet's' Victorian electricity distribution network.

The crossarm population is comprised of approximately 241,000 steel high voltage (HV) crossarms, 36,000 wood HV crossarms, 191,000 wood low-voltage (LV) crossarms, 31,000 steel sub-transmission crossarms, and 9,400 composite fibreglass crossarms.

Since 1991, low-voltage aerial bundled cable (LVABC) programs have resulted in retirement of crossarms however; the majority of LV circuits are still supported by Australian hardwood crossarms. The LV wood crossarm population is stable as most of the new LV circuits are underground cable or LVABC.

In the early 1970s, steel crossarms were introduced with concrete poles and became standard construction for 66kV lines in the late 1970s and for 22kV, 11kV and 6.6kV circuits following the 1983 bushfires. Accordingly, the number of steel crossarms in service continues to rise, and the number of HV wood crossarms is declining.

Since 2011/12, the replacement rate of wood crossarms was increased significantly and between 2011 and 2014 more than 39,000 wood crossarms were replaced to match increasing deterioration rates and reduce limited life crossarm volumes. This volume included 10,000 replacements targeted in extreme bushfire risk areas as part of the approved Electricity Safety Management Scheme. This has had the effect of since 2015, the number of wood crossarm failures has decreased.

Moreover, the amendments to the Electricity Safety (Bushfire Mitigation) Regulations 2013 introduced the use of codified areas, which are prescribed geographical areas of highest file loss consequence where replacement or construction of powerlines (1kV to 22kV) of four or more consecutive spans must be with insulated or covered conductor. This resulted in the removal of in-service crossarms

It is estimated by an average of 2,090 crossarms will need to be replaced each year to address deterioration and failures over the period 2026 to 2031.

Ongoing proactive management of crossarm application, inspection, maintenance, and replacement practice is required to ensure AusNets meet stakeholder expectations of cost, safety, reliability and environmental performance.

1.1. Asset Strategy Summary

1.1.1. New Assets

- Install insulated cable systems for new 22kV, 11kV and 6.6kV circuits in codified areas, eliminating need to install crossarms.
- Install insulated underground cable or LVABC for new LV circuits, eliminating the need to install crossarms
- Install steel crossarms on new 66kV, 22kV, 11kV and 6.6kV circuits
- Continue to use and monitor the performance of composite fibreglass crossarms as a replacement for LV wood crossarms.

1.1.2. Inspections and Monitoring

- Inspect crossarms in accordance with criteria in the Asset Inspection Manual 30-4111

1.1.3. Maintenance Planning

- Maintain crossarms as per Asset Inspection Manual 30-4111 and Standard Maintenance Guidelines SOP 70-03

1.1.4. Replacement

- Replace deteriorated 66kV, 22kV, 11kV and 6.6kV wood crossarms with steel crossarms
- Replace individual deteriorated LV wood crossarms with wood or composite fibreglass crossarms
- On a case-by-case basis, use insulated underground cable and LVABC to replace groups of deteriorated LV wood crossarms

2. Introduction

2.1. Purpose

The purpose of this document is to outline the inspection, maintenance, replacement and monitoring activities identified for the economic life cycle management of crossarms in AusNet's' Victorian electricity distribution network. This document is intended to be used to inform asset management decisions and communicate the basis for activities. In addition, this document forms part of our Asset Management System for compliance with relevant standards and regulatory requirements. This document demonstrates responsible asset management practices by outlining economically justified outcomes.

2.2. Scope

This asset management strategy applies to all cross arms used to support conductors operating at 66kV, 22kV, 11kV, 6.6kV and below.

The other related assets are described in:

AMS 20-52 Conductor

AMS 20-70 Poles

AMS 20-66 Insulators – High and Medium Voltage

2.3. Asset Management Objectives

As stated in *AMS 01-01 Asset Management System Overview*, the high-level asset management objectives are:

- Operate to our risk appetite
- Optimise risk, cost and performance
- Improve network reliability
- Meet customer service objectives
- Reduce safety risks and meet our obligations
- Support the energy transition
- Increase community energy resilience
- Sustainability and modernisation of the network

As stated in *AMS 20-01 Electricity Distribution Network Asset Management Strategy*, the electricity distribution network objectives are:

- Improve network performance
- Leverage advances in technology and data analytics
- Reduce bushfire risk
- Reduce electric shocks from network assets
- Deliver REFCLs
- Meet metering compliance obligations
- Meet quality of supply obligations

3. Abbreviation and Definitions

TERM	DEFINITION
AMS	Asset Management Strategy
GRP	Glass Reinforced Plastic
HBRA	High Risk Bushfire Area
HV	High Voltage
LBRA	Low Risk Bushfire Area
LV	Low Voltage
LVABC	Low Voltage Aerial Bundled Cable

4. Asset Description

4.1. Function

Crossarms primarily support the conductors, which operate at various levels throughout the network.

The crossarms are installed along the upper part of the pole to assure the energised conductors are operating at a safe elevation from the ground – away from members of the public, vehicles, animals and vegetation. On top of that, crossarms maintain electrical clearances between phases of open wire construction.

4.2. Population

4.2.1. Population Considerations

The population profile for Crossarms 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 crossarms 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 HV, MV, and LV crossarms, 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 network 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 crossarms. 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 crossarms 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 crossarms..

Bushfire Areas: Bushfire-prone areas may pose a risk of fire damage to crossarm infrastructure.

4.2.3. Population by Asset Type

4.2.3.1. Steel Crossarms

Summary Explanation of Form and Function: Steel crossarms are typically made from galvanised steel and are used to support high voltage conductors. They are designed to be durable and resistant to corrosion, making them suitable for high-stress environments.

Purpose within the Asset Class: Steel crossarms serve as the primary support structures for conductors, ensuring they remain elevated and properly spaced from each other and from the ground.

Purpose within the Network Design: In the network design, steel HV crossarms are installed on HV feeders to maintain electrical clearances and support the weight and tension of the conductors. Their robust construction makes them ideal for high-stress applications.

Process Function: The crossarms provide mechanical support and maintain electrical clearances, ensuring safe and reliable operation of conductors.

Figure 1 shows a steel crossarm. In the 1970s, galvanized steel crossarms became standard construction for 66kV lines and 22kV, 11kV and 6.6kV feeders. Those crossarms are highly durable and resistant to corrosion.

Figure 1 - Steel Crossarm

4.2.3.2. Wood Crossarms

Summary Explanation of Form and Function: Wood crossarms are made from high-quality timber and are used to support conductors. They are a cost-effective option but have a shorter lifespan and a potential risk of burning.

Purpose within the Asset Class: Wood crossarms support conductors, maintaining their elevation and spacing to ensure safe operation.

Purpose within the Network Design: In the network design, wood HV crossarms are used on HV feeders where cost considerations are a priority, and environmental conditions do not pose significant risks to the timber. In contrast, wood LV crossarms are used on LV feeders, especially in areas where undergrounding is not feasible.

Process Function: These crossarms provide mechanical support and maintain electrical clearances for conductors.

Figure 2 shows a wood crossarm. Since 1991 only high-quality wood has been installed in the distribution network. Wood crossarms are the economic option but display a shorter life and a potential risk of burning.

Figure 2 - Wood Crossarm

4.2.3.3. Composite Fibreglass Crossarms

Summary Explanation of Form and Function: Fibre glass crossarms are made from composite materials and were introduced to reduce manual handling risks. They are lightweight, durable, and do not rot, making them a practical alternative to timber.

Purpose within the Asset Class: Fibre glass crossarms support LV conductors, offering a durable and lightweight solution for maintaining safe clearances.

Purpose within the Network Design: In the network design, fibre glass crossarms are used on LV feeders where manual handling and durability are significant considerations.

Process Function: These crossarms provide mechanical support for LV conductors, maintaining safe clearances and reducing the risk of electrical faults.

Figure 3 shows a composite fibreglass crossarm. Fibreglass crossarm have been approved for LV applications. These composite crossarms have been engineered to be a direct replacement for timber crossarms with respect to strength, durability, and size.

Figure 3 - Composite Fibreglass Crossarm

The strategy use to replace crossarm with the preferred type is detailed in SOP 70-03.

4.2.4. Population Profile

AusNet's electricity distribution network has 405,309 crossarms. S

The breakdown of crossarm by material and voltage is shown in Figure 4.

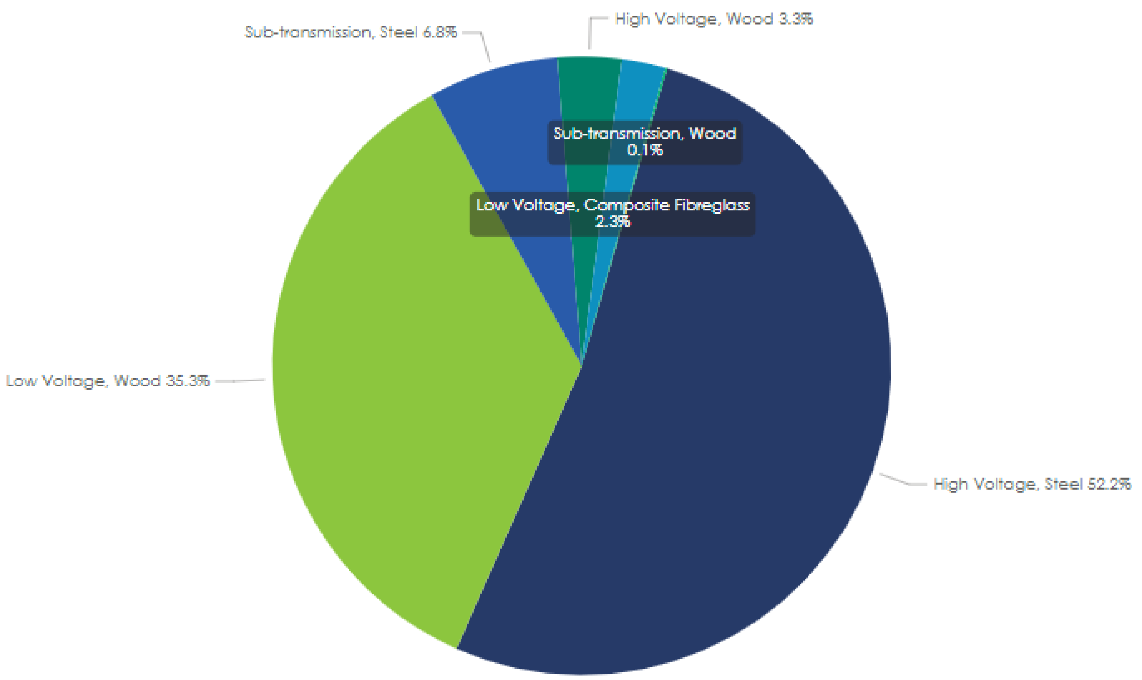

Figure 4 - Crossarm by Type

In terms of geographical location, 57% of the crossarm population are located in Hazardous Bushfire Risk Areas/Codified Areas, and 43% are located in LBRA region.

Table 1 shows the breakdown of crossarm fleet in terms of material, type and location

Table 1 - Crossarm by type, material and location

REGION	COMPOSITE FIBREGLASS	STEEL			WOOD			TOTAL
	LV	ST	HV	LV	ST	HV	LV	
HBRA/Codified Area	0.6%	4.3%	34.6%	0.0%	0.2%	3.9%	13.8%	57.4%
LBRA	1.3%	1.7%	12.7%	0.0%	0.1%	3.2%	23.7%	42.6%
Total	1.8%	6.0%	47.3%	0.0%	0.3%	7.0%	37.5%	100.0%

4.3. Age

Understanding the age profile of crossarms is essential 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.

4.3.1. Age Considerations

Steel Crossarms: The age profile of steel crossarms can indicate potential issues related to metal fatigue and corrosion

Wood Crossarms: Over time, wood crossarms can experience degradation as they age.

Fibre Glass (GRP) LV Crossarms: As a relatively new introduction, the long-term age profile data for GRP crossarms is limited. However, ongoing monitoring can help assess their performance over time

4.3.2. Age by Material

4.3.2.1. Steel Crossarms

In the 1970s, galvanized steel crossarms became standard construction for 66kV lines and 22kV, 11kV and 6.6kV feeders. There has been minimal change in the technical specification of galvanized steel crossarms resulting in a homogenous population.

The galvanised steel crossarm service age profile is illustrated in Figure 5The spike shows at 48 years is due to assets lacking a confirmed installation date.

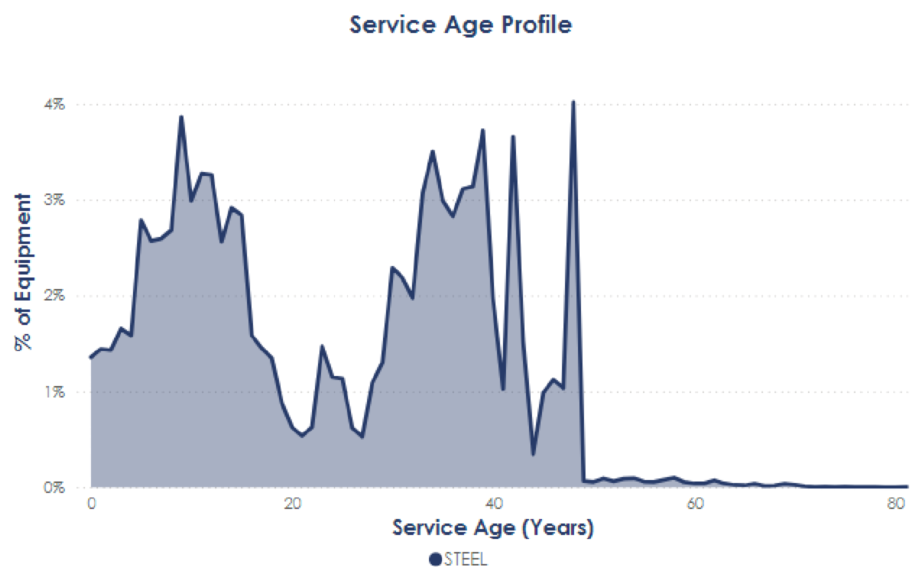

Figure 5 - Steel crossarm age profile

4.3.2.2. Wood Crossarms

The volume of wood crossarms replaced by steel units over the last two decades has significantly reduced the total volume of wood crossarms supporting high voltage circuits.

Figure 6 shows that more than half of the wood crossarm population has a service age less than 30 years due to the impact of accelerating replacement rates over the last decade.

Since 1991, only high-quality wood has been installed in the distribution network. The mean expected technical life of wood crossarms ranges from 40 to 50 years.

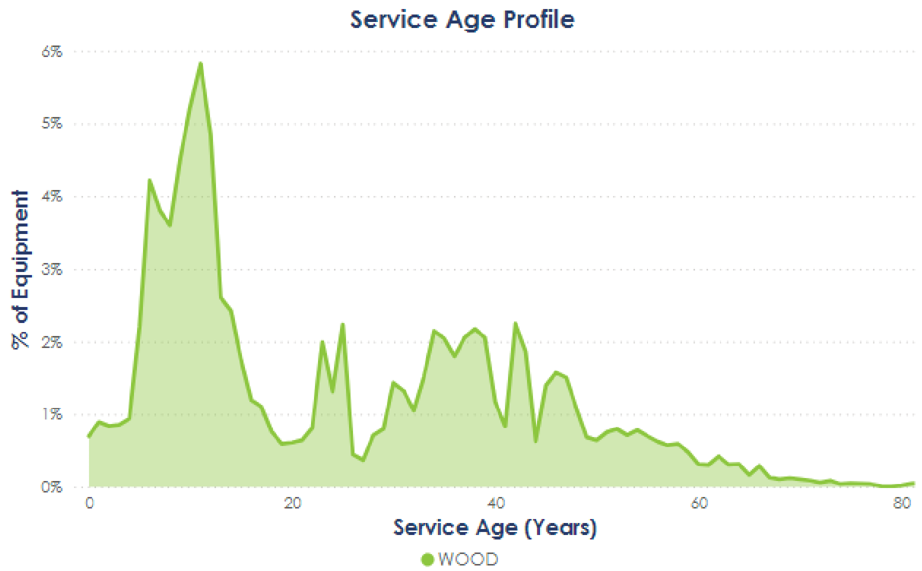

Figure 6 - Wood Crossarm Age Profile

4.3.2.3. Composite Fibreglass Crossarms

The composite fibreglass crossarms were introduced as a trial in 2016.The composite crossarm range was specified as a like-for-like alternative to the timber crossarm range. The composite crossarms are at least the same strength as the timber crossarms, which are durable and are approximately half the weight compared to wood crossarms. Since the fibreglass crossarms were introduced less than 10 years ago, the performance is under continuous monitoring.

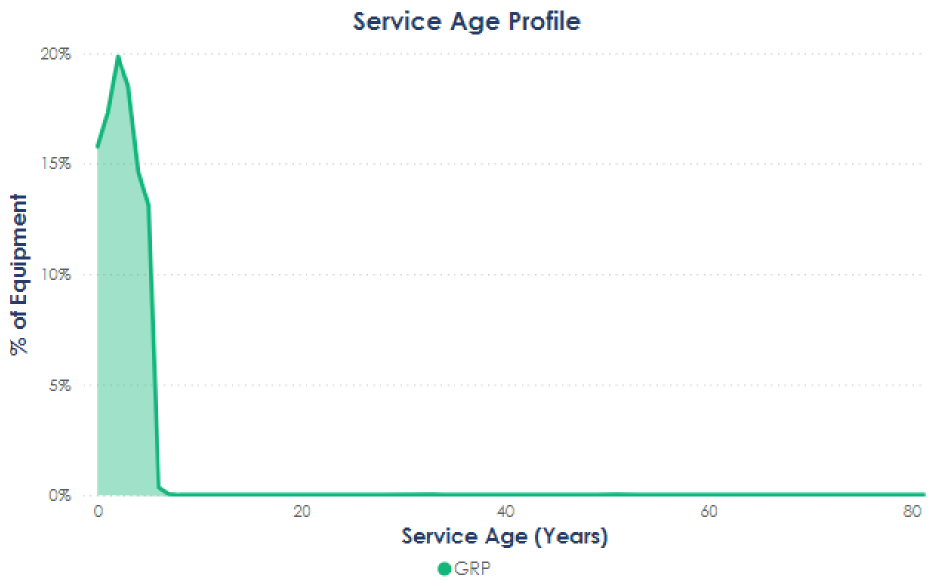

Figure 7 - Composite Fibreglass Crossarm Age Profile

4.3.3. Age by Voltage

4.3.3.1. Sub-transmission

The prevailing focus on replacing sub-transmission wood crossarms with galvanised steel units over the last decade has reduced the population of wood crossarms supporting 66kV circuits to less than 1% of the crossarm population.

The service age of this small population is shown in Figure 8.

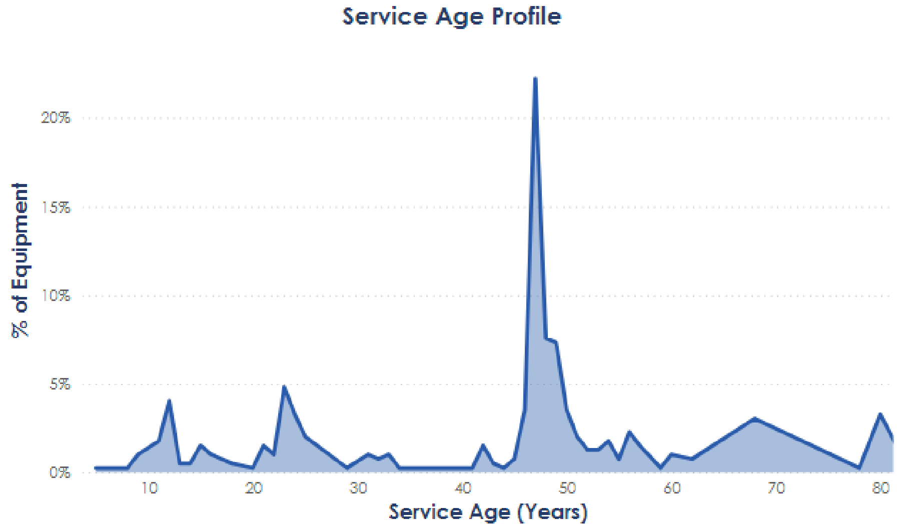

Figure 8 - Sub-transmission Wood Crossarm Age Profile

4.3.3.2. High Voltage

The prevailing focus on replacing HV wood crossarms with galvanised steel units over the last decade has reduced the population of wood crossarms supporting 22kV, 11kV and 6.6kV feeders to less than 4% of the crossarm population.

The service age of this fleet is illustrated in Figure 9..

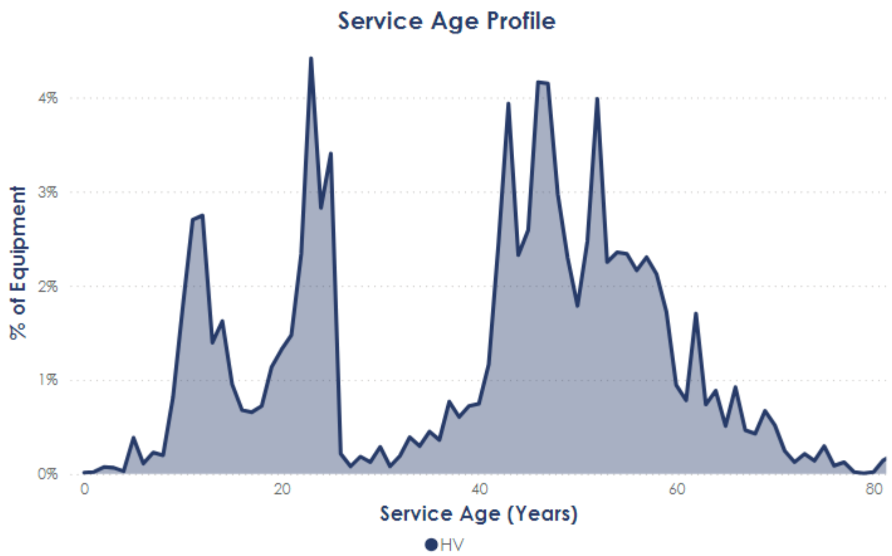

Figure 9 - HV Wood Crossarm Service Age

4.3.3.3. Low Voltage

Low voltage wood arms supporting LV circuits contribute approximately 35% of the crossarm population. The service age of this fleet is illustrated in Figure 10.

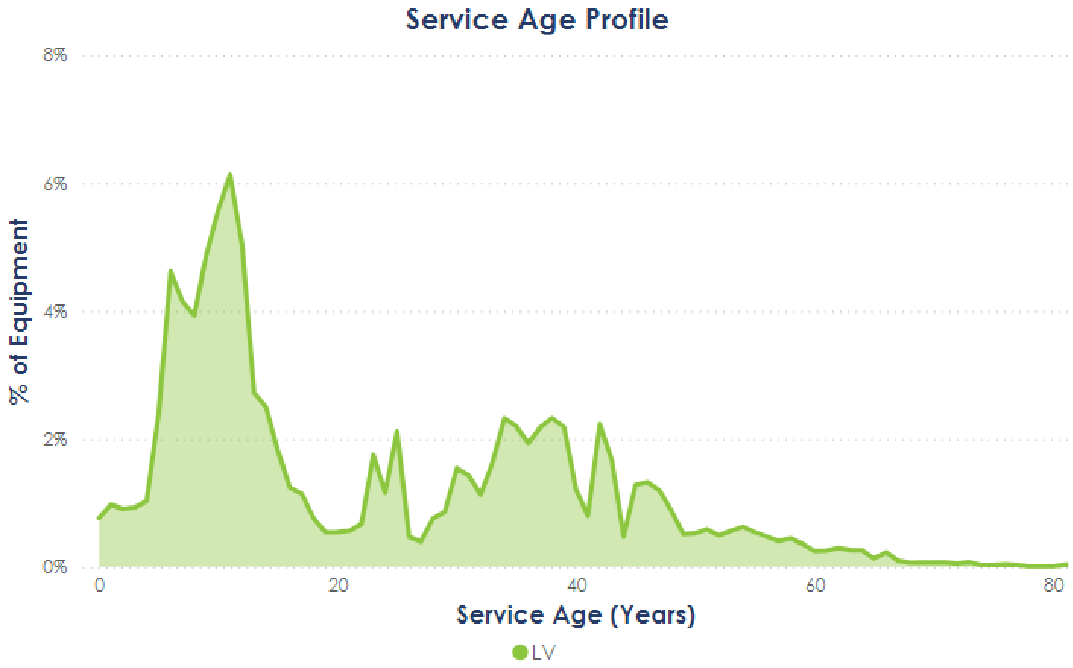

Figure 10 - Low Voltage Wood Crossarm Age Profile

5. Strategic Asset Management

5.1. Condition

5.1.1. Condition Assessments

5.1.1.1. Condition Assessment Protocols

Condition assessments are a critical element of lifecycle management for crossarms. These assessments provide vital information on the current state and performance of crossarms, 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 crossarms. AusNet employs a standard approach to condition assessments that employs a 5-point rating scale to assign assets a condition rating score.

The AusNet 5-point rating scale is designed to categorise assets based on their current condition and performance. AusNet's standard condition assessment protocol therefore follows these high-level scoring criteria:

Condition 1 (C1): A rating of Condition 1 indicates an asset in very good condition, typically with no history of significant defects or failures. Routine inspection and condition monitoring is recommended. The standard AusNet Asset Condition scoring card benchmarks the remaining useful life of Condition 1 (C1) assets at 95%.

Condition 2 (C2): A rating of Condition 2 reflects a better than average condition that neither require intervention between scheduled inspections nor show any trends of serious deterioration in condition or performance. The standard AusNet Asset Condition scoring card benchmarks the remaining useful life of Condition 2 (C2) assets at 70%.

Condition 3 (C3): A rating of Condition 3 signifies average condition, typically where the asset require some maintenance activity. Assets are showing signs of deterioration in condition or performance. The standard AusNet Asset Condition scoring card benchmarks the remaining useful life of Condition 3 (C3) assets at 50%.

Condition 4 (C4): A rating of Condition 4 indicates worse than average condition. Specialised work may be required to manage specific defects. The standard AusNet Asset Condition scoring card benchmarks the remaining useful life of Condition 4 (C4) assets at 25%.

Condition 5 (C5): This category includes assets, which are typically inspection and maintenance intensive. These assets are approaching the end of their economic life. Crossarm is being managed through to "Unserviceable" condition and get replaced. The standard AusNet Asset Condition scoring card benchmarks the remaining useful life of Condition 5 (C5) assets at 5%.

The condition scoring methodology outlined above provides high-level scoring criteria that can apply to all crossarms within AusNet's electrical distribution network.

5.1.1.2. The Standard Approach to Monitoring

The standard direction taken from the framework for condition assessment (as detailed above) can enable AusNet's lifecycle planners and asset managers to:

Standardise Assessments: Apply consistent evaluation methods across different types of assets, facilitating a unified understanding of asset health. Example: Using the same 5-point rating scale for both wood and steel crossarms ensures that assessments are comparable and standardised, helping to prioritise maintenance activities effectively. Another Example: Assessing the structural integrity and overall condition of crossarms can be standardised across similar structures.

Compare Conditions: Easily compare the condition of various asset classes and identify priorities for maintenance, repair, or replacement

Streamline Decision-Making: Use a standard set of criteria to inform investment decisions and resource allocation. Having a standardised guidance protocol is beneficial as it allows for the presentation of data across asset classes, enabling an "apples to apples" comparison. However, each asset class is unique, operating under different environments and performing distinct functions. Therefore, to truly understand the specifics of their condition, assessments may need to be tailored for each individual asset class.

5.1.1.3. 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 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, steel crossarms may be evaluated based on structural integrity and corrosion levels, while wood crossarms may be assessed for signs of rot and mechanical stability.
- **Detailed Inspections**: Conducting thorough inspections tailored to the 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.
- **Environmental Factors:** Considering the impact of local environmental conditions, such as exposure to coastal salt air for steel crossarms.

5.1.2. Condition Profile

To provide a consistent assessment of the condition of the whole asset group, a common condition scoring methodology has been developed. This methodology uses the known condition details of each asset and grades that asset against common asset condition criteria.

There are 5 different condition scores that have been applied to each distribution pole, ranging from "Very good" (C1) to "Very poor" (C5).

5.1.2.1. Crossarm condition summary

Figure 11 shows the overall condition of crossarm

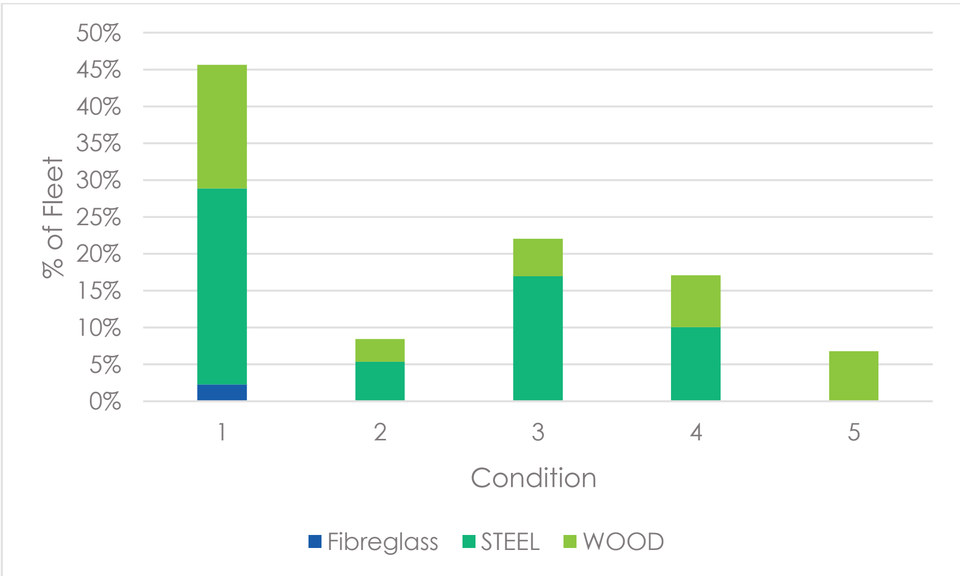

Figure 11 - Overall Crossarm Condition

5.1.2.2. Crossarm condition by type

5.1.2.2.1. Wood Crossarm Condition

Issues such as rotting, splitting and insect infestation determine the service life of a wood crossarm.

Figure 12 shows that approximately 51% of wood crossarms are assessed as 'Good' or 'Very Good' Condition (C1 and C2), 13% are in 'average condition' and 36% have been assessed as in 'poor' (C4) or 'very poor' (C5) condition.

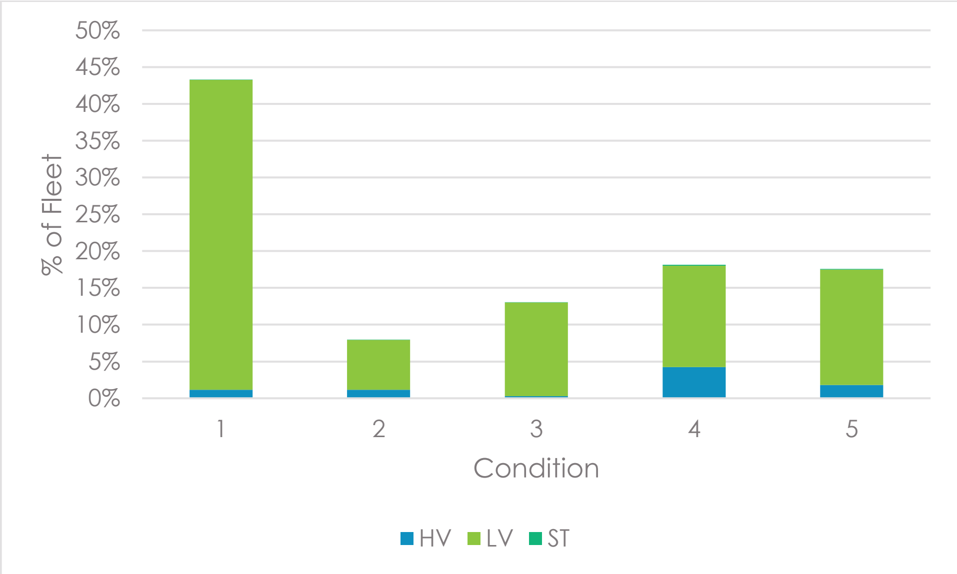

Figure 12 - Wood Crossarm Condition

5.1.2.2.2. Steel Crossarm Condition

Approximately 17% of steel crossarm population are considered to be in a 'below average' condition (C4 and C5) as shown in Figure 13. Overall, it is expected that steel crossarms will deliver long service lives as 54% of steel crossarms are assessed as 'Good' or 'Very good' condition (C1 and C2).

There have been two minor issues with steel crossarms:

- Poor galvanising: This issue has been addressed and was identified as a manufacturing defect, caused by poor cleaning of the bare steel crossarms prior to the application of the zinc coating.
- A number of HV crossarm end caps were incorrectly welded by the manufacturer and this issue has been rectified.

AusNet's has recorded damage to steel crossarms, which have buckled and bent due to abnormal loading e.g. a tree fell onto the overhead line, rather than deterioration of base material

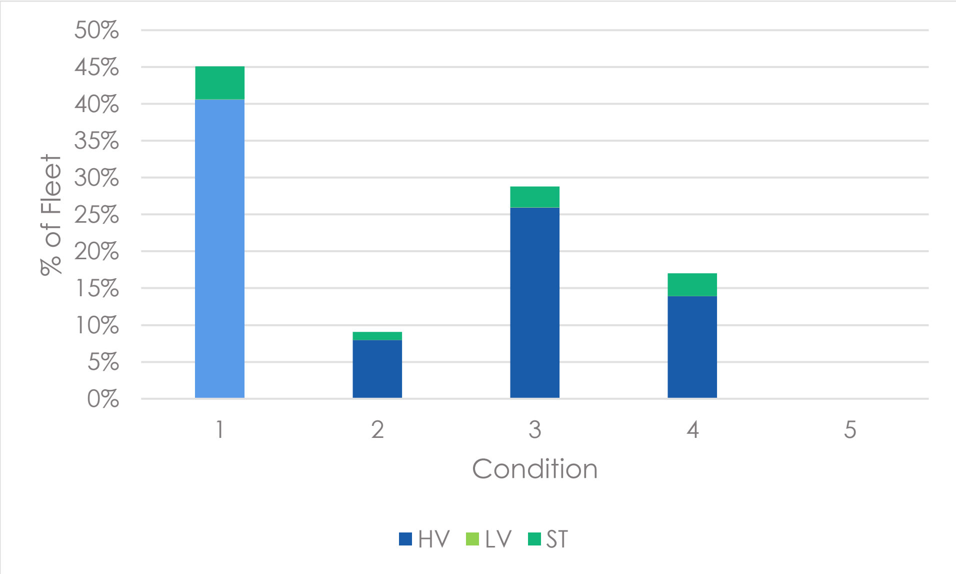

Figure 13 - Steel Crossarm Condition

5.1.2.2.3. Composite Fibreglass Crossarm Condition

The overall condition of composite fibreglass crossarm is 'very good' (C1). The performance is currently under monitoring.

5.2. Criticality

5.2.1. Failure Modes

5.2.1.1. Application of 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.

5.2.1.2. Typical Failure Modes by Asset Class

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 crossarms are detailed below.

- **Rot**: Wood crossarms can suffer from rot due to prolonged exposure to moisture and environmental conditions. This can compromise their structural integrity and lead to failures. It is usually detectable and failure is largely predictable as shown in Figure 14

Figure 14 - Wood Rot

- **Mechanical Failure**: Figure 15 shows a steel crossarm, which has suffered corrosion. The corrosion can only be seen from the underside of the crossarm, has been exacerbated by the presence of the animal cover as the moisture is retain after being wetted by rain.

Figure 15 - Steel Crossarm rusting under an animal cover

Mechanical damage due to external factors such as trees or vehicles is occasionally responsible for a bending failure as shown in Figure 16.

Figure 16 - Steel Crossarm Bending Failure

The predominant failure mode for wood crossarms is a fracture at a stress concentration point such as the kingbolt or insulator mounting, when mechanical loadings of conductors exceed the strength of deteriorating wood as shown in Figure 17 and Figure 18.

Figure 17 - Wood Crossarm Fracture

Figure 18 - Wood Crossarm Fracture at kingbolt

- **Termites:** East of Bairnsdale, Wodonga and Benalla districts have relatively high termite infestation rate sand some wood pole assets have required termite treatment. Termite attack is difficult to predict in crossarms and early detection is challenging for asset inspectors. Structural failure can occur within months of infestation and often well within a single routine inspection cycle
- **Crossarm Fires:** Crossarm failures can cause a fire start, which may result into a bushfire during a hot day. On December 2016, the Victorian Government published the "F-Factor Scheme order 2016" (the 2016 order). It targets incentives towards fire ignitions that pose the greatest risk of harm via ignition risk units (IRUs), which fire is weighted by a "location factor" and a "fire risk factor". AusNet has an average of less than a single ignition per annum due to crossarm failure leading to a ground fire since FY15 (Figure 19)

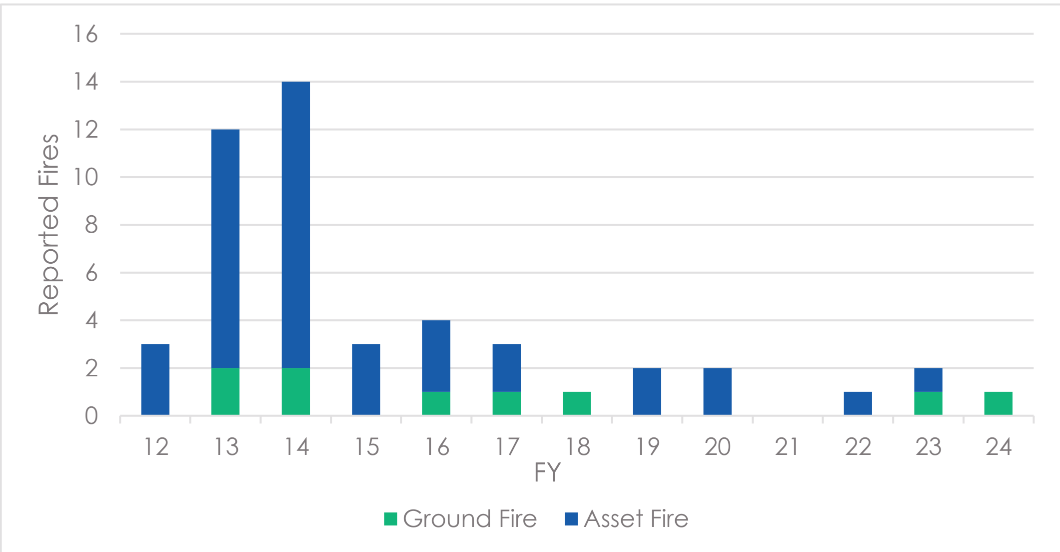

Figure 19 - Crossarm Fires

5.3. Performance

5.3.1. Performance Analysis

In the context of asset management for crossarms, 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 assets 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 the assets.

5.3.2. Performance Profile

5.3.2.1. Crossarm Failures

A crossarm failure or functional failure is when an asset is unable to fulfil a function to a standard of performance which is acceptable to user. The function of a crossarm has been defined in Section4.1.

The trend and breakdown of the causes of notification completed since 2018 is shown in Figure 20 and Figure 21. It is observed that the rate of failures has been reduced by around 59% since 2018. The major cause of notification is wood rot.

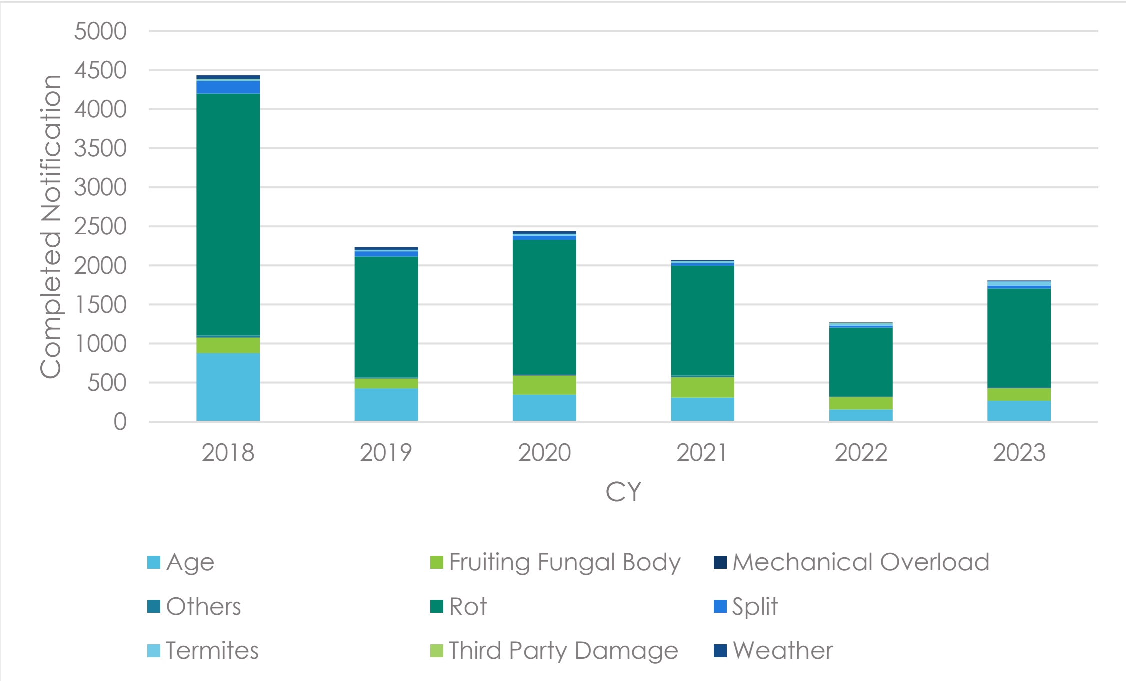

Figure 20 - Completed Crossarm related Notifications 2018 – 2023

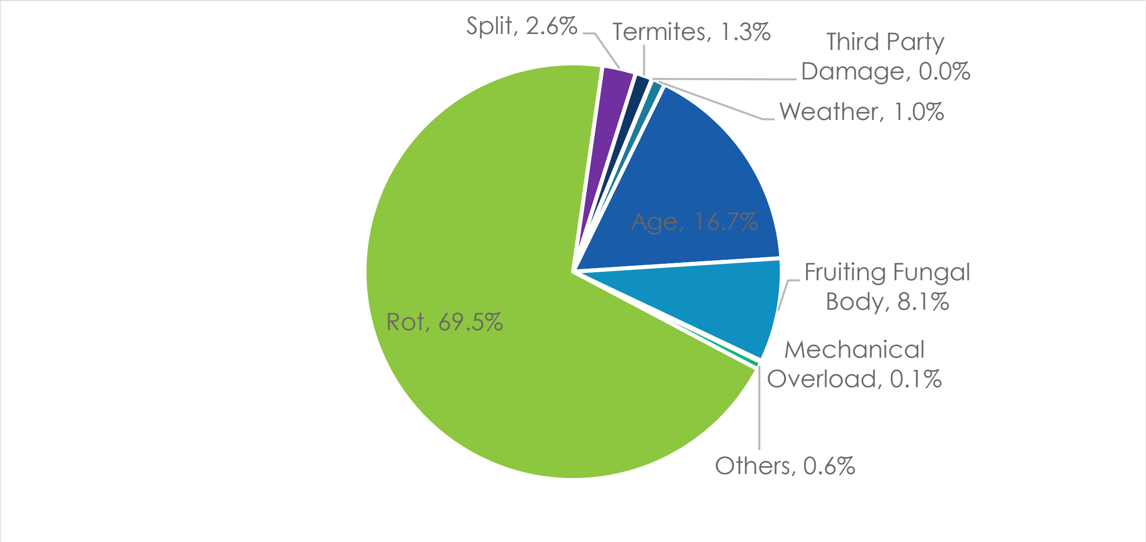

Figure 21 - Cause of Notification

5.3.2.2. Customer Impact

The failure of a crossarm affects the customer by two main ways, which is supply outages and the risk of starting an asset fire or ground fire. The introduction of aerial inspections on the crossarm fleet has been instrumental in lowering the number of failures in the fleet with positive outcomes.

6. Regulatory Framework

6.1. Compliance Factors

6.1.1. 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.

Pole Top Asset such as crossarm are inspected at regular intervals together with the pole. As the result of an inspection, inspectors may assign one of the below categories to the crossarm:-

- Serviceable (until next inspection); or
- Limited Life – Prioritised for replacement at
  - PT30 (within 30 days);
  - PT90 (<90 days);
  - PT180(<180 days); or
  - PT912 (re-inspection within 912 days)

6.1.2. 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 the regulations and Australian Standards can prevent unplanned failure and operational faults, enhancing network reliability. Inspection procedures are detailed in Asset Inspection Manual 30-4111and Standard Maintenance Guidelines SOP 70-03

6.1.3. Safety

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.

7. Asset Strategies

7.1. New Assets

The 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.

A list of targeted activities apply to new asset is shown in Table 2.

Table 2 - Targeted Activities on New Assets

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Install insulated underground cable or LVABC for new LV circuits eliminating the need to install crossarms
02	Install steel crossarms on new 66kV, 22kV, 11kV and 6.6kV circuits.
03	Continue to use and monitor the performance of composite fibreglass crossarms as a replacement for LV wood crossarms

7.2. 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.

A list of targeted activities apply on inspection and monitoring is shown in Table 3.

Table 3 - Targeted Activities on inspection and monitoring crossarms

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Inspect crossarms in accordance with criteria in the Asset Inspection Manual - 30-4111

7.3. 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.

A list of targeted activities apply on maintenance planning is shown in Table 4.

Table 4 - Targeted Activities on Maintenance Planning

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Maintain crossarms as per Asset Inspection Manual 30-4111 and Standard Maintenance Guidelines SOP 70-03

7.4. Replacement

A strategic asset strategy replacements provide 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.

A list of targeted activities apply to crossarm replacement is shown in Table 5

Table 5 - Targeted activities on crossarm replacement

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Replace deteriorated 66kV, 22kV, 11kV and 6.6kV wood crossarms with steel crossarms
02	Replace individual deteriorated LV wood crossarms with wood or composite fibreglass crossarms
03	On a case-by-case basis, use insulated underground cable and LVABC to replace groups of deteriorated LV wood

8. Risk and Options Analysis

8.1. Overview

The failure of a wood crossarm has a variety of consequences depending on the mode of failure, the surrounding physical environment and the location of the crossarm within the distribution network.

In an urban environment, HV crossarms support three-phase circuits with relatively high electrical loads and high customer densities. Hence, a failure usually inconveniences many customers and incurs a relatively high reliability incentive scheme penalty.

There are also more motorists and pedestrians in an urban environment and a failure may create a safety hazard due to low clearance conductors in public places.

Most LV crossarms are installed in urban environments. The failure of a LV crossarm has a lower reliability incentive scheme impact, as fewer customers are disadvantaged, but the public safety hazard is similar to that of a HV or MV wood crossarm failure.

A rural environment has a much lower customer density than the urban environment. However, rural HV feeders are considerably longer than urban feeders and thus the failure of a crossarm supporting a three-phase circuit near the source will disadvantage many customers and incur a high reliability incentive scheme penalty.

Many crossarms in the rural environment are located on single-phase spurs with few downstream customers and hence failures incur a low reliability incentive scheme penalty.

The public safety risk in rural areas arises from the potential for a wildfire ignition following a crossarm failure as well as from low clearance conductors.

8.2. Replacement Forecast

End of life replacements are forecasts based on observed condition at time of inspection. The possible result of an inspection is that a crossarm may fail and made unserviceable, or it remains as serviceable. Using historical failure data, Weibull probability distribution can be calculated.

9. Legislative references

STATE	STANDARD	REFERENCE

NO.	ACT	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.	ID (Link)	Title
1	30-4111	Asset Inspection Manual
2	AMS 01-01	Asset Management System Overview
3	AMS 20-01	Electricity Distribution Network Management Strategy
4	AMS 20-52	Conductor
5	AMS 20-57	Cross-arms
6	AMS 20-66	Insulators – High and Medium Voltage
7	BFM 10-01	Bushfire Mitigation Plan- Electricity Distribution Network
8	BFM 21-79	Bushfire Mitigation Manual
9	ESMS 20-01	Electricity Safety Management Scheme: Electricity Distribution Network
10	SOP 70-03	Standard Maintenance Guideline

11. of revisions

ISSUE	DATE	AUTHOR	APPROVED BY	DETAILS OF CHANGE
1	1995/96	D Postlethwalte	G Towns	Initial Document
2	27 Aug 2008	D Postlethwalte	G Towns	Revision – added RCM models
3	10 Sep 2008	J Kenyon	G Towns	Editorial by technical writer
4	11 Dec 2008	D Postlethwalte	G Towns	Revision of replacement forecast
5	27 Feb 2009	D Postlethwalte	G Towns	Update of failures and replacement
6	21 Apr 2009	D Postlethwalte	G Towns	Amended strategy for high consequence circuits
7	12 Oct 2009	D Postlethwalte	G Towns	Update of RCM models following ARMs Reliability Engineers review
8	25 Nob 2009	D Postlethwalte	G Towns	Added replacement forecasts to executive summary
9	15 Jul 2010	D Postlethwalte	D Postlethwalte	Update 2009 failures and replacement and proposed addition BFM replacements
10	30 Mar 205	D Erzetic-Graziani D Meade T Gowland	J Bridge	Majore revision including Dependability management
11	28 May 2019	F Lirios	P Ascione	Major revision to the content and format of the document
12		I Kwan		Major revision to the content and format of the document

AusNet Services

Level 31
2 Southbank Boulevard
Southbank VIC 3006
T +613 9695 6000
F +613 9695 6666
Locked Bag 14051 Melbourne City Mail Centre Melbourne VIC 8001
www.AusNetservices.com.au

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