Asset Management Plan

Overhead Line Support Structures – Distribution

Record Number: R2355521
Version Number: 5.0
Date: October 2022

Authorisations

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Reviewed by		20/01/2023
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Review cycle	30 months	

Responsibilities

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The approval of this document is the responsibility of the Executive, Operations.

Please contact the Asset Strategy Leader with any queries or suggestions.

- Implementation All TasNetworks staff and contractors.
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Reference documents

R954721 – TasNetworks Strategic Asset Management Plan

R40766 – TasNetworks Asset Management Policy

R909655 – TasNetworks Risk Management Framework

Record of revisions

Revision	Details	Date
5.0	Full Review of Original Issue October 2017 R260425	31/10/2022

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1 Purpose

The purpose of this document is to describe for distribution overhead line support structures and related assets:

- TasNetworks' approach to asset management, as reflected through its legislative and regulatory obligations and strategic plans;
- The key projects and programs underpinning its activities; and
- Forecast CAPEX and OPEX, including the basis upon which these forecasts are derived.

2 Scope

This document covers distribution overhead support structures, including poles and pole accessories.

3 Management strategy and objectives

This asset management plan has been developed to align with TasNetworks' Asset Management Policy, Strategic Asset Management Plan and Strategic Objectives. This management plan describes the asset management strategies and programs undertaken to manage the distribution overhead support structure assets.

For these assets the management strategy focuses on the following objectives:

- Safety will continue to be our top priority and we will continue to ensure that our safety performance continues to improve for customers, public, workers and bushfire risk
- Service performance will be maintained at current overall network service levels, whilst service to poorly performing reliability communities will be improved to meet regulatory requirements
- Cost performance will be improved through prioritization and efficiency improvements that enable us provide predictable and lowest sustainable pricing to our customers
- Customer engagement will be improved to ensure that we understand customer needs, and incorporate these into our decision making to maximize value to them
- Our program of work will be developed and delivered on time and within budget

4 Description of the asset portfolio

Line support structures provide support, insulation and adequate clearances between the overhead conductors, overhead switchgear and pole mounted transformers to the ground, surrounding vegetation and building infrastructure.

For asset management purposes, overhead line support structures are divided into 2 parts:

1. pole structures; and
2. pole accessories.

Pole top structures are in a separate Asset Management Plan (R2286926)

4.1 Pole structures

There are four main types of pole structures used in the distribution system:

1. Wood poles, including:

   - natural (untreated); and

- Copper-Chrome-Arsenate (**CCA**) treated.

2. steel and concrete poles (commonly known as Stobie poles)
3. concrete poles, including:
   - spun concrete;
   - pre-stressed concrete; and
   - FRP composite spun concrete (Titan) poles.
4. steel structures, including:
   - steel lattice poles;
   - steel lattice towers;
   - railway section (**RSJ**) steel poles;
   - round steel service poles; and
   - square section steel service poles.

There are some structures that are used also by other services such as communications cables and public lighting. Poles that support only public lighting are now privately owned assets.

The various pole structure types and quantities are shown in Table 1.

Table 1 Overhead line support structures installed in TasNetworks' distribution system (at 2021/22)

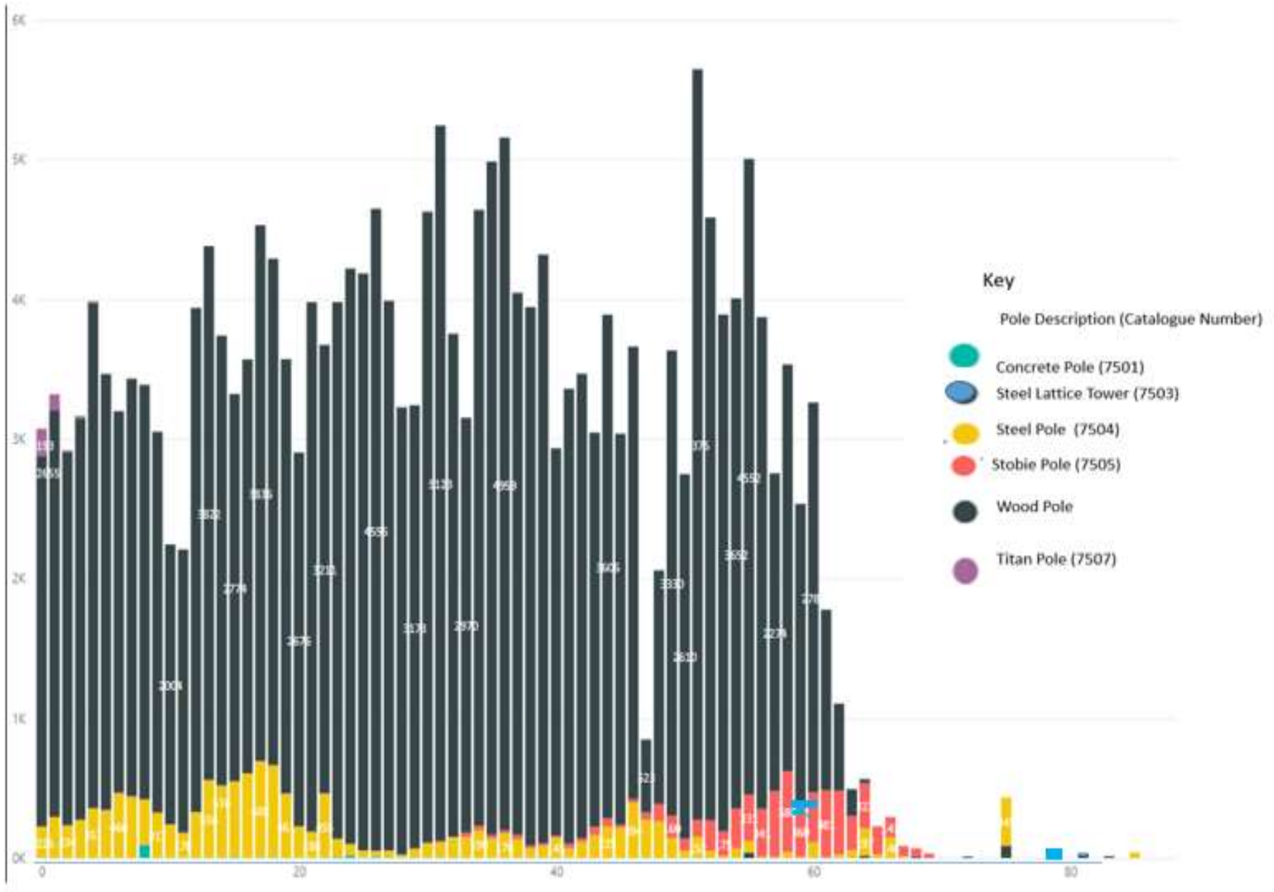
Support structure catalogue no.	Pole structure type	TasNetworks owned quantity	Percentage of total
7501	Concrete pole	158	0.07
7502	H-Pole[1]	300*	
7503	Steel Lattice Tower	214	0.09
7504	Steel pole[2]	16,478	7.08
7505	Stobie pole	6,189	2.66
7506	Wood[3]	209,342	89.93
7507	Spun Concrete Fibre Reinforced (Titan) pole	411	0.18
Total		**232,792**	

1 'H –pole' exist as a unified structure made up of two distribution poles. As each distribution pole is separately identified as a unique pole, their combined structure is excluded in this total to avoid double counting.

2 Steel pole includes steel circular and square section poles as well as high voltage steel lattice distribution poles (1500 less).

3 Wood poles are mostly CCA Treated Natural (TN) poles, with fewer than 2,865 untreated wood poles remaining.

Figure 1 Line support (pole) service age by installed date for Fleet Service Age Profile



The average service age of the pole fleet is approximately 32 years. The average pole service age at staking is 37 years. Staked poles have an expected life extension of 10 to 15 years, however 50 per cent of staked poles in service currently were staked over 15 years ago.

4.1.1 Natural wood poles

Natural wood poles are untreated eucalypt timber sourced from within Tasmania. The natural wood poles that were installed were of the ‘ironwood’ (Eucalyptus siberius) species, procured under contract from the St Mary’s district up until 1994. Originally these were sourced from old growth forest but in later years were sourced from regrowth timber.

It was soon discovered that poles sourced from regrowth forests had integrity issues, due to an increased susceptibility to heart rot. This has resulted in failures of natural wood poles in as little as seven years. Natural wood poles have no preservative, meaning that the sapwood is prone to deteriorate very quickly, especially below ground level. The sapwood is not included in the calculation of pole strength on these poles.

4.1.2 Copper-Chrome-Arsenate (CCA) treated wood poles

The use of CCA treated wood poles began in the late 1960s/early 1970s, as replacement for creosote treatment and untreated wood poles. Choices of pole chemical treatment, pole species and tested strength durability rating all influence the expected service life of wood poles. The majority of wood poles now in service are treated poles, with only 2,600 natural untreated wood poles remaining in service. Of these, the youngest untreated poles have been in service for 26 years.

The Australian Standard treatment used on the wood poles here is now pressure impregnated CCA. The specified treatment chemical density applied has increased over time, as shown in Table 2. There has been no SAA standard increase in CCA chemical density since 1993. This is a risk managed balance between pole service life, environmental amenity and end of life disposal, especially if subjected to bushfire. Earlier period treatment dated CCA TN poles and/or waterlogged poles can potentially face earlier condition-based condemning for earlier onset rot damage.

Table 2 Level of CCA treatment

Period	Average Treatment (kg/m^3)	Minimum Treatment (kg/m^3)
Pre-1970	10	6.5
1971-1980	12	8
1981-1994	15	10
Post-1994	24	18

Wood poles are rated by durability classes S1, S2, S3 and S4 timbers (as per AS5604 Timber – Natural Strength Durability Ratings). Tasmanian grown native species hardwood wood poles strength durability class used are S3 or S4. There are no Natural Durability Class S1 and S2 poles grown within Tasmania but some Class S1 and Class S2 poles were imported from the mainland for special design needs or post bushfire resupply.

4.1.3 Wood pole tree species and strength durability with CCA

Local natural Strength Durability Class 3 (S3) and Class 4 (S4) timbers have relatively less wood density, and should have a shorter service life expectancy than the Strength Durability Class 1 (S1) and Class 2 (S2) timber grown and used on mainland Australia. Currently about 80 per cent of wood poles in the TasNetworks network are locally grown S3 strength durability, and 20 per cent are local grown S4 strength durability. S3 wood resupply is becoming increasingly more difficult due to factors beyond the control of TasNetworks, resulting in an increase in the use of lower quality S4 poles (with shorter service lives). TasNetworks is implementing a shift to the use of non-wood poles in response to this issue.

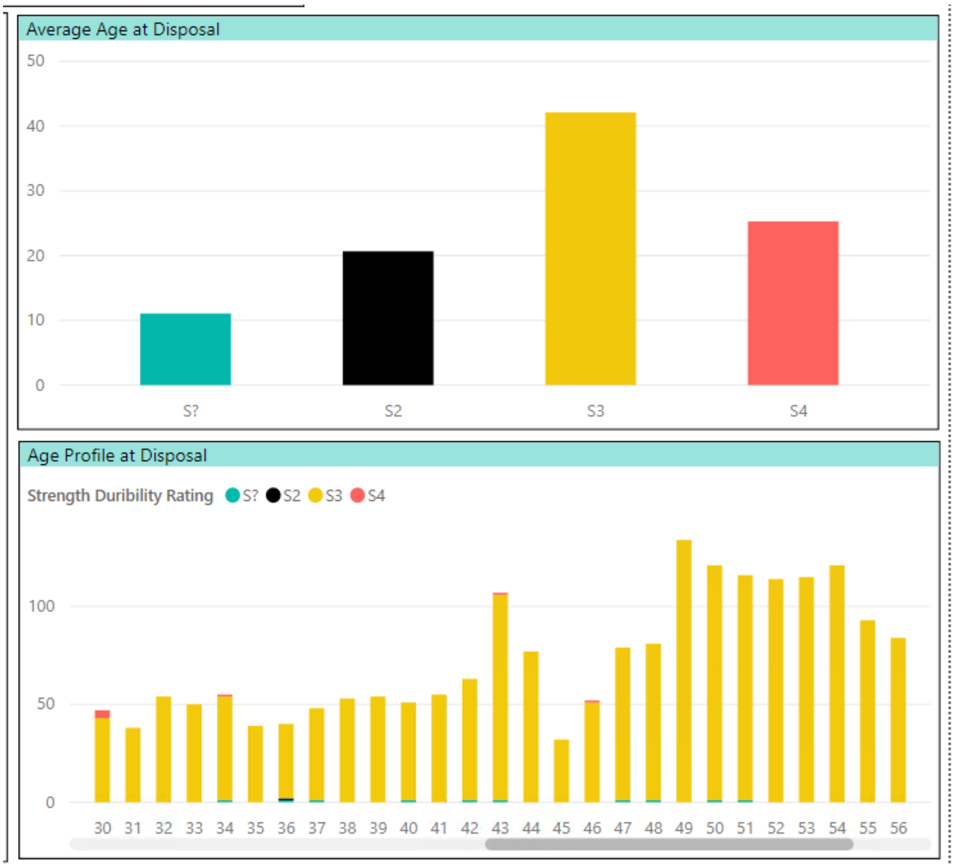
The majority of tree species poles used in TasNetworks' fleet now are presently S3 strength durability. Two species make up 77 per cent of the total. They are Brown topped stringy bark (**BT**) at 54 per cent of the wood pole population, and next is S3 strength durability Mountain stringy bark (**MS**) at 22 per cent of population. A few imported S1 /S2 species poles are in service for specific designs.

In TasNetworks, the average service age of S4 strength durability wood poles is now at 26 years at asset disposal. That appears to be about half that of an S3, which is now at 44 years at asset disposal, based on records for strength durability poles to date.

Figure 2 shows pole average service age at disposal for pole strength durability. It compares the average service age at disposal for the local grown "S?"4 (untreated wood), imported S2 and local grown S3 and S4 poles. (The smaller number of imported S2 poles data performance is indicative of a relatively shorter service life expectation here for imported wood species deployed in the local Tasmanian environment – 46 years here compared to about 60 years expected on mainland – and compared to local grown species S3 here for 44 years). The Pole Fleet average service age of TasNetworks' poles has risen to 32 years in FY 2022.

[4] The "S?" are untreated local wood poles felled and stood on site up to 1997

Figure 2 Average service age at disposal for untreated S?, S2, S3 and S4 poles and their presence in Pole Fleet age profile



About 2,000 imported S3 and S4 species CCA TN treated poles of NSW grown species were imported to fill a local supply shortfall after the 2019 bushfires. These will provide a trial for likely shorter service lives here. As an alternative to importing poles, about 86 CCA treated local plantation grown pine softwood poles in a HEC/Koppers long term trial of Tasmanian pole service life for strength durability class S7.

Carroty rot is the second major cause for condemning poles after termites in all mainland Australia. Tasmania does not have naturally occurring wood termites, so detected wood rot is the major cause of wood pole condemning.

4.1.4 Staking of wood poles

In Tasmania, without termites, most wood poles become impaired by wood rot growth, which is limited by moisture availability and antifungal treatment like CCA or boron. Wood pole moisture availability is mainly at or just below ground level in oxygenated soil zone to a depth of 350 to 450mm. Pole top wood rot is limited by moisture access and is so is a secondary risk, mostly in aged poles.

Proprietary designed and rated steel stake methods for staking of poles remediates rotted bases of poles to extend pole life. Historically, only short height above ground level driven into ground stakes have been used, and so continuing from near ground wood rot is periodically tested for near stake securing kingbolts.

4.1.5 Concrete and steel, spun-concrete and steel structures

These types of line support structures generally have a longer service life than wood poles and require minimal maintenance, other than the painting or re-galvanizing of the steelwork at ground line. However, they have a higher initial capital cost and require more careful handling during installation than wood poles. Concrete cover thickness and cover integrity are important for reinforced steel concrete pole life.

In particular, Stobie Poles that have an exposed mild steel design may have a short service life of 41 years. The Stobie poles made in Tasmania by HEC have lasted well with galvanized steel and are “plated” for ground line steel corrosion maintenance as needed in Tasmania. Local Stobie pole production stopped before 1997. There is a high incidence of use of Stobie poles in Hobart 33kV subtransmission, and as multi-circuit HV and subtransmission poles.

Steel and concrete poles require all conductive components to be earthed to ensure greater public safety, effective protection and safe operational activities while working on or near the pole. They also require greater insulation considerations between the conductors and the structure, particularly in areas where bird and animal wildlife interactions are an issue.

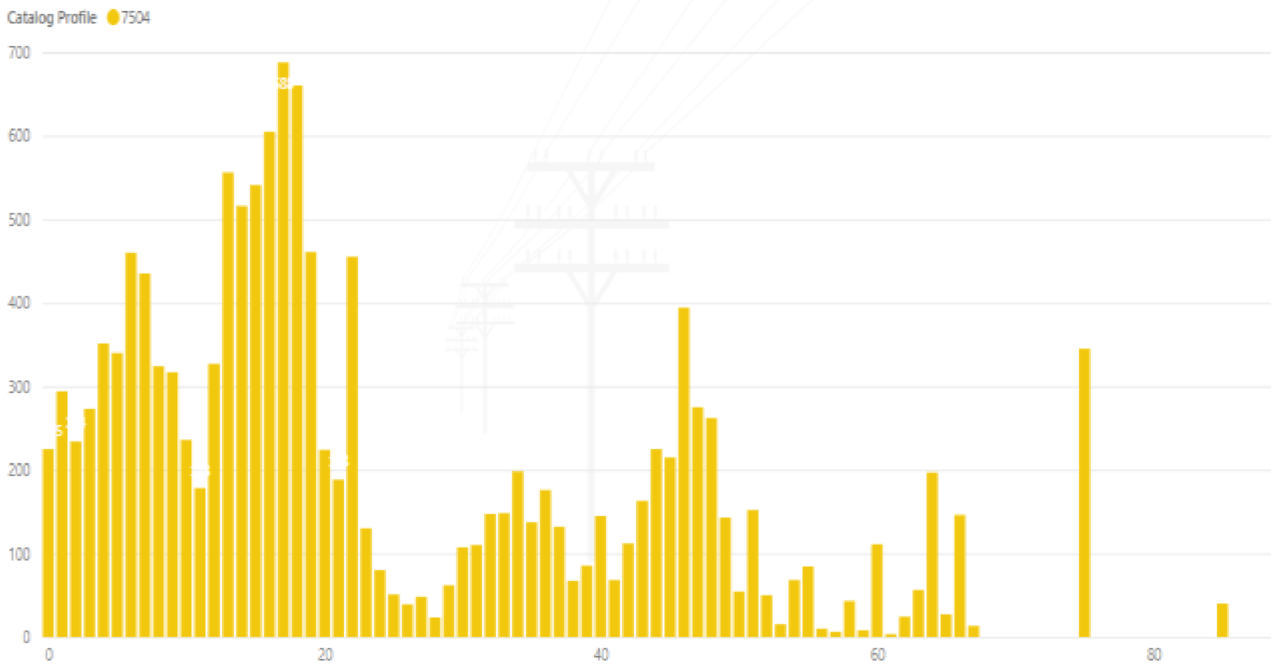
Steel hollow section poles are predominately used as service poles on the LV system as they have a small footprint on the streetscape and are easily manhandled in difficult situations.

Deterioration of steel, steel-lattice towers, and steel-concrete and spun-concrete poles is mainly due to corrosion and is dependent on the installation location and footing conditions. Corrosion occurs when both moisture and oxygen are present, typically in conditions from the ground level to approximately 300 mm below ground level. The existence of corrosion that occurs internally is hard to detect.

Acidic soil, dusts and coastal salt spray are sources of ground line corrosion. The extent of the resulting corrosion is normally limited to about 100 mm below ground level and generally will be found on the shaded south facing side of the pole.

The foundations for this class of pole are typically a concrete encased foundation with near ground level corrosion protection.

Figure 3 Steel poles by installed date age profile and locations



4.1.6 RSJ steel poles

Steel poles made from railway section (**RSJ**) poles, have been banned from being used to support electricity service lines in new installations. This is because of railway steel’s inherent risk of fracture due to its brittle nature.

Second hand railway steel sections have been used previously for service poles, crossover poles and private poles for many years. While the section and strength would appear to be strong enough for some applications, experience shows that second hand rail may not be safe due to the metal's brittleness.

Around Australia, there have been a number of incidents of brittle fracture when rail sections have been subjected to additional shock loading, for example, failures when a ladder is placed against a pole and when making changes to pole top arrangements. A rail section also has a relatively thin bottom flange that is more susceptible to corrosion (particularly near ground level) than other parts of the pole. Any significant corrosion leads to some reduction in cross section of the flange that reduces the strength of the pole. Some rail sections were manufactured with notches at intervals along the bottom flange. These notches were used to facilitate breaking the rail into lengths and, as a consequence, are a weak spot. The welding of railway section steel poles can also cause a reduction in the cross-sectional area that is similar to a notch, in terms of its impact on the strength of a pole. Welding can also make the steel more brittle.

Most existing RSJ steel poles support older, lighter conductor services, often with a wooden raiser to increase ground clearances. They may be of inadequate strength for the heavier 25 mm^2 standard aluminium services now used. As services for the heavier 25 mm^2 standard aluminium services are planned to be augmented, a matching design pole change will see the RSJ pole population phased out.

4.1.7 Lattice steel poles & ex-transmission steel lattice towers

A small number of lattice steel distribution poles and repurposed ex-transmission lattice tower structures remain in service as part of the distribution network. These structures have a longer service life and are more fire resistant compared to wood poles. Transmission–style asset inspection and treatment methods are used for these structures.

Of the steel lattice towers remaining, most are in former 88kV transmission line sections reused as 22kV HV feeder line sections. The cost of refurbishing ex-transmission towers, especially with tower leg footings, can be high when compared to replacement with a new distribution pole. Table 3 lists the former transmission lines of steel lattice towers used in HV distribution feeders.

Table 3 Former transmission line Towers and asset age now used as HV distribution lines

Tower Line No	NAME	(kV)	No of Towers	Installed	Age (years)
586	Rowallan/Fisher	11	53	1968	55
588	Railton/Needles	22	108	1947	76
589	Georgetown/Longreach #	22	17	1954	69
590	Trevallyn/Prospect	22	23	1937	86
594	Knights Road/Huonville (11 kV)	11	8	1941	82

4.1.8 Fibre glass reinforced (Titan) poles

The current non-wood pole alternative used by TasNetworks is the 'Titan' pole. It is a fiberglass reinforced (**FRP**) spun concrete composite pole. The 'Titan' pole is type tested to ENA Guide Bushfire Type Test. They are also type tested electrically insulated, weigh approximately two thirds of the weight of a wood pole equivalent, require less maintenance over a longer service life and are capable of helicopter lift installation in remote locations.

4.2 Pole accessories

The accessories associated with structures are:

- stays;
- pole stakes;
- pole operating platforms;
- fauna guards;
- anti-climbing barriers and signage; and
- pole caps.

4.2.1 Stays

Poles and structures are graded by their ability to withstand the forces placed on them by conductors and pole mounted equipment. Where the natural strength of the pole or structure is inadequate to withstand these forces, additional measures such as stays and guys are used in conjunction with the pole or structure. Unless installed with back up (n-1), stays need to be visually inspected aboveground and by non-destructive testing methods to assess their condition, to avoid the need for age based replacement or replacement on failure.

4.2.2 Operating platforms

Pole operating platforms have been used previously to provide a safe working platform for overhead line workers working on the overhead system. These are now deemed to be unsafe as they are unmaintained and are progressively being removed from the system. Current instruction is to no longer install them and to remove them when working on a pole for planned works.

4.2.3 Fauna guards

Fauna guards are accessories installed on a structure to prevent animals and birds interfering with electricity assets and include:

- possum guards (also functions as a rat, quoll and cat guard);
- cattle/horse guards (poletop/conductor clashing from animal rubbing on stay); and
- bird perches (to provide perching away from energized conductor).

Possum guards are installed on wooden poles carrying uninsulated HV conductors and equipment to prevent possums from climbing up the poles. A possum guard can inadvertently increase moisture retention accelerating wood rot if applied too tightly so inspections under possum guards have been completed previously to ensure correct installation.

Cattle/horse guards are installed on stayed poles located in areas accessed by livestock to prevent larger animals from rubbing themselves against the pole stay, potentially causing a clashing of conductors. When a pole is stayed, stay sighters are installed on the stay to prevent possums from climbing the stay to access the pole-top.

Certain birds such as raptors (eagles, goshawks, owls and kites) tend to use poles and cross arms to perch and survey the surrounding area to hunt for prey. Bird perches are installed on pole tops to provide a safer location on the pole for the bird to land without the risk of contact with live conductors. Poletop perches are angled to suit the location’s prevailing winds and to help hunting birds select targets that will direct them away from diving through conductors.

4.2.4 Anti-climbing barriers and signage

Anti-climbing barriers and signage for people are required for steel lattice towers to discourage and prevent unauthorised access to these structures.

Section 8.4.3 of ENA Guidelines for Design and Maintenance of Overhead Distribution and Transmission Lines AS/NZS 7000 requires that "Provision shall be made on all climbable structures for the fixing of signage and devices to ensure the protection of the public from hazards associated with access to electrical works, and to provide public awareness of operational safety issues".

4.2.5 Pole caps

Pole caps prevent accelerated pole top rot by preventing water ingress into splits and cracks in wood pole tops that would otherwise collect water from rainfall, hail, snow and mist. The pole caps protecting wooden pole tops are gang nailed in place to reduce pole top opening due to splitting and cracking as the wood ages. Most pole caps are made of galvanised steel and nailed to the wood pole top. These are subject to rust and the loosening of nails with wind and wood aging. Some modern plastic pole caps are in service. The rusting out and/or loss or absence of a pole cap is a reportable inspection defect, with relatively low priority and longer maximum time to replace. However, excessive time spent without a pole cap can reduce wood pole service life by allowing the entry of moisture, leading to accelerated pole top rot.

4.2.6 Intumescent coating

Intumescent coatings are applied from 150mm below ground line to about 1.8 metres above ground to reduce the risk of CCA after-burn from ground level fires, such as fuel reduction burns and lower intensity bushfires.

Fire Shield grey was selected and used for an intumescent coating of 22kV wood poles as part of a Queenstown to Strahan Feeder trial in South West Tasmania. In 2020-21, 88 wood pole on the 22 kV radial feeder between Queenstown and Strahan were retrofitted in situ with the intumescent coating, including all equipment poles as critical support structures. The use of an Intumescent coating is one option in SAA HB 331:2020 for bushfire risk mitigation for wood (or steel) poles.

5 Associated risk

5.1 Risk Management Framework

TasNetworks has developed a Risk Management Framework for the purposes of assessing and managing its business risks, and for ensuring a consistent and structured approach is applied to the management of risk.

An assessment of the risks associated with the distribution overhead line support structures has been undertaken in accordance with TasNetworks' Risk Management Framework. The quantification of risk is supported by the Health Based Risk Management (**HBRM**) framework. This approach allows the risks of individual assets to be quantified against the defined assessment. This asset management plan describes the major risks associated with distribution overhead line support structures current or proposed treatment plans.

5.2 Performance data

Performance information, which include historical failure rates, defect trends and incident investigation reports are included in risk assessment to support program justification.

5.2.1 Poles

The main mechanisms of failure in poles are:

- natural wood and treated wood poles rot over time (combination of internal and external, often undetected internal carroty rot);
- corrosion of Stobie or steel poles or steel lattice pole bolts;
- corrosion of steel lattice grillage footing;
- cracking of steel reinforced concrete poles;
- vehicle and machinery impact (Third party impact);
- lightning strike on timber poles;
- flood damage to pole footings (water erosion and debris flood resonance);
- pole burnt due to fire;
- tree falls on pole or stay;
- pole footing failure;
- excess wind stress leading to pole footing failure; and
- loss of a support for a fully supported pole (conductor attachment or ground stay).

The impact or consequences of a pole failure may include: network outages, injury or fatalities, damage to other TasNetworks plant and equipment, damage to third party assets, starting a bushfire, financial impacts for outage penalties and emergency replacements.

The mitigation or elimination measures include:

- periodic visual inspection for visible structural defects;
- periodic destructive tests of wood pole with tap and drill, modified by use of IML Resistograph PD 300;
- non-destructive tests for detection for carroty rot;
- corrosion painting of Stobie and steel poles (as used in an earlier program);
- the addition of vehicle barriers where there Is a high likelihood of a vehicle impact;
- vegetation management to eliminate or reduce the likelihood of trees striking poles;
- replacement of critical wooden poles in bushfire prone regions with less flammable poles;
- wood sample Carroty Rot DNA ID assessment tests;
- intumescent Coating wood pole at ground line;
- buttress footings to mitigate pole flood resonance, debris and water erosion of footings; and
- Increased pole attachment heights for flood crossing span lift.

5.2.2 Stays

The main mechanisms of failure of stays are:

- stay (7/12 old style) broken by livestock rubbing on it;
- incorrectly installed Screw-In-Stays;
- stay (bow) wooden anchor block rots over time;
- cattle rubbing on stay causing pole-top movement and conductors to clash;
- aerial stay (horizontal part) eye bolts (smaller old style) pulling through poles when poles dry out and split;

- corrosion of steel components below ground;
- detachment from cracked concrete anchor blocks or wood baulks; and
- flood debris build up and water flows eroding footings.

The impact or consequences of a stay failure may include: network outages, injury or fatalities, damage to other TasNetworks' plant and equipment, damage to third party assets, bushfire starts (through the stay failure causing a pole failure), financial impacts for outage penalties and emergency replacements.

Risk mitigation or elimination measures include:

- trial of periodic Non Destructive Testing (NDT) using ultrasonic, microwave or gamma beam devices;
- painting of stays and early detection of corrosion;
- the addition of vehicle barriers where there is a high likelihood of a vehicle impact;
- barriers to prevent cattle coming in contact with stay poles;
- replacement of stay poles with stronger poles that no longer require stays; and
- installation of n-1 reliability with duplicated stays.

The risk mitigation measures presently used are described in detail in Distribution Overhead Design Manual, and Asset Inspectors Pole Inspection Training Manual.

5.2.3 Pole stakes

The main mechanisms of failure of pole stakes are:

- pole stake corrosion;
- loose pole stake bolts;
- Build-up of debris behind pole stakes (rot and vandal fire hazard);
- flood resonance; and
- undetected wood pole wood rot at attachment points (stake kingbolts).

The impact or consequences of a pole stake failure may include: network outages, injury or fatalities, damage to other TasNetworks' plant and equipment, damage to third party assets, starting a bushfire, financial impacts for outage penalties and emergency replacements.

The mitigation or elimination measures include:

- clearing of debris around stakes;
- non-destructive tests for detection for carroty rot;
- painting or other corrosion prevention techniques;
- inspection of bolts to detect loose connections;
- vegetation management to eliminate or reduce the likelihood of trees striking poles; and
- replacement of poles due to condition or age which eliminates the need for the stakes.

5.3 Summary of risks

Appendix A provides a summary of programs, risk drivers, risk level before and residual risk level after program controls. The program specific overhead line structure risks, the mitigation strategy and residual risk levels, are detailed in specific Investment Evaluation Summaries:

R24-D_OH_REPOL _Complex Design, Document Number R2295899

R24_D_OH_REPOL_Replace-Pole_ Fault, Document Number R2295874

R24_D_OH_REPOL_Basic Fleet-Pole – Replacement, Document Number R2295853

R24_D_OH_RESTK_Pole Staking, Document Number R2295859

R24_D_OH_REPOL- Replace Pole FRC Basic Fleet Pole – Document Number R2022545

5.4 Condition based assessment

Given the uncertainties in the detection of internal carroty wood rot and the variations in DNA ID rotting rates, some poles measured to be between a Safety Factor of 3.0 and 2.5 are deemed **"**Intermediate Safety Factor" poles and are, therefore, re-inspected at shorter 2.5 yearly intervals.

These Intermediate poles include any remaining natural untreated wood poles (now only 3,000 poles still in service) and advanced rotting in-service CCA wood poles.

A decision to stake or replace an intermediate pole is presently made at a Safety Factor of 2.5, or if the pole is deemed as a "fully supported" pole, if its remaining wood annulus is greater than the minimum thickness required for avoiding vertical collapse in its designed loading.

A staked pole can deteriorate again at stake securing attachments to re-enter the Intermediate pole range when its Safety Factor again declines below 3.0 at stake securing heights, as wood rot progresses.

A life cycle history review of 4,000 poles showed that wood poles typically stay at a high level Safety Factor for many years, then they can reach condemned Safety Factor for staking or replacement in only two regular inspection cycles (10 years). This supports the need to manage Intermediate Safety Factor poles via a shortened inspection cycle (currently 2.5 years) when the Safety Factor drops below 3.0.

Figure 4 Number of Poles with a Safety Factor of less than 3.0

Table 4 shows the Asset Inspectors' condition–based actual numbers of poles replaced and poles staked. Trending is a slow fall in the condition based staking of poles per annum, and a rise in the number of condition based poles condemned and replaced per annum.

Table 4 Poles Inspected, condemned pole replacement and staking rates

Description	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Number of Poles Inspected	62,951	64,975	39,247	51,171	65,853	56,642	47,641
Number of Poles Staked	1,187	867	787	608	644	533	435
Number of Poles Replaced	830	1,166	2,320	1,523	1,519	1,930	1,923

5.4.1 Variations in condition based pole replacement and staking

The trend in actual numbers of condition based pole condemning and condition based pole staking can be used in forecasting likely future trends. An underlying asset condition deterioration based bow wave is detectable. Drought cycle has some variation impact by water dependent growth or dormancy in wood rot that is detectable, in particular visible external soft rot/ carroty rot, or increased rate of pole top leaning and /or cumulative pole splitting.

5.4.2 Forecast pole replacements and pole staking

Pole staking rates have remained largely stable over the longer term, however, more recently the annual staking volume has been in decline (based on condition assessments over the last 4 years). The number of previously staked poles being condemned annually has been increasing in response to the age and condition of stakes installed in the early 2000s, and the total staked pole subpopulation has hence slowly dropped to now just below 30,000.

5.5 Other risks

5.5.1 Pole top fires

Loose bolts (due to wood shrinkage), broken ties (causing energized conductors to dislodge) and excess salt air pollution can all cause leakage current to flow, with the resultant overheating of wood in bolt holes potentially causing pole top fires. The selection of insulated non-wood poles and non-conductive cross arms can reduce the incidence of pole top fires.

5.5.2 Bushfire risk and asset resilience

TasNetworks' bushfire mitigation framework has been overlaid onto the TasNetworks Asset Management framework to show the direct relationship between the two. Overhead Line support structures can be vulnerable to fire risk and asset failure may be a cause of fire risk.

In the 2018-19 bushfires 118 TasNetworks wood poles were lost to fire. Approximately 100 wood poles were also lost in bushfires in 2016 and in the 2013 Dunalley Bushfire around 400 poles were lost to fire. The highest pole loss in Tasmania to bushfires was on 7 February 1967, when 5,000 wood poles were lost in the *Black Tuesday* bushfires.

Table 5 shows the wood pole population in the High Bushfire Loss Consequence Area (**HBLCA**) by critical structure type and location. There is a subtotal of 3,608 wood poles located in the HBLCA that are critical structure poles.

The current strategy is to use non-wood poles when replacing equipment poles or other critical poles in the HBLCA. This will be expanded during the next regulatory period to all replacement poles in the HBLCA and equipment and other critical poles in high fire risk areas. An alternative is to apply a preventative bushfire resistant (intumescent) coating treatment of wood poles in situ when replacement is not yet required.

Table 5 Wood pole population by critical structure type and by location in HBLCA

TN Wood Poles	Total in network	Located in HBLCA	Located in Other areas
Equipment structures	13,483	2,376	11,107
High stress structures	7,000	1,232	5,768
Other poles	199,517	35,272	164,245
Total poles	220,000	38,880	181,120

Where a new replacement or an existing wood pole exists with an expectation of significant remaining service life, the retrofitting of an intumescent coating for at least the first 1.5 to 2.5 metres of pole height above ground level offers added afterburn resilience from ground line vegetation fuel reduction burns, as well as low intensity bushfires.

5.5.3 Condemning rate

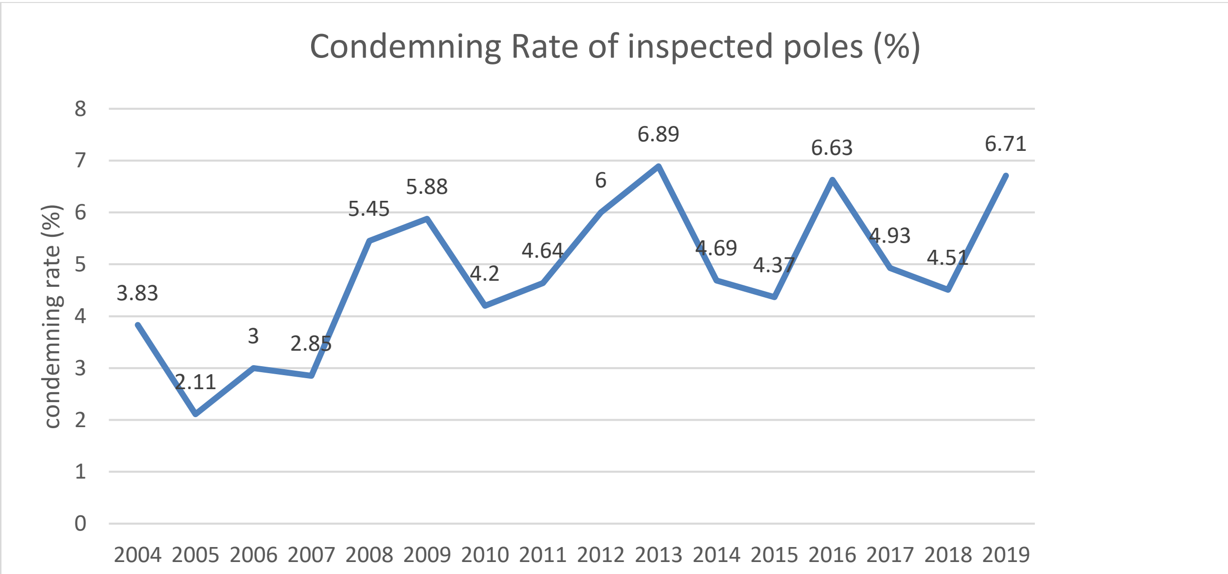
Wood rot as undetected soft rot is the cause of over 50 per cent of unassisted pole failures and a contributor cause in the rest from mechanical splits. 54 per cent of the poles condemned per annum are for detected wood rot. Undetected wood rot is a significant factor in assisted pole failures in extreme events like storms, along with tree impact. Figure 5 shows unassisted pole failures from undetected carroty rot.

Figure 5 Wood poles that has failed in service from rot

The rate of condemned/impaired wood poles has been reviewed and a variation pattern identified in the impairment rate based on moisture content due to seasonal rainfall, and possibly local irrigation variation. Aging poles are also prone to more cumulative wood splitting for increased moisture access.

The longer term trend of the annual pole condemning rate for the number of poles inspected is increasing over time as shown in Figure 6 below. This is in part due to the pole fleet aging and the trend is forecast to peak in 2027-28 before reducing.

Figure 6 Actual rate of condemned/impaired wood poles



5.5.4 Wood rot

Diffusible fungicide chemical treatment rods are used for treating drilled inspection holes, as well as wood treatment drilled holes, to delay the onset of wood rot. The chemical treatment for treating an established wood rot infection is per chemical suppliers' instructions and warranty for rod replacement period. The diffusible chemical rods system used in Australia is a combined Fluoride/Boron chalk rod. This system has been in use in Australia for over two decades and remains the most widely used internal remedial treatment in the country. The premise with this system is that the boron and fluoride move through the wood at different rates and have differing degrees of activity.

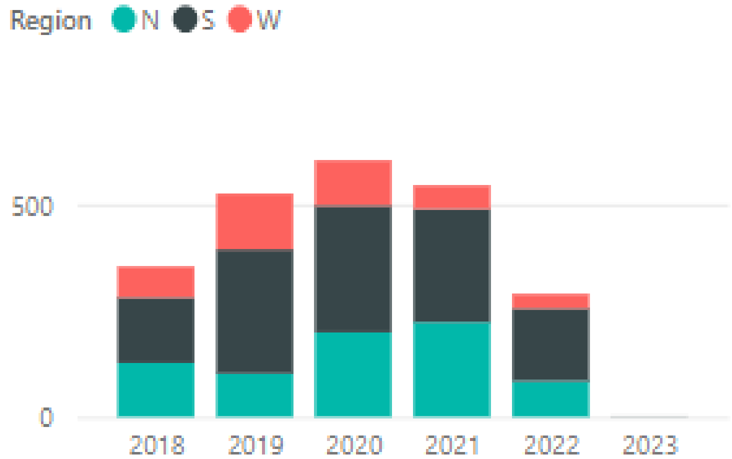
Recent research suggests Boron tends to move primarily downward from the point of treatment. The chemical treatment Boron-Fluorine chalk rods are placed in treatment drilled holes above inspection hole drillings levels and in the drilled inspection holes.

An alternative diffusible fungicide chemical treatment to the insertion of a Boron Fluoride Chalk Rod (or a Boron Fluoride Glass Rod as a five yearly refresh) is instead to use a Copper-Boron Glass Rod similarly placed into holes drilled in wood poles, as used in North America, with longer, possibly ten yearly, refreshes. Although approved for use in North America for decades, Copper-Boron Rod still awaits approval for use in Australia. The trialing of Copper Boron Glass Rods is a preliminary step toward a likely future introduction of a copper-tolerant biocontrol, as recommended by the University of Tasmania Research Final Report in 2018.

5.5.5 Leaning poles

Pole failure history indicates pole failures are more likely to occur in extreme winds, especially in the case of excess leaning poles with water saturated soil profiles. In AS7000:2016 distribution wood poles can be designed with partial pole footing failure by design in sag clearance allowances, as a cascade failure containment feature in the overhead line tension section line supported. A leaning pole measured at more than 6 degrees from vertical is a reportable defect. Figure 7 shows leaning pole defect volumes.

Figure 7 Poles leaning more than 6º (4 pole top diameters) by region and year



Leaning wood poles are mainly caused by problems associated with soil profile and foundation design strengths, backfill medium, compactness at the foot and heel of the pole and inadequate counterforce infrastructure (stays, baulks, etc.). Footing erosion, excavations and undermining can also be factors.

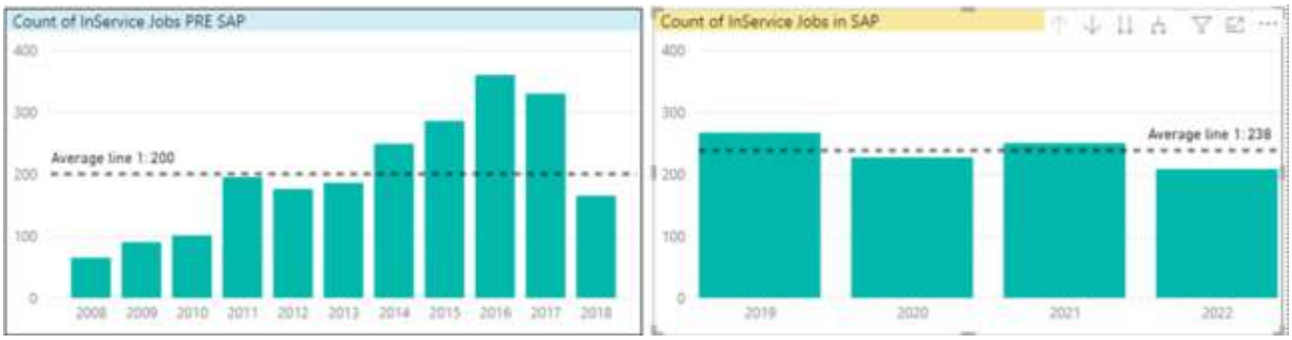
Historically, there has been a policy of condemning any leaning pole that was over 10 years old, regardless of its condition. This policy has now been replaced and the condition of the pole rather than the age is now the decider as to whether the pole is suitable for straightening.

Approximately 200 leaning poles are recorded per year and currently a defect pool exists of approximately 750 leaning poles. This category of work has historically been done under overhead asset repairs (**RMPOL**), ALARP risk priority defects higher priority tasks being completed first. The pole angle leaning rate of change is assessed between inspections.

5.5.6 Pole failures

Figure 8 shows that from 2018 to 2022 total pole failures (assisted and unassisted) has stabilized at approximately 200 poles per annum.

Figure 8 Annual pole failures from 2008 to 2022



Trends in pole condition and pole failures (such as during major wind storms, floods, bushfires, and other extreme weather events) are also monitored for grid resilience, and storm hardening needs for climate change policy action list. In the 50 years ahead maximum wind velocities, return frequency, more frequent and more severe droughts mean bushfires and intervening wet period higher floods are likely to rise.

5.5.7 Pole top wood deterioration

Use of CCA treatment is still new, comparable to pole service life. Pole top wood deterioration uses visual risk assessment to detect progressive pole top tilt at load attachment points and for an excess of cumulative splits.

5.5.8 Pole splits

Wood pole splits from high wind velocity impacts and any continued wood drying increase over time. As wood poles increase in service life, a reduced wood fibre strength is compensated by increased wood splits to assist "tree" trunk survival in strong winds stress. Pole splits can be mitigated by the application/use of pole bands. A field trial for pole bands as retrofit or preventative support (applied especially near major load bearing dressings on pole tops) to contain the rate of wood split opening is proposed.

5.5.9 Pole selection

Analysis has been performed comparing the annual equivalent cost for imported S1 and S2 wood poles, local S3 and S4 wooden poles, concrete poles , steel poles and FRP reinforced composite spun concrete poles. The analysis demonstrates that FRP reinforced composite spun concrete poles are the most cost effective option for TasNetworks in higher bushfire risk prone locations. However, S3 CCA wood poles remain cost effective in other locations.

Wood poles are purchased with a metal pole cap attached over the top of the pole to reduce the ingress of water from the top of the pole through the pole center thereby reducing the onset of pole top wood rot. Gang nails are attached to pole wood faces at top and bottom to reduce the rate of star pattern end splitting with drying and in service cumulative wind stress.

5.5.10 Pole footing failure

The majority of TasNetworks wood poles are direct butt buried. AS7000-2016 Limit State design provides increased detailing for direct butt buried wood pole foundation design for distribution poles.

Soil profile strengths are plotted on the GIS database, field testing and engineering studies were undertaken to refine pole foundation design, with more options for the few Tasmanian locations with poor footing strength soil profiles, such as stiff clays. AS7000-2016 allows for pole footing failure containment by design for natural wood distribution poles, and some allowance for pole head flex and some pole top lean angle is included in pole and pole footing design for in overhead line designs.

Existing wood pole holes footings positioned into rock footing soil profiles, often require extra excavating or blasting as rock holes. The cost of constructing new pole rock holes encourages reuse of existing pole holes when the poles are required to be replaced.

5.6 Distribution Overhead Line Support Structure Risk Analysis

Table 6 Risk Analysis for Distribution Overhead Line Structures

Distribution Line Support Structures		Risk Analysis				
ASSET	Risk Description	Category	Likelihood	Consequence	Risk Rank	Treatment Plan Yes / No
Distribution Line Support Structures	Unidentified degradation and loss of strength through rot or corrosion results in fallen support structure with resultant: • death or serious injury • loss of supply to customer load • bushfire as a result of fallen conductors	Safety and People	Rare	Severe	Medium	Yes
		Financial	Rare	Moderate	Low	
		Customer	Rare	Moderate	Low	
		Regulatory Compliance	Rare	Minor	Low	
		Network Performance	Rare	Moderate	Low	
		Reputation	Rare	Moderate	Low	
		Environment & Community	Rare	Severe	Medium	

6 Whole of Life Management Plan

6.1 Asset Strategy of Poles

Overhead line supports can be relatively long service life assets with individual asset reliability based upon condition based risk maintenance, and at relatively high cost to asset replace.

6.1.1 Pole inspection cycle

Following a review in 2012/13 TasNetworks pole inspection cycle was changed from a 3.5 year cycle to 5 year inspection cycle. The untreated wood poles remained on a 3.5 year to address risk concerns for Intermediate Safety Factor poles. The 3.5 year was recently changed to 2.5 year inspection cycle to align with 5 year inspection cycle same area inspections.

Untreated wood poles now total fewer than 2,900 poles and are a subpopulation exceeding 50 years in service with a corresponding high condemning rate.

6.2 Preventative and Corrective Maintenance (OPEX)

6.2.1 Routine maintenance – Inspection and Monitoring - AIOHS

There is a fundamental requirement under AS7000:2016 for TasNetworks to periodically inspect its own support structures to ensure their physical condition does not represent a hazard to the public. This is achieved as periodic inspection for monitoring the asset condition, and maintenance reapplying fungicide chemical treatment (such as pole rods).

TasNetworks' overhead structures inspection and monitoring program consist of three components:

- Inspection of overhead structures;
- Inspection of tower Structures; and
- Inspection of natural timber poles for rot under the possum guard.

Twice a year update training & workshops are provided to Asset Inspectors under AIOHS.

The business objectives driving these programs are:

1. Managing business operating risk (through identifying defects before they impact on safety or fire risks – primary driver); and
2. Maintaining network performance (through identifying defects before they impact on reliability – secondary driver).

6.2.2 Inspection of structures and overhead lines and equipment - AIOHS

This program mitigates the risks associated with timber poles failing in service.

The results of the tests undertaken during this inspection determine whether a pole is:

- serviceable – considered to be in an adequate condition to safely remain in service until the next pole inspection;
- impaired – not considered to be in an adequate condition to safely remain in service until the next pole inspection, but suitable to be considered for staking (it may then be condemned if it does not meet the detailed staking criteria); or
- condemned – not considered to be in an adequate condition to safely remain in service until the next pole inspection and not suitable for staking.

To slow the rate of deterioration and extend the life of wood poles, the application of boron pole saver rods and bandages to treat wooden poles for heart and carroty rot/soft rot are undertaken as part of the pole inspection program.

6.2.3 Inspection of steel towers - AIOHS

TasNetworks has a small population of ex-transmission high voltage steel lattice towers in the distribution system. The majority of towers were installed in the late 1940s and 1950s and are approaching the end of their nominal asset life. TasNetworks undertakes sample inspections to monitor their condition for proactive maintenance works and undertakes minor remedial action to defer replacement expenditure.

The population of distribution steel lattice poles are routinely asset inspected (AIOHS) and steel defects maintained in non-routine maintenance RMOHS or condemned for pole replacement (REPOL). Minor steel replacement work is non-routine maintenance RMOHS OPEX. For some steel lattice towers major remedial action is undertaken under RESTK to reinforce below ground portion of tower leg.

6.2.4 Inspection of natural timber poles under the possum guard - AIOHS

There have been failures of natural timber poles under the possum guard. The failure seems to be linked to the possum guard being too tightly wrapped around the pole preventing moisture from escaping which in turn allows wood rot to attack the pole. The purpose of the work is to check the condition of natural timber poles. Around 7 per cent of inspected natural timber poles have been found to have sufficient wood rot to require condemning.

The majority of natural timber poles are located on the East Coast of Tasmania and were inspected in 2013-14. The program finished testing the remaining natural timber poles over the 2016-17 financial year of a small volume scattered across the state. This inspection cycle will repeat every 5 years to closely monitor the condition of untreated possum guards and mitigate against the associated risks.

6.2.5 Straighten leaning poles - RMPOL

The aim of this program is to rectify leaning poles in TasNetworks' system. A pole is considered leaning, and is a reportable defect when it is leaning more than 6º from vertical (or approximately four pole head widths out of vertical).

When a pole is leaning between 6º and 10º from vertical, there is a higher risk of conductor clashing and ground clearance defects, but the pole itself is structurally sound. A lean of greater than 10º indicates that the foundations of the pole are potentially compromised and the pole may be in danger of collapsing: the pole is then condemned.

Leaning wood poles are mainly due to problems associated with ground and foundation strengths, backfill medium, compactness at foot and heel of the pole and inadequate counterforce infrastructure (stays, baulks, etc).

Historically there has been a policy of condemning any leaning pole that was over 10 years old regardless of its condition. This policy has now been replaced and the condition of the pole rather than the age is now the decider as to whether the pole is suitable for straightening.

If Asset Inspector defects a pole with an excess lean angle it is either straightened as planned routine maintenance as RMPOL (OPEX) or if lean is too severe the pole is condemned and replaced as REPOL (CAPEX).

6.2.6 Replacing pole caps - AROCO

Replaced pole caps help prevent water ingress into wood pole top. Most pole caps are of galvanized steel, and nailed to wood pole top. These metals are subject to rust and the loosening of securing nails with wind and wood split aging.

6.2.7 Plating of rust impaired Stobie poles - AROCO

This program involves maintaining steel and Stobie structures in serviceable condition by repairing components found to be defective through the various inspection programs.

These poles were installed predominately from the 1950s through to the 1970s. They are very expensive to manufacture and are susceptible to corrosion at or just below ground line as the steelwork is generally only protected by enamel paint. However, they can be repaired in situ by welding a steel plate across the affected area. Repairing the below section of direct buried Steel and Concrete poles is cost effective as it will extend their lives by 15 to 20 years.

6.3 Summary of OPEX Programs expenditure

Table 7 Summary of OPEX Overhead Line Support Structures Programs

Work Program	Work Category	OPEX	Project/Program
OPEX Routine Maintenance	Overhead structures inspection & monitoring	AIOHS	Overhead structures inspection
			Inspection of towers/steel lattice poles
			Inspection of natural timber poles under possum guard
			Inspector training & workshops
OPEX Non-Routine Maintenance	Overhead structures maintenance	RMOHS	Repair steel and concrete poles
	Overhead structures maintenance	AROCO	Plating repair of Stobie poles
	Overhead structures maintenance pole straightening	RMPOL	Straighten leaning poles

Table 8 Summary of opex programs and expenditure

Project/Program	Func. Area	Program Data										
		Financial year	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**FY27**	**FY28**	**FY29**
Overhead system inspections (includes Ground line Routine Inspections of line supports)	AIOHS*	Expenditure ($m)	$ 1.64	$ 1.64	$ 1.64	$ 1.64	$ 1.64	$ 1.64	$ 1.64	$ 1.64	$ 1.64	$ 1.64
Straightening leaning poles	RMPOL	Expenditure ($m)	$0.075	$0.075	$0.075	$0.075	$0.075	$0.264	$0.264	$0.264	$0.264	$0.264
Repair Overhead Defects (includes Plating of rusted Stobie poles)	AROCO*	Expenditure ($m)	$1.46	$1.46	$0.80	$1.0	$1.46	$1.46	$1.46	$1.46	$1.46	$1.46

*Note these are the budgets for the whole functional areas AIOHS and AROCO which contain programs in this Asset Management Plan as well as the Distribution Poletop Hardware Asset Management Plan.

6.4 Reliability and Quality Maintained (CAPEX)

6.4.1 Replace damaged/condemned poles - REPOL

The drivers for this major asset type program are managing business operating risks (safety) and maintaining network performance.This program has multiple strategic options:

1. Replace condemned poles as planned works
   a) as complex design
   b) as basic fleet with wood pole
   c) as Basic Fleet with FRC pole (Contingent plan for supply)
2. Replace poles as unplanned work upon failure

Planned replacement is more economical than unplanned emergency replacement and avoids safety and bushfire risks and unplanned outage penalty costs.

The aim of this program is to replace poles that are classified as condemned by TasNetworks' asset inspection program. These condemned poles require replacement within a set period based on risk not exceeding 720 days.

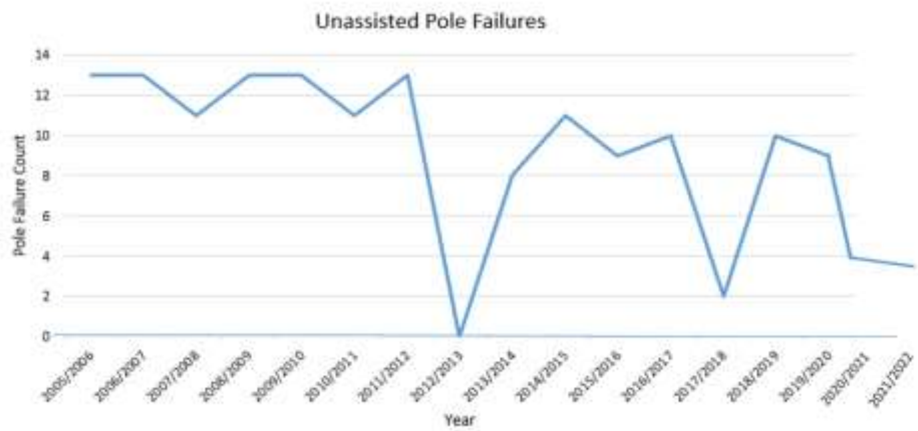
The driver for this program is public safety, reliability of supply and bushfire risk. TasNetworks is responsible to ensure that a pole at the end of its life is removed from service before it fails and impacts public safety.

The volumes for this program are based on historical data and condition information that is gathered about the poles during audits (safety factor, amount of rot).

There are no major changes to this program and expenditure in the next regulatory period is based on the:

1. current trend of condemning poles;
2. age profile of current poles with significant increases in poles greater than 40 years old during the determination period; and
3. A decline in the total staked pole subpopulation as annual number of condemned staked poles exceeds annual new staking rates.

Figure 9 TasNetworks owned unassisted pole failures trend



Replace poles upon failure (extreme events such as storms) is a reactive work program to cover the capitalisation of pole replacements undertaken under fault during major events such as during a storm or bushfire. The work is initially performed under the fault and emergency budget and later transferred to this program.

6.4.2 Pole staking - RESTK

The driver for this project is minimising asset life-cycle costs and cost to customers through life extension of existing poles.

There are two components to this program:

1. Stake impaired poles; and
2. Reinforce tower legs.

6.4.3 Stake impaired poles

The purpose of this program is to defer replacement of poles by staking suitable poles. As wooden poles deteriorate at a greater rate below ground level than above reinforcement at ground level using staking technique defers the replacement of the decayed wood pole by up to and in excess of 15 years.

Whole of life analysis has indicated that staking is a cost effective method of extending the life of a wooden pole. Wood poles are staked as per Network Policy *NN R AM 11 Wood pole reinstatement by ground-line reinforcement.* After staking, testing of the pole continues on the standard 5 year cycle, however additional testing is undertaken further up the pole to ensure appropriate strengths are maintained above the reinforcement.

6.4.4 Reinforce tower leg

The aim of this program is to undertake major remedial works on the below ground portion of TasNetworks' distribution line steel towers. As with wood poles, steel towers deteriorate below ground at a faster rate than above ground. The remedial action proposed is the reinforcement or replacement of the below ground section of the legs. The alternative is to replace the entire steel tower structure, which is very costly. The remedial action costs only a fraction of the amount to replace the entire tower and extends the life of the tower in the order of twenty to thirty years. Where cost to remediate former transmission tower exceeds cost to replace by a pole, and tower is no longer required for transmission line use in future, the tower is replaced by a pole.

6.4.5 Anti-climbing barriers and signage - REBCA

Anti-climbing barriers and signage for people are required for steel lattice tower to discourage and prevent unauthorised access onto these structures.

ENA Guidelines for Design and Maintenance of Overhead Distribution and Transmission Lines AS/NZS 7000, Section 8.4.3 requires that:

> *Provision shall be made on all climbable structures for the fixing of signage and devices to ensure the protection of the public from hazards associated with access to electrical works, and to provide public awareness of operational safety issues*

ENA DOC 015-2006 National Guidelines for Prevention of Unauthorised Access to Electricity Infrastructure provides a national uniform standard approach for signage and fencing for electrical infrastructure which TasNetworks aims to comply with. Tasks in this program are undertaken as they are identified and reported.

6.4.6 Retrofit of Intumescent Coating - REPOP

A retrofit intumescent coating program in R24 is under REPOP CAPEX as planned works to add a fire retardant barrier to existing wood poles in high bushfire risk areas.

6.5 Summary of CAPEX expenditure

Details of future capex projects/programs with more detailing are in references for each future CAPEX programs are the IES Documents listed and linked in Table 9.

Table 9 Summary of CAPEX Overhead Line Support Structures Programs

Work Program	Work Category	CAPEX	Project/Program
CAPEX Reliability and Quality Maintained	Pole replacements	REPOL	Replace damaged/ condemned poles
	Pole staking	RESTK	Pole Staking
			Reinforce tower legs
CAPEX Reliability and Quality Maintained	Intumescent Coating	REPOP	Retrofit intumescent coating to wood pole
CAPEX Regulatory Obligations	Install anti-climbing barriers / signage program	RECBA	Install anti-climbing barriers/signage program

6.6 Economic Investment Details on future CAPEX Programs /project details.

Table 10 is the Summary of Economic Investment Details for Future CAPEX Programs for Overhead Line Supports with links to Program detailing documents.

Table 10 Economic Investment Details on future CAPEX Programs /project details.

Project/Program description	Functional area	Document Id. (IES Word Format)	Link to HBRM initiative	Copperleaf ID.	Link to Initiative
Staking impaired poles	RESTK	R2351308	R24_D_OH_RESTK_Pole Staking	PRJ000500	http://assetzone.tnad.tasnetworks.com.au/R24_distribution/NOL/FINAL%20-%20For%20submission%20to%20AER%20in%20January%202022/R24_IES_D_OH_RESTK%20_Pole%20staking.xlsx
Condemned pole Basic Fleet wood pole replacement	REPOL	R23513093	R24_D_OH_REPOL_Basic Fleet-Pole – Replacement	PRJ000652	http://assetzone.tnad.tasnetworks.com.au/R24_distribution/NOL/FINAL%20-%20For%20submission%20to%20AER%20in%20January%202022/R24_IES_D_OH_REPOL_Basic%20Fleet%20Pole%20Replacement.xlsx
Condemned pole Complex Design pole replacement	REPOL	R2351311	R24-D_OH_REPOL _Complex Design	PRJ000653	http://assetzone.tnad.tasnetworks.com.au/R24_distribution/NOL/FINAL%20-%20For%20submission%20to%20AER%20in%20January%202022/R24_IES_D_OH_REPOL_Complex%20Design.xlsx
Pole Failure Emergency Pole Replacement OPEX capitalised	REPOL	R2351307	R24_D_OH_REPOL_Replace-Pole_ Fault	PRJ000654	http://assetzone.tnad.tasnetworks.com.au/R24_distribution/NOL/FINAL%20-%20For%20submission%20to%20AER%20in%20January%202022/R24_IES_D_OH_REPOL_Replace_Pole_Fault.xlsx
Retrofit Intumescent Coating	REPOP	R2357815	R24_TQR_D_OH_REPOP_ intumescent coating ground near line planned works	PRJ000657	http://assetzone.tnad.tasnetworks.com.au/R24_distribution/NOL/InvestmentSummary_R24_D_OH_REPOP_Intumescent%20Coating_2023-01-12h17m05s50.xlsm

7 Spares management

Contingency planning for reliability and resilience of grid supply means that overhead line material spares holding are assessed during the asset management plan review cycle and minimum and maximum stock levels and spares holdings are amended in alignment with TasNetworks' spares policy.

Replacement overhead line support structures are sourced from the stock pool. Supply chain stock resupply resilience to match grid contingency planning can be for foreseeable natural disaster, subject to further ongoing review as per the TasNetworks Climate Change Policy.

Until recent times, the Tasmanian wood pole supply chain had equivalent of about two year annual usage in reserve in various stages of preparation for a disaster recovery response. Contingently pole supply is now partly supplemented by evolving a BAU supply from non-wood pole suppliers under contract.

8 End of life management

Overhead line support structures are de-commissioned and removed from the network and are disposed. Required assets are retained for system spares.

Environmental Risk Management guidelines applied for disposal relate to waste materials by type, such as CCA TN wood and bushfire burnt CCA byproducts as per toxicity classification CCA byproducts ash level. Based on recent Pelham/Elderslie bushfires in 2019/20, a dollar figure was added to the unit rate of CCA TN poles and fire burnt toxic ash in the regulatory submission for their responsible disposal and to reduce the backlog of stored pole waste. Highest level Toxic Ash level 5 now needs to be exported to Victoria for approved disposal.

9 Related standards and documentation

The following documents have been used to either in the development of this management plan, or provide supporting information to it:

1. Standard for Design and Maintenance of Overhead Distribution and Transmission Lines AS/NZS 7000 - 2010
2. Structures – Annual Equivalent Calculation (R295175)
3. Asset Management Strategic Plan (R94876)
4. Economic Evaluation of Treated Wooden Pole Inspection Cycles (R295189)
5. Network Policy NN R AM 11 Wood pole reinstatement by ground-line reinforcement (NW10149727)
6. ENA DOC 015-2006 National Guidelines for Prevention of Unauthorised Access to Electricity Infrastructure
7. Timber – Natural Durability Ratings AS 5604 – 2005
8. Alternative Structures for Equipment & other High Risk Structures (R452795)
9. TasNetworks Network Climate Change Resilience and Adaptation Strategy, http://reclik/R0000766603.

Appendix A – Summary of programs, risk level, drivers, residual risk

Description	Work Category	Risk Level	Driver	Expenditure Type	Residual Risk
OH & Structures inspection	AIOHS	High	Safety	OPEX	Medium
Inspection of towers/steel lattice poles	AIOHS	High	Safety	OPEX	Medium
Inspection of natural timber poles under possum guard	AIOHS	High	Safety	OPEX	Medium
Repair Steel and Concrete Poles	RMOHS	High	Safety	OPEX	Medium
Straighten Leaning Poles	RMPOL	High	Safety	OPEX	Medium
Replace damaged/ condemned poles	REPOL	High	Safety	CAPEX	Medium
Replace damaged/ condemned Critical Structure poles with Alternative Pole based on bushfire risk	REPOL	High	Safety and bushfire or fuel reduction fire resilience	CAPEX	Medium
Retrofit Intumescent coating to 2.5m on TN pole based on bushfire risk	REPOL	High	Safety and bushfire or fuel reduction fire resilience	CAPEX	Medium
Pole Staking	RESTK	High	Safety	CAPEX	Medium
Pole Staking life extension	RESTK	High	Safety	CAPEX	Medium
Reinforce tower legs	RESTK	High	Safety	CAPEX	Medium
Install anticlimbing barriers / signage program	RECBA	High	Regulatory	CAPEX	Medium