AMS 10-65 Line Easements

2023-27 Transmission Revenue Reset

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1 Executive Summary

This document defines the asset management strategies for the Victorian transmission line easements which are approximately 3,600 kilometres in length and cover a total area of approximately 21,600 hectares.

Transmission line easements are generally created through allocation statements under the Electricity Industry Act. They secure access rights for all transmission lines to ensure security of supply and maintenance activities can be performed.

The volume of transmission line easements has increased marginally in recent years mainly to accommodate connections of new generators.

Asset management strategies for transmission line easements are stated below.

1.1 New Assets

- Register new easements for all new transmission line constructions.
- Take a more pro-active approach to the provision of information to, and education of, the public regarding easement use and development.

1.2 Inspection

- Continue with regular inspections of the BTS – RTS 220 kV cable easement.
- Extend inspections using aerial photography to all other transmission line easements situated within Melbourne Metropolitan boundary. Store all identified non-compliant developments in the asset management system against the relevant line easement segment numbers including detailed descriptions and associated levels of risk.
- Implement process to make the condition inspection of the easement access roads and gates the duty of care for all internal and external parties which require access to the easement.
- Continue with aerial laser vegetation-clearance scanning of transmission lines.
- Continue with annual inspection of line easements.
- Perform feasibility studies on the implementation of vegetation management programs outside existing easements on critical corridors identified as presenting high risk to security of supply during bushfire events.
- Identify hazardous trees and implement risk mitigation works.

1.3 Maintenance

- Implement risk management plans which outline steps required to address identified non-compliant developments on easements.
- Liaise with authorities and neighbourhood watch groups to develop a plan aimed to drive the acts of vandalism to a minimum. This is a priority particularly for urban easements.
- Create a register of fuel loading and transmission corridors based on the fire risk assessments.

1.4 Refurbishment and Replacement

- Continue to remove inappropriate tree species and where appropriate, replace with low growing shrubs.
- Continue to treat regrowth at short intervals to ensure treatment has a minimal environmental impact and within the capacity of economical and low-profile equipment.
- Continue to perform detailed vegetation treatment assessments including local environmental and landowner sensitivities to ensure the optimum solution for all stakeholders.

- Work in conjunction with DELWP and CFA to develop fire risk assessments for the critical transmission corridors that consider vegetation near the transmission line or easement to quantify the fire risk to the corridors.

2 Introduction

2.1 Purpose

The purpose of this document is to define the asset management strategies for AusNet Services' electricity transmission network's line easements.

2.2 Scope

This asset management strategy applies to all regulated transmission line easements associated with AusNet Services' electricity transmission network. The plan does not include asset management aspects of unregulated line easements and easements for the distribution network or areas within switching stations, zone substations or terminal stations.

2.3 Asset Management Objectives

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

- Maintain network performance at the lowest sustainable cost;
- Meet customer needs now and into the future;
- Be future ready;
- Reduce safety risks; and
- Comply with legal and contractual obligations.

As stated in *AMS 10-01 Asset Management Strategy -Transmission Network*, the electricity transmission network objectives are:

- Maintain top quartile benchmarking;
- Maintain reliability;
- Minimise market impact;
- Maximise network capability;
- Leverage advances in technology and data analytics;
- Minimise explosive failure risk.

3 Asset Summary

3.1 Asset Function

Transmission line easements can generally be defined as the lots of land on which transmission overhead and underground lines are built and include a buffer area to ensure the safe and secure operation of the lines.

There are three basic categories of transmission line easement lands:

1. Private freehold land with registered easements which make up the bulk of transmission line easements. Most of these easements were created by the SECV and allocated to AusNet Transmission Group Pty Ltd through the provisions of the various Electricity Industry Acts.
2. Crown Land including land vested in Parks Victoria. These lands do not have a Certificate of Title and as such cannot have easements registered over them. Transmission line assets have been constructed over these lands by agreement with various State Government Departments.
3. Generation Company and other Utility Service Provider lands. These lands were previously either under control of the SECV or other State Government Utility Service providers such as Melbourne Water, VicTrack, Melbourne Port Corporation and local governments. While generally all are private lands owned by the relevant corporations, easements for transmission lines were never granted due to common ownership of the State. Transmission line assets are on these lands by agreement or licence.

3.2 Asset Population

Operationally, all three categories of easements are treated the same by AusNet Services and have statutory protections provided by the Electricity Safety (Installations) regulations in addition to the registered easement rights and implied easement rights.

Easements include motor vehicle roads and tracks, bridges, gates and drainage culverts. There are 8,689 transmission lines easement segments with a total length of approximately 3,600 km and 21,600 ha in area. They vary in width from approximately 36 m for some rural 66kV single-circuit tower lines to in excess of 100 m for multiple circuit transmission lines in both rural and urban environments. The percent of total easement area for each network voltage is shown below in Figure 1.

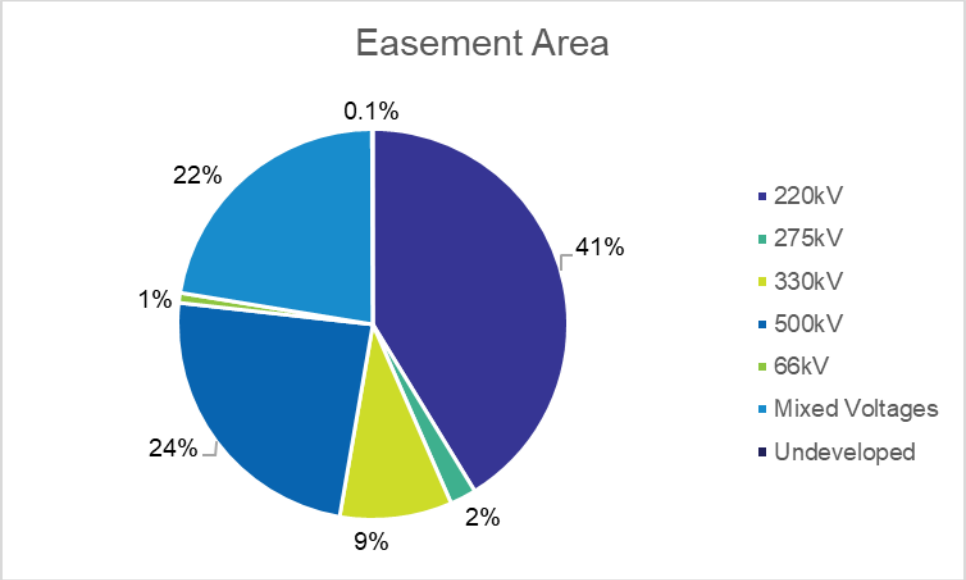


Figure 1 – Easement area (% of total) in hectares (by network voltage)

Line Easements

The existing in-use easements often contain additional width as a provision for future lines. These, and the undeveloped easements, are managed by AusNet Services on behalf of Australian Energy Market operator (AEMO) to allow for future network development and they account for 0.1 percent of the total easement area.

Easements over privately-owned land make up approximately 90% of the total easement area. The remaining easements are over Crown Land. Registered easements on private land are shown on the property title. On Crown Land; AusNet Services is working towards an agreement in the form of a deed with the Department of Environment, Land, Water, and Planning (DELWP) for the use of Crown Land easements and access rights.

AusNet Services also manages an underground cable easement associated with the nine-kilometre BTS-RTS 220kV cable route. This is located primarily on road reserve and through parkland in the inner north eastern suburbs of Melbourne.

3.3 Asset Condition

Line easement maintenance includes vegetation management and inspection and remediation of civil assets.

Line Easement do not receive a score as other assets due to the varied and complex nature of easement assets including land management legislation, shared use of easements etc.

The condition is derived from the volume of corrective work orders performed on line easements.

Main easement activity areas are outlined in this section.

A total of 18,246 corrective work orders relating to vegetation and civil assets have been completed over the past 5 years on line easements.

The average has been 3,649 work orders per annum. This is an increase compared to previous five years mainly due to following factors:

- The asset management software SAP improved the defect notification reporting efficiency and progressed from issuing multi-item workorders to itemised defect notifications,
- Implementation of Lidar aerial vegetation inspection further improved the defect notification reporting process by generating automated notifications upon survey data analysis.

3.3.1 Vegetation Management

Vegetation inspection of transmission line easements is conducted by aerial Lidar survey.

Apart from Lidar survey there are ground inspection maintenance activities performed by trained linesmen on annual basis. The scope of these inspections is both line and easement assets and ensure that the clearances between vegetation and lines infrastructure remain within acceptable limits.

During scheduled line and easement inspections, linesmen identify clearance breaches which require corrective actions such as tree trimming or tree removals. Subsequent corrective work orders (defect notifications ZA) are raised in the asset management system. Emergency work orders (fault notifications ZK) are issued when a maintenance tasks is required urgently usually following an incident such as a tall tree fall, weather event or bushfire.

Figure 2 illustrates the corrective work orders relating to vegetation completed over the past 5 years on line easements. Vegetation Corrective W/O represent 97% of the total 18,246 over past five years. The average has been 3,512 vegetation related work orders per annum.

Line Easements

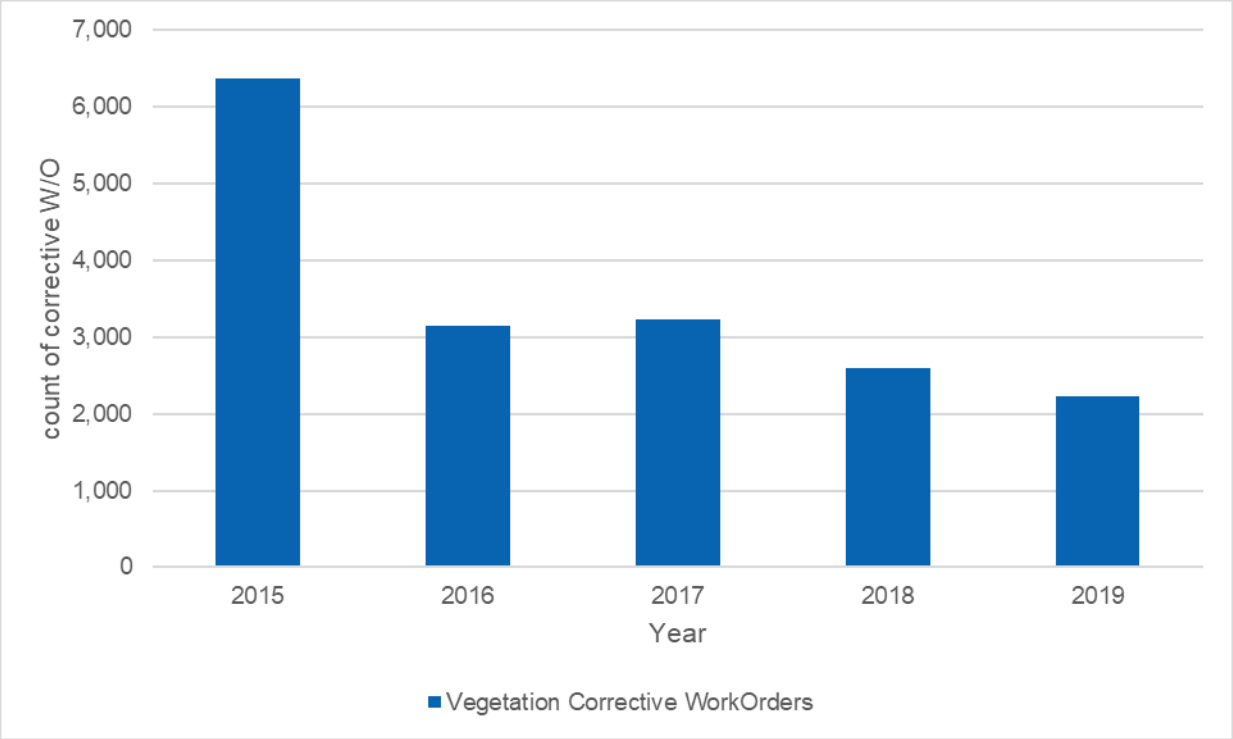


Figure 2– Vegetation management related work orders on line easements

The 2015 spike in corrective maintenance workorder is discussed at the beginning of section 3.3.

3.3.2 Civil Assets

Line easement civil assets include access tracks, tower sites, gates, culvert or drains and bridges. Reporting the corrective work requirements on these assets is the responsibility of all work parties using the line easements. The rectification works are performed on an as required basis as part of line easement maintenance works.

Civil Assets Corrective W/O represent 3% of the total 18,246 over past five years. The average has been 138 work orders per annum. Just over 70% of the civil asset work orders were recorded in 2015, therefore Figure 3 excludes 2015 in order to prevent data skew.

Line Easements

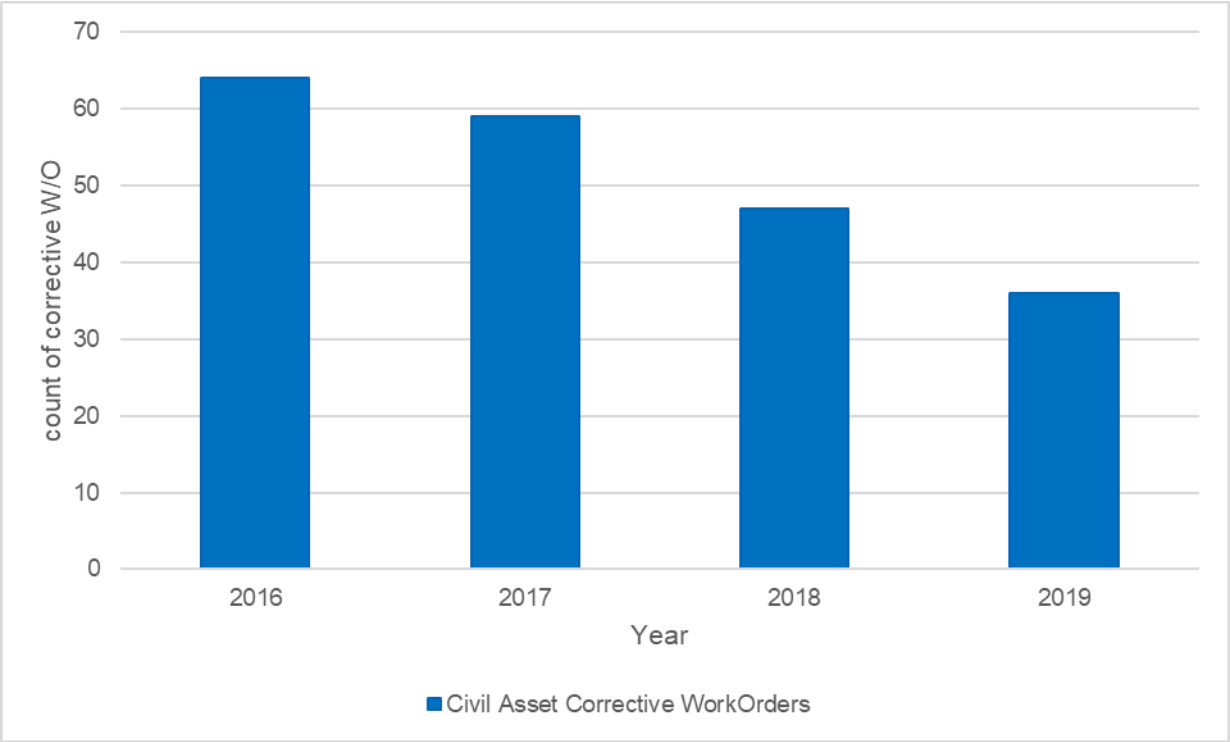


Figure 3 – Civil Assets related work orders on line easements

Figure 3 illustrates the corrective work orders relating to civil assets completed over the past 4 years. The 2015 spike in corrective maintenance workorder is discussed at the beginning of section 3.3.

Figure 4 illustrates the number of civil assets maintenance work orders completed in past five years by object part. Approximately 38% of the total defective civil assets are sections of access track, 14% are culverts and 2% are access bridges. Typical corrective actions for access tracks include reinstatement of eroded vehicle tracks and grading of tracks to remove deep ruts; both issues result from heavy rainfall. Tower sites often become overgrown and require clearing or can become flooded in winter months.

The 2015 spike in corrective maintenance workorder is discussed at the beginning of section 3.3

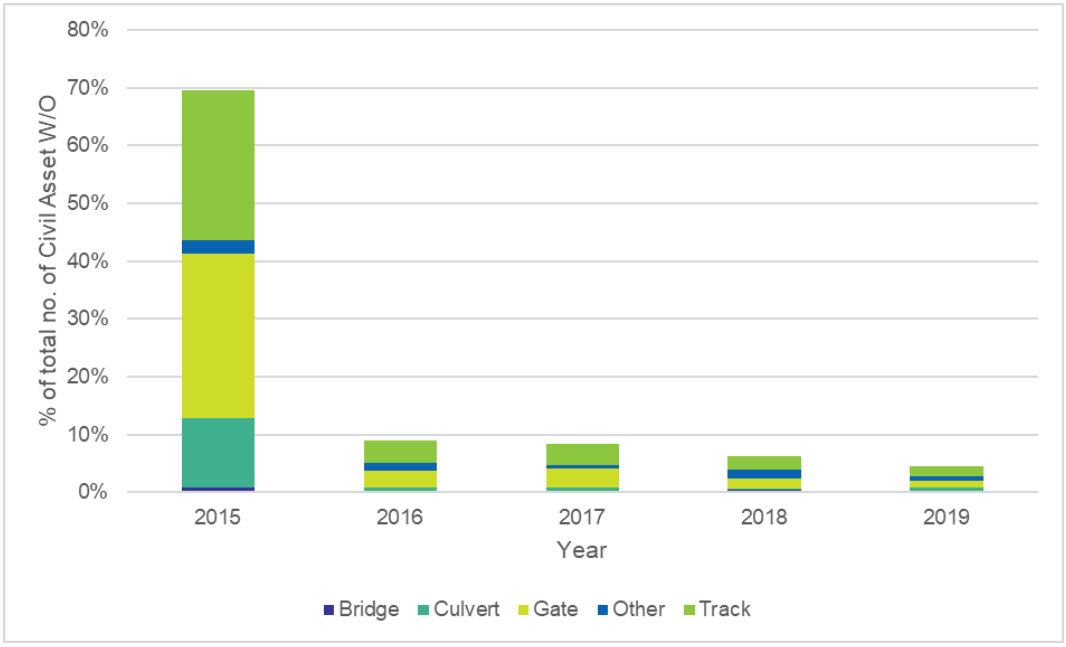


Figure 4 – Civil Assets related work orders on line easements by Object Part

3.4 Performance

There have been no forced transmission line outages caused by vegetation infringements or defective line easement civil assets. However, there have been multiple forced outages caused by bushfires in close proximity or on transmission line easements. Thick smoke produced by bushfires can reduce the insulating properties of air in the vicinity of extra high voltage circuits and cause electrical flashovers to structures at earth potential.

Figure 5 displays the number of bushfire related faults experienced since 2019. Fifty per cent of the total bushfire related faults took place in 2009, seventeen per cent took place in 2014 and thirty per cent in 2019 and 2020. The 2017 event was caused by fire on an industrial site nearby easements unlike the other which were caused by wild bushfires.

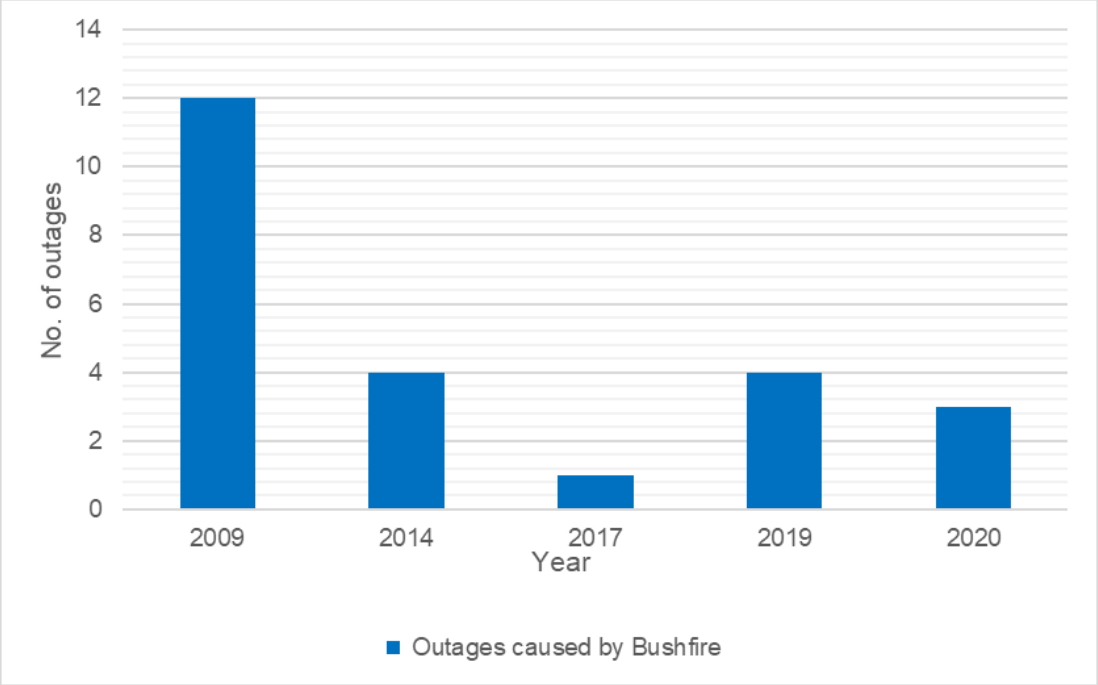


Figure 5 – Bushfire related transmission line outages

4 Other Issues

The key issues associated with transmission line easements are as follows:

- Some line easements share usage with other infrastructure such as roads, railways, pipelines and fences posing increased health and safety risks.
- Identification of Non-compliant developments on transmission line easements which compromise the levels of safety and reliability of the overhead line is not fully automated.
- Forced outages of transmission lines can be caused by bushfire on or in close proximity to easements.
- Easement tracks can be adversely affected by heavy rainfall and require remedial works so that adequate access is maintained.
- Flashovers caused by the operation of equipment with no permission granted.
- Erosion due to land owner activity near towers placing tower integrity at risk.

5 Asset Criticality

An easement segment failure can be defined as a change in the environment surrounding transmission lines which result in a power outage.

Examples of failure are vegetation breaching minimum clearance space, soil erosion, 3rd party infrastructure breaching the clearance space.

Consequences of a failure can be grouped in:

- Health and Safety of employees, contractors and the public,
- Bushfire Ignition,
- Market Impact and
- Collateral Damage.

5.1 Health and Safety

Line easements functional failures can present health and safety risks to employees, contractors and members of public. The Health and Safety asset criticality is quantified at span level by a combination of three characteristics:

1. Easement land use,
2. Road and rail crossings and
3. Fire zone Index.

5.2 Bushfire Ignition

Faults on transmission line easements can result in discharges of energy which are capable of igniting ground fires. Some transmission lines are situated in easements through high density fuel loads in grasslands and forests. In extreme weather conditions ground fires started close to such fuel loads can quickly develop into widespread bushfires.

The bushfire ignition asset criticality is quantified at span level by the easement fire zone index.

5.3 Market Impact

Faults on transmission line easements can result in a transmission line power outage which negatively impact on performance levels within the incentive schemes.

The electricity transmission lines forming the National Electricity Market have high levels of redundancy under average loading conditions. However, at peak loading periods; transmission line failures can constrain generator connections causing a re-scheduling of generators in other states and load shedding may be required to provide network security for a subsequent un-related failure.

For more details on market impact calculation please see AMS 01-09 Asset Risk Assessment Overview.

5.4 Collateral damage

Line easements functional failures can result in damage of 3rd party property. For instance, soil erosion can lead to tower and conductor collapse over private property. Easements in urban area present a higher consequence than those in rural area as well as highway or rail crossing on an easement present a higher consequence than a collector type road.

Collateral damage asset criticality is quantified at span level by the easement by a combination of three characteristics:

1. Easement land use,
2. Road and rail crossings and
3. Fire zone Index.

5.5 Criticality parameters

To assist the risk assessment easements are grouped by land use, by shared use of easements and by fire zone.

From land use perspective easements are grouped in three categories described in Appendix1. The consequence of a transmission line component failure is quantified in relation to the easement use i.e. a dropped conductor on an urban built up easement (Type 2) has a higher health and safety and collateral damage consequence than a dropped conductor on an urban easement (Type 1) and a rural easement (Type 0) respectively. Figure 6 illustrates easement segment population by easement type.

From a shared use perspective, the easements are grouped in five categories subject to road class and rail crossings. The consequence of a transmission line component failure is quantified in relation to the road class or rail crossing the easement i.e. a dropped conductor on an easement crossed by a highway or railway has a higher consequence than a dropped conductor over a sub-arterial or collector road and again higher than on an easement without shared assets. Figure 7 illustrates easement segment population by easement crossing type.

From a fire zone perspective, easements are grouped in high bushfire risk area (HBRA) and low bushfire risk area (LBRA). The consequence of a transmission line component failure resulting in a fire start is quantified in relation to the easement fire zone i.e. the health and safety, collateral damage and power outage consequence of vegetation breaching the minimum clearance space is higher in HBRA compared to LBRA. Figure 8 illustrates easement segment population by easement fire zone.

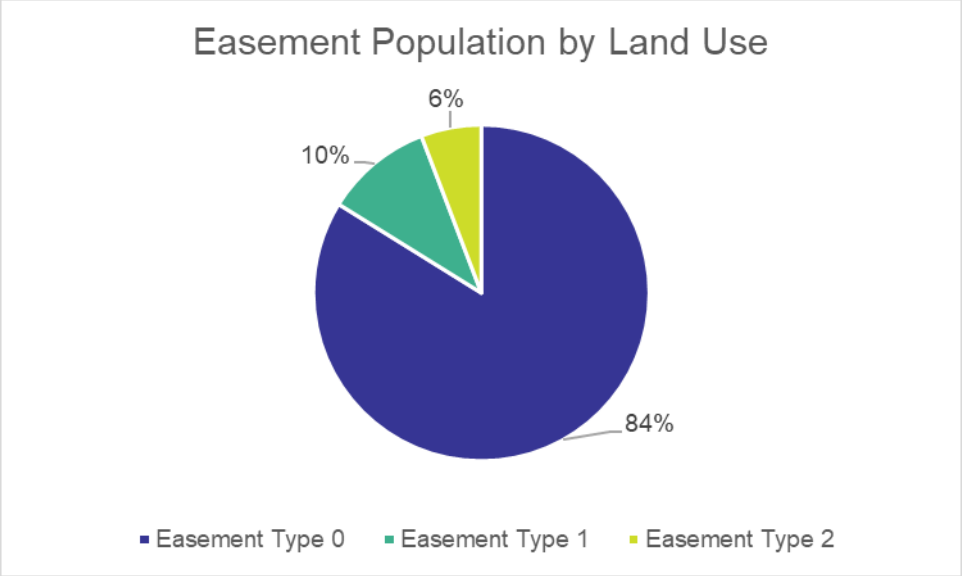


Figure 6 – Easement Population by Easement Use

Table 1 illustrates easement categories by Vicroads road class and rail crossing the easement.

Table 1 – Easement category by road and rail shared use

Easement Category	Description of VicRoads Road Class & Rail
5	Freeway & Rail
4	Highway & Rail
3	Arterial OR smaller than Arterial & Rail
2	Sub-Arterial
1	Collector
0	No road or rail crossing

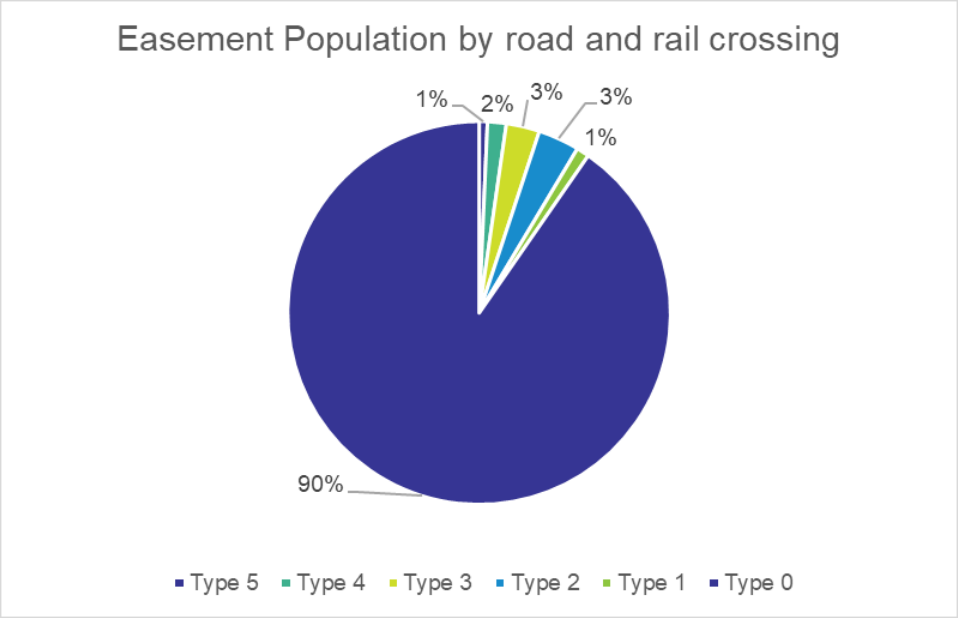


Figure 7 - Easement Population by Road and rail crossing

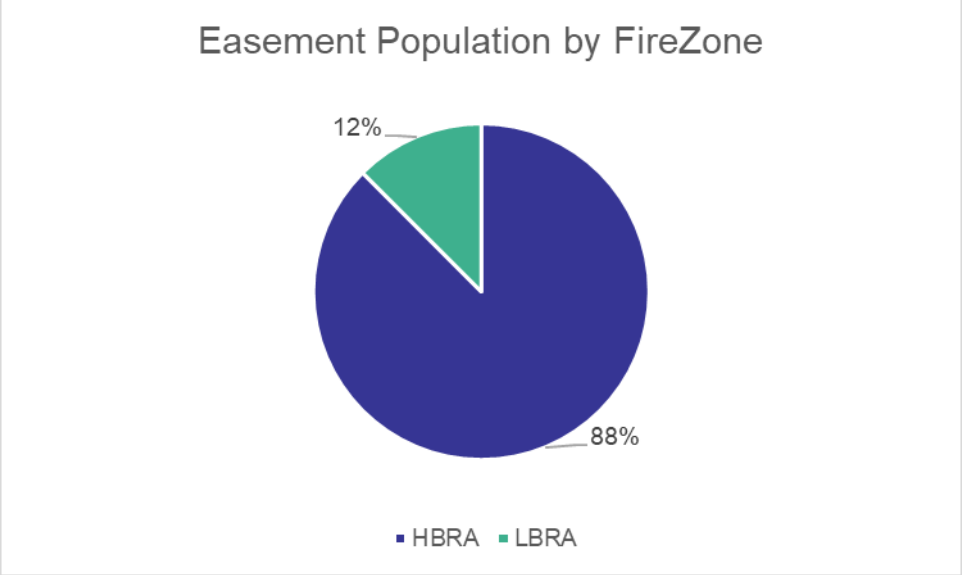


Figure 8 - Easement Population by Fire zone

6 Risk Management

Transmission line easement risk assessment considers the impacts of easements condition on the assets operated on the easements i.e. transmission lines and underground cables.

Easement management strategy includes mitigation of following risks:

- Health and Safety of employees, contractors and the public,
- Market Impact and
- Collateral Damage.

A detailed risk assessment is performed for the entirety of transmission lines systems using FMECA. The consequence of a transmission line asset failure is calculated in the context of the easement land use, easement

shared usage and easement fire zone. The risk assessment is presented in each transmission line asset strategy document.

Following activities form part of the easement risk management plan adopted by AusNet Services.

Vegetation inspection of transmission line easements is conducted by aerial Lidar survey. This technology enables very accurate identification of the clearances between live conductors and closest vegetation. It also gives rise to improved easement management through regular easement data acquisition. Given the consistency in measurement methodology and the accuracy of measurement this technology opens great possibilities in vegetation management such as: creation of a danger tree and managed tree map, development of a fuel density map, identification of new plantings, development and yearly update of a high bushfire risk map

Annual ground inspection maintenance activities performed by trained linesmen (Cert 2 or 3) on annual basis. These inspections are aimed at inspecting both lines and easements and ensure that the clearances between vegetation and lines infrastructure remain within acceptable limits. The inspection also performs an audit role for vegetation trimming activities before the bushfire season.

AusNet Services' line and easement vegetation management activities comply with the Electricity Safety (Electric Line Clearance) Regulations 2010 and its Schedule – Code of Practice for Electric Line Clearance (the Code). The Vegetation Management Plan[1] is reviewed annually to provide guidance for transmission line and easement vegetation management practices.

7 Strategies

7.1 New Assets

- Register new easements for all new transmission line constructions.
- Take a more pro-active approach to the provision of information to, and education of, the public regarding easement use and development.

7.2 Inspection

- Continue with regular inspections of the BTS – RTS 220 kV cable easement.
- Extend inspections using aerial photography to all other transmission line easements situated within Melbourne Metropolitan boundary. Store all identified non-compliant developments in the asset management system against the relevant line easement segment numbers including detailed descriptions and associated levels of risk.
- Implement process to make the condition inspection of the easement access roads and gates the duty of care for all internal and external parties which require access to the easement.
- Continue with aerial laser vegetation-clearance scanning of transmission lines.
- Continue with annual line easement inspections.
- Perform feasibility studies on the implementation of vegetation management programs outside existing easements on critical corridors identified as presenting high risk to security of supply during bushfire events.
- Identify hazardous trees and implement risk mitigation works.

7.3 Maintenance

- Implement risk management plans which outline steps required to address identified non-compliant developments on easements.
- Liaise with authorities and neighbourhood watch groups to develop a plan aimed to drive the acts of vandalism to a minimum. This is a priority particularly for urban easements.
- Create a register of fuel loading and transmission corridors based on the fire risk assessments.

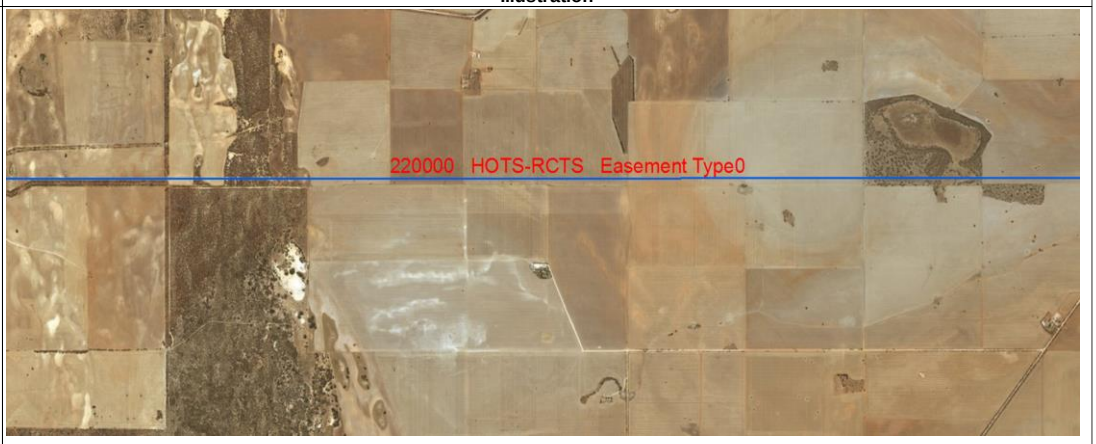
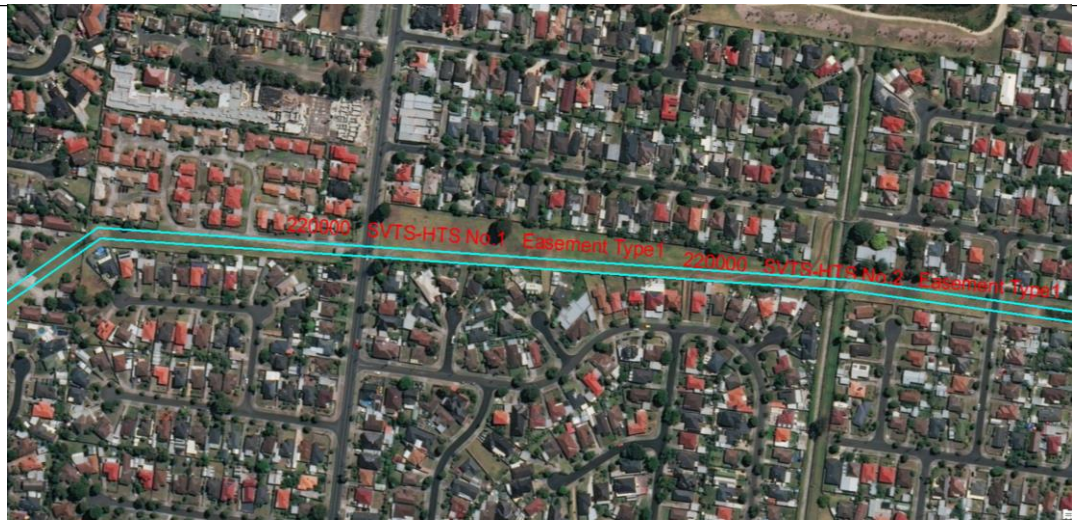
[1] BFM 10-06 Vegetation Management Plan and Procedures (Transmission).

- Consider developing a condition score matrix for easement segments.

7.4 Refurbishment and Replacement

- Continue to remove inappropriate tree species and where appropriate, replace with low growing shrubs.
- Continue to treat regrowth at short intervals to ensure treatment has a minimal environmental impact and within the capacity of economical and low-profile equipment.
- Continue to perform detailed vegetation treatment assessments including local environmental and landowner sensitivities to ensure the optimum solution for all stakeholders.
- Work in conjunction with DELWP and CFA to develop fire risk assessments for the critical transmission corridors that consider vegetation near the transmission line or easement to quantify the fire risk to the corridors.

8 Appendix 1 – Easement Types

Easement Type	Illustration
Type 0 - Rural area	
Type 1 - Residential area with cleared easment	
Type 2 - Residential area with built up easement