Program of Works

2017 – 2022

Structures (Towers) – Fall Arrest Installation

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Contact

This document is the responsibility of the Asset Management Division, AusNet Services. Please contact the indicated owner of the document with any inquiries.

Edoardo Viel
AusNet Services
Level 31, 2 Southbank Boulevard
Melbourne Victoria 3006
Ph: (03) 9695 6000

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1 Summary

PROGRAM	Installation of Fall Arrests on EHV Steel Lattice Towers Program 2017–2022
SERVICE DATE	On-going throughout period 2017 – 2022
LOCATION	Different areas of Victorian Network
VALUE	$ 21.6M

This program of works aims to install fall arrest systems (FAS) on 25% towers in the transmission fleet. This equates to a total of 3,284 transmission towers being retrofitted with a FAS.
This works program document should be read in conjunction with the transmission line structures AMS 10-77 Transmission Line Structures. AMS 10-77 details the background and option analysis performed in order to determine optimal fall arrest installation strategies.

1.1 Project Scope

The scope of works will cover the following key activities related to the installation of a cable fall arrest system (vertical and horizontal systems) on 3,284 Extra High Voltage (EHV) tower structures in the Victorian electricity transmission network during the period 2017 to 2022, which represent 25% of the tower fleet. The scope of work includes the following activities:

- Site inspection to confirm tower type and access conditions.
- Provision of tower drawings and schedules to suppliers and contractor for them to obtain the correct length of stainless steel cable and the correct number of intermediate support brackets per structure.
- Structural review of the tower and the restraining system to model their mechanical reaction in the event of a fall.
- Strengthening of the tower by replacing or adding members if analysis identifies the need for it.
- Material purchase of stainless steel cable, intermediate support brackets, top and bottom anchors, traveller, and tools & devices.
- Storage and store management for the efficient and secure handling and storage of the above materials.
- Installation of top anchors and stainless cables.
- Installation of guide wire holders on specific points (while descending the tower).
- Installation of the bottom bracket, with the tension ring to check cable tensions.

1.2 Program Expenditure Forecast

2017/18 ($k)	2018/19 ($k)	2019/20 ($k)	2020/21 ($k)	2021/22 ($k)	Total ($k)
4,314	4,314	4,314	4,314	4,314	21,570

Table 1 – Program timing and forecast expenditure

Forecast costs shown in Table 1 are $2014/15 P50 direct costs. These costs exclude overheads, finance charges and cost escalation. Unit costs are described in Appendix 4D: Unit Rates.

2 Project Drivers

The installation of fall arrest devices on EHV towers is driven by the legislative and OH&S requirements associated with working at heights. Whilst the electricity industry has an excellent record with no recorded fall from a tower by a worker in the course of their duty, the general construction industry in Victoria has a very poor record. A fall from an elevated position on a tower could result in the following:

- Severe injury or possible fatality to a worker.
- Financial penalties from WorkSafe.
- Litigation for failure to provide a safe environment for workers.

Implementation of this program of work will assist AusNet Services in addressing the following business drivers:

- Safety of employees, contractors and the general public:
  - Minimise OH&S risk to employees and contractors.
- Financial risk:
  - Reduce operating costs through efficiency – (more productivity by providing a faster and safer way to access towers).
  - Reduce financial penalties associated with breach of WorkSafe regulations.
  - Reduce civil actions resulting from personal injury/compromised health.
- Regulatory compliance:
  - Compliance with Occupational Health & Safety Regulations 2007, No. 54 – Part 3.3.
  - Occupational Health & Safety Act (provide safe work environment).
- Corporate image maintained as prudent asset managers:
  - Manage risk as low as reasonably practicable.

3 Overview

AusNet Services has approximately 13,000 EHV towers which are climbed at least every three years for inspection purposes. Occupational Health and Safety Regulations 2007, No. 54 – Part3.3 require systems installed to prevent a worker falling from heights.
The Latchways cable fall arrest system has been adopted for transmission towers. An installation program was established which will result in the installation of the system on 53% of the EHV tower fleet by March 2017.
This program is a continuation of the previous programs and will install cable fall arrest systems on a further 25% of the tower fleet by 2022. The FAS will be installed on towers with flat delta configurations (on 330kV and 500kV fleet), which requires a horizontal system for line workers in addition to the vertical system.
The implementation of this program will significantly reduce AusNet Services' risk profile of accidents related to a fall while accessing a tower, and increase productivity by providing faster climbing rate to line workers and maintenance crews.

4 Risk Mitigation

Risk reduction will primarily be obtained by reducing the likelihood of a fall that could cause serious injury and secondarily reducing the severity of consequences associated with a fall. The vertical and horizontal cable fall arrest system will prevent a worker from falling a considerable distance (i.e. the FAS will limit the worker's fall to 300mm), and therefore reduce the likelihood of a serious injury or fatality (i.e. the worker will only experience an action similar to a seat belt). The restraint system will also limit the potential for a worker to fall into the safe approach distance near a live conductor.

5 Options

Three options were evaluated to reduce the risk of a worker falling from a tower.

Option 1: Do nothing beyond continuing to use double lanyards to access the towers.

Option 2: Defer the program to start in FY 2020/21.

Option 3: Install the cable system on EHV towers starting in FY 2017/18.

5.1 Option 1 – Do nothing and continue to use double lanyards to access the towers

The Do Nothing option involves:

- Continuing indefinitely to use double lanyards to access the towers on 47% of the EHV fleet. The other 53 % of the structures fleet will have fall arrests installed by April 2017.
- Continuing with the present level of risk of a fall from height, to ground or into steel elements of the tower.
- Increasing risk of WorkSafe fine and not meeting OH&S regulations.
- Risk of litigation if worker sustains an accident while on duty.
- Inconsistent with the obligations of the Electricity Safety Act.

5.2 Option 2 – Defer the program to start in FY 2020/21

Deferring the program involves:

- Continuing to use double lanyards to access 47% of EHV towers for 3 years longer than Option 3.
- Continuing with the present level of risk of a fall from height, to ground or into steel elements of the tower.
- Increasing risk of WorkSafe fines and risk of not meeting OH&S regulations.
- Inconsistent with the obligations of the Electricity Safety Act.
- Risk of litigation if worker sustains an injury at work.
- Risk of increasing labour and material costs.

5.3 Option 3 – Install the cable system on EHV towers starting in FY 2017/18

Continuation of the existing program of cable system installation on EHV towers involves:

- Proactive installation of the vertical and horizontal cable fall arrest system on 3,284 EHV tower structures (25% of the tower fleet) by 2022.
- Meeting Occupational Health and Safety Regulations 2007, No. 54 – Part3.3.
- Providing the safest method of climbing towers.
- Substantial reduction of the current risks associated with inspection, maintenance and project works on EHV towers – see NPV tables.

6 Options Analysis

6.1 Option 1 – Do nothing and continue to use double lanyards to access the towers

The do nothing option would result in delays during climbing inspections and the continued exposure of line workers from the hazards associated with falling from a considerable height whilst climbing or descending the tower. Double lanyards are designed to extend to more than 1.5 metres as a means of dampening the fall of a line worker. This means that although a line worker is restrained from falling to the ground, there is a high probability that they will strike the steelwork (step bolts, bracing members, etc.) beneath them.
This option will therefore leave AusNet Services exposed to substantial fines from WorkSafe, and possibly a ban on the use of double lanyards. In this event, the Company would be forced to use Elevated Work Platforms and/or Brontos (electrically insulated work platforms) for all maintenance work, inspections, and project works. The costs associated with this work methodology would be very high. The negative impact to AusNet Services Corporate Reputation of a penalty from WorkSafe, and the implications of a power utility not being able to access its assets is very serious.
This option carries an excessive level of risk with potentially very expensive consequences, as well as failing to adopt sound industry practice; therefore it is not recommended.

This option is inconsistent with AusNet Services' obligations under the Electricity Safety Act to *design, construct, operate, maintain and decommission its supply network to minimise, as far as is practicable, the hazards and risks to the safety of any person arising from the supply network*.[1]

[1] Electricity Safety Act 1998, section 98(a).

What is considered "practicable" is determined by having regarded to:

a) the severity of the hazard or risk in question; and
b) state of knowledge about the hazard or risk and any ways of removing or mitigating the hazard or risk; and
c) the availability and suitability of ways to remove or mitigate the hazard or risk; and
d) the cost of removing or mitigating the hazard or risk.[2]

6.2 Option 2 – Defer the program to start in FY 2020/21

This option has the same disadvantages as the Do Nothing Option, in addition to the risk of increasing labour and material costs, and is therefore not recommended.

6.3 Option 3 – Install the cable system on EHV towers starting in FY 2017/18 - preferred

This option will continue to manage the risk associated with falling from a tower whilst ascending and descending it via the designated access paths, as well as improve the productivity of line workers during tower inspections, maintenance and project works by increasing the rate of access.
The installation of the FAS on 25% towers in the transmission fleet is in line with the Occupational Health and Safety Regulations 2007, No. 54 – Part3.3.
Staging the FAS installation at a steady pace over more years is efficient and results in material risk reduction compared to retrofitting all 47% of the towers over the forecast regulatory period.

7 Financial Analysis

Each option has been financially analysed using an NPV model[3]. Option 3 which is the continuation of the fall arrest installation program achieves the greatest amount of benefit compared to option 1 and 2. These benefits are based on the expected increase in safety for the lineworkers while climbing up and down the structure.

Economic Analysis of Options ($'000s)	PV Capital Cost	PV Opex Costs	PV Community Benefits	PV Proceeds From Sales	Total PV Cost	NPV including Reg Return
Do Nothing	-	(8,652)	(32,308)	-	(40,960)	-
Defer the program to start in FY 2020/21	(15,226)	(7,277)	(16,270)	-	(38,773)	690
Install the cable system on EHV towers starting in FY 2017/18.	(19,986)	(6,849)	(11,273)	-	(38,108)	724

Table 2 – NPV analysis

All figures are in $000's unless otherwise stated (nominal and discounted)

[2] Electricity Safety Act 1998, section 3.
[3] \\Rchfil100\asset\Asset Engineering\Lines\General Team Information\Regulatory Resets\TRR\TRR 2018-2022\4. Program of Works 2017-2022.

8 Recommended Action

Option 3, the continuation of the fall arrest program on 25% of the tower fleet is recommended. This will increase the proportion of the total transmission towers fleet retrofitted with FAS to 78%.

9 Reference Documents

- Electricity Safety Act.
- Electricity Safety (Management) Regulations.
- Occupational Health & Safety Act.
- AMS 10-77 Transmission Line Structures.
- Tower FAS installation 2015-2017 ver2.xls.
- ProgramofWorksforcurrentReset15-20.xls.