Program of Works

2017 – 2022 Civil Infrastructure Replacement

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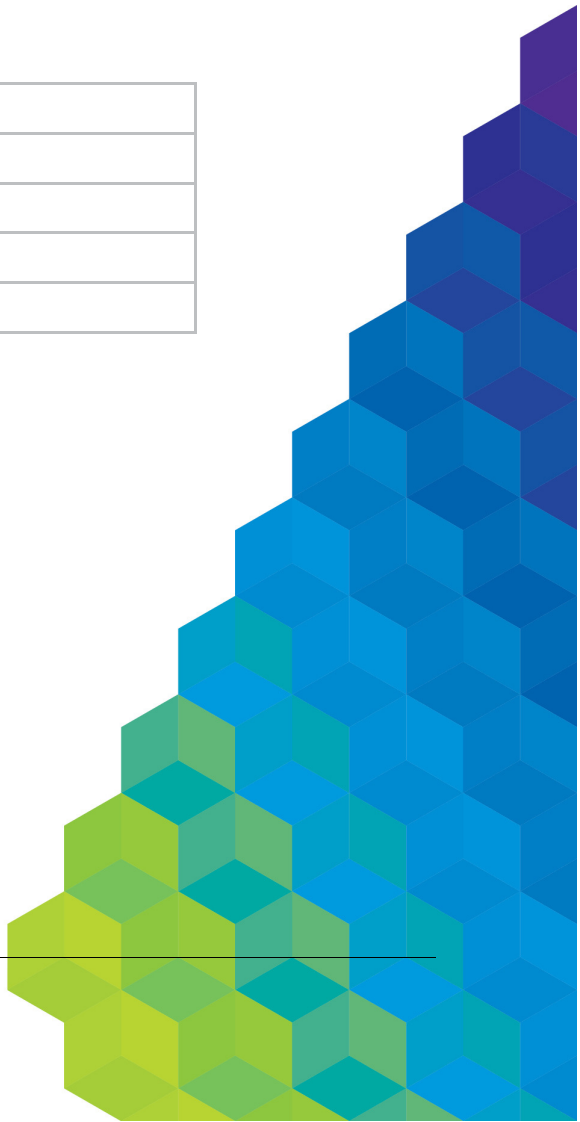

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Table of Contents

1 Summary 4
1.1 Program Scope 4
1.2 Program Expenditure Forecast 5
2 Program Drivers 6
3 Overview 7
3.1 Buildings 8
3.2 Switchyard Surfaces, Access Roads, Drainage and Environmental systems 8
3.3 Support Structures, Retainer Walls, Hand Rails and Earth Embankments 8
3.4 Station Service Transformers, Metallic Cabinets, and Air Conditioning Units 9
4 Risk Matrix 10
5 Options 11
5.1 Option 1 – Do nothing 11
5.2 Option 2 – Replace on condition 12
5.3 Option 3 – Replace on service age 12
5.4 Option 4 – Replace on failure 13
6 Financial Analysis 13
7 Recommended Action 14
8 Reference Documents 14

1 Summary

PROGRAM	Civil Infrastructure Capital Replacement Program 2017/18 – 2021/22.
SERVICE DATE	On-going throughout period 2017/18 – 2021/22.
LOCATION	Various Terminal Stations across Victoria.
VALUE	$10.35M ($8.85M over 2017/18 to 2021/22).

Table 1 – Program Overview

1.1 Program Scope

The scope for civil infrastructure and station facilities (CISF) assets replacement program covers replacement, and where necessary upgrade, works, at various terminal stations sites across the state, related to the following assets:

- All type of buildings including metallic, brick, cement clad or any other type of building or housings with/without asbestos.
- Switchyard surfaces, access roads, drainage systems, cable trenches etc.
- Support structures such as steel structures, lighting poles, hand rails, retainer walls, and earth embankments/flood levees etc.
- Station service transformers and LV supply metallic cabinets in switchyards.
- Air conditioning and ventilation systems.
- Oil water separators and triple interceptor pits (environmental control equipment).

Further detail of the scope of replacement works by asset type is detailed below.

Buildings
Based on condition and asbestos removal targets/plans (Appendix 1, section 10.1), the following works are proposed (continuation of current practice or program) to be carried out during 2017/18 to 2021/22:

- Removal/ replacement of asbestos tiles/ cement sheets/ claddings at 15 terminal stations sites with asbestos presence) with an estimated expenditure of $3.0M. Additionally, other sites are expected to have asbestos removed during station rebuild projects.
- Replacement of bad condition roofs at five buildings with condition rating of C4/C5 at an estimated expenditure of $0.5M. Five roofs have been replaced over last 6 years due to poor condition (C5).

Switchyard Surfaces, Access Roads, Drainage & Environmental Systems
Three terminal stations sites with condition rating of C4/ C5 are proposed to be upgraded for switchyard surfaces and access roads during 2017/18 to 2021/22, with an estimated expenditure of $1.2M.

Expenditure of $0.5M is proposed for the installation of safety measures such as safety rails and wire mesh protection on holding tank at five stations.

Support Structures, Retainer Walls, Hand Rails & Earth Embankments
Expenditure of $1.5M is proposed on retainer walls, earth embankments and safety hand rails to provide strength, flood protection and safe work environment for employee and contractors at three terminal stations sites.

Station Service Transformers, Metallic Cabinets & Air-conditioning Units

Based on load and condition data (C4/C5) the following replacements are proposed during the forecast period:

- SST/MDBs/COBs at three terminal stations sites ($3.0M).
- Metallic cabinets at 4 terminal stations sites ($0.3M).
- AC units and other minor replacements at 12 terminal stations sites (2 sites each year) (0.6M).

1.2 Program Expenditure Forecast

2016/17 ($k)	2017/18 ($k)	2018/19 ($k)	2019/20 ($k)	2020/21 ($k)	2021/22 ($k)	Total ($k)
1,500	1,770	1,770	1,770	1,770	1,770	10,350

Table 2 – Program timing and forecast expenditure

The total program is $10.35M, however, $1.5M of this work is scheduled for the 2016/17 financial year resulting in expenditure of $8.85M over the 2017/18 to 2021/22 regulatory period.

Forecast costs shown in Table 2 are $2014/15 P50 direct costs. These costs exclude overheads, finance charges and cost escalation. The expenditure of the program has been estimated based on average actual expenditure on similar projects during last five years.

2 Program Drivers

The condition of civil infrastructure and station facilities at several terminal stations has deteriorated such that these assets are no longer capable of performing at the required level.

Several assets under CISF systems require replacement/upgrade in order to maintain acceptable levels of risk. Major failure of CISF assets can result in the following:

- Health and Safety incidents.
- Asset damage.
- Financial penalties.
- Significant repair costs.
- Severely constrained system capacity.

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 capital and operating costs through asset damage control.
  - Reduce financial penalties associated with poor asset availability.
  - Reduce civil actions resulting from personal injury / compromised health.
- Regulatory compliance:
  - Compliance with National Electricity Rules.
  - Compliance with Electricity safety Act.
  - Compliance with accepted Electricity Safety Management Scheme.
  - Occupational Health & Safety Act (provide safe work environment).
  - Compliance with environmental legislative requirements and guidelines from State Environmental Protection Policy (SEPP) Victoria.
  - State Environmental Protection Policy N – 1: Control of noise from Commerce, Industry, and Trade.
- Corporate image maintained as prudent asset managers:
  - Manage risk as low as practicable.

3 Overview

A number of CISF assets are in-service at each terminal station to facilitate and support the safe operation and proper functioning of main electrical equipment. These infrastructure assets play an important role by providing all weather housing and safe work / operating environment for the main electrical equipment. The useful service life of the CISF assets can vary significantly based on specific site conditions and the surrounding environment in which they operate.

CISF assets include a large number of assets as per the following:

- Buildings (several different purposes) such as control / relay rooms, switch room, communication rooms, battery rooms, compressor house, amenities, stores, etc, to provide all weather housing.
- Access roads to facilitate electrical equipment installation, replacement, maintenance, etc.
- Switchyard surfaces with specified surfaces to limit the electrical step and touch potential issues and provide all weather access for equipment.
- Storm water drainage systems for drainage without flooding.
- Environmental systems to control oil spills and other liquid discharges.
- Support structures, foundations, retainer walls and earth embankments to support various electrical assets and structural support base.
- Cable ducts and trenches to provide safe housing.
- Metallic cabinets and enclosures for safe housing of LV systems.
- Water pipes and water storage tanks for storage and supply of water for amenities and cleaning purposes.

The main issues with all these civil structures are:

- Management of solid asbestos in walls, floor tiles, ceilings, roofs and equipment mounting panels and possible asbestos dust in cable trenches and ducts. As per AusNet Services' current strategy, all accessible asbestos should be removed by 2025.
- Provision of additional security in the form of exterior hardening such as window screens, door facings, locks and hinges.
- Provision of adequate environmental housing for the increasing volume of digital electronic equipment that requires the superior control of dust, humidity and ambient temperature.
- Compliance with environmental legislation such as oil spill control, rain water discharge and noise pollution.
- Compliance with occupational health and safety legislation such as working at heights and confined spaces.
- Provision of appropriate pedestrian and vehicle access including elimination of potential hazards such as unmarked / un-barricaded open drains.
- Maintaining switchyard surface electrical resistivity to ensure safe step and touch potentials for personnel working in switchyards.
- Stability of mobile work platforms and vehicles involved in maintenance and construction activities manoeuvring on crushed rock switchyard surfaces.
- At many locations, in older terminal stations, protective ducts and trenches are full with a combination of in-service PVC secondary cables and abandoned vulcanised rubber cabling.
- Cable trenching is susceptible to damage from vehicles or soil movement caused by vehicles.

Please refer to AMS document AMS 10-55: Civil Infrastructure for further details.

Economic evaluations by NPV modelling (AusNet Services' financial assessment tool) has been performed in conjunction with risk assessments to establish that proposed upgrade / replacement program of CISF assets is financially / economically justified. This program of work will remove significantly the existing risk associated with major failure of CISF asset resulting in asset damage or OHS incident.

3.1 Buildings

Approximately 216 buildings provide all weather housing for a range of equipment. Most of the buildings dates back to the original construction of terminal stations but some of the buildings are partially modified or new buildings are constructed during major augmentation and asset renewal projects.

The terminal stations buildings vary widely in age, construction materials and conditions. Ranging from multi-storied brick and masonry construction to single story timber and asbestos cement sheet construction, many are in need of augmentation, refurbishment or replacement.

3.2 Switchyard Surfaces, Access Roads, Drainage and Environmental systems

Approximately 133 hectares of switchyard surfaces are graded, drained and surfaced (selected crushed rock) to assist with installation, operation and maintenance of electrical equipment in all weather conditions. The return of more than normal rainfall after prolonged drought has had a negative impact on switchyard surface conditions. Large investments in recent years have maintained switchyard surfaces in serviceable condition and no major works are forecast for 2017/18 to 2021/22.

Approximately 13km of reinforced roads (bitumen sealed or concrete with kerbing / drains) in terminal stations provide transport for heavy equipment such as large transformers. A further 29 km (bitumen sealed with spoon drains) provide all-weather access to electrical equipment located in switchyards. Some switchyard perimeter roads are gravel surfaced and without edging and rely on natural drainage.

The conditions of access roads have been maintained, in general, quite well so far without any major issues. But now with ageing electrical asset fleets and increasing use of these roads for replacement works have resulted in negative impact on access roads. Therefore continuous replacement of deteriorating roads is essential to keep the overall conditions above an acceptable level of risk.

Generally, drains are in good conditions and should generally handle typical rainfalls effectively. Also, a major environmental upgrade program was initiated in 2002 to comply with stricter requirements from State Environmental Protection Policy Victoria. The four stages of the program have been completed successfully to cover 30 terminal stations. The fifth and the last stage of the program is expected to be completed by March 2017. Therefore no major expenditure is estimated in the near future for environmental upgrade works.

Some of the stations don't have safety rails and wire mesh protection on holding tanks. These safety measures should be installed at these stations.

3.3 Support Structures, Retainer Walls, Hand Rails and Earth Embankments

There are numerous structures supporting various plant items in terminal station. These structures are typically galvanised steel in bolted lattice or welded component arrangements. Also there are number of retainer walls, earth embankments and safety hand rails installed for various reasons to provide strength, flood protection and safe work environment for employee and contractors.

The general conditions of these assets are quite good with occasional replacement required due to corrosion or physical damage. However, with the increase in extreme weather incidents each year and adoption of mission ZERO safety policy, there are increasing requirements for replacement of existing ageing support structures or installation of new safety structures.

AusNet Services has experienced substantial expenditure ($4M at 5 terminal stations sites) on these assets in previous/current regulatory periods based on poor (deteriorated at faster rate) condition or new requirements.

3.4 Station Service Transformers, Metallic Cabinets, and Air Conditioning Units

Station service transformers (SST) and metallic cabinets for LV supply are an essential part of every terminal station. There are approximately 100 SST installed at 45 terminal stations across Victoria. Data indicates that several SST and cabinets date back to the initial installation of the terminal station. Load and condition data for SST indicates that several are now overloaded and deteriorating faster than normal rate.

Please refer to asset management strategy document AMS 10-126: AC Station Service supplies for further details.

Additionally, several 415V main distribution boards (MDB) and changeover boards (COB) contain Asbestos Cement (ACM) panels. These boards would require significant repair time and efforts during a fault due to restrictions on modification work on any ACM panel/boards. Replacement/upgrade of entire station supply including the main distribution and change over boards is a more efficient and prudent option in comparison to replace the equipment in isolation.

Also conditions of several metallic cabinets at various terminal stations have been reported poor requiring urgent replacement.

Air-conditioning units and ventilation systems are required for all building containing sensitive electronic equipment and panels such as control room, relay rooms, switch rooms and communication rooms. The average age of AC units have been assessed as approximately 10 years.

4 Risk Matrix

The CISF upgrade / replacement program will significantly reduce the likelihood of any major failure of any CISF asset causing damage to the main electrical equipment or any OHS issue. This reduction in likelihood will be achieved by replacing/ upgrading CISF assets which are in poor condition (C4/C5) / non-compliant or aged. The upgrade of CISF assets is an ongoing program to ensure the safe and good working environment/ structural base for operation of main electrical equipment and employees.

Although some upgrade of CISF assets are coupled with rebuilt program but as per previous experience several assets are left out with original conditions or with bare minimum upgrade works due to budget constraints during major rebuilt works. Therefore, a small number of separate programs / projects are essential to keep the CISF assets in good conditions. This upgrade program shall ensure the significant reduction in the risk of any major asset damage, financial penalties, or compensations. Also with reduced OHS risks the possibility of any OHS incident shall be reduced significantly resulting in reduced negative impact on community.

Therefore, the continuation of the program is recommended to ensure levels of risks remain below acceptable limits into the future. Implementation of the CISF assets upgrade / replacement program will reduce the consequence from major to moderate and likelihood from moderate to unlikely as indicated below in.

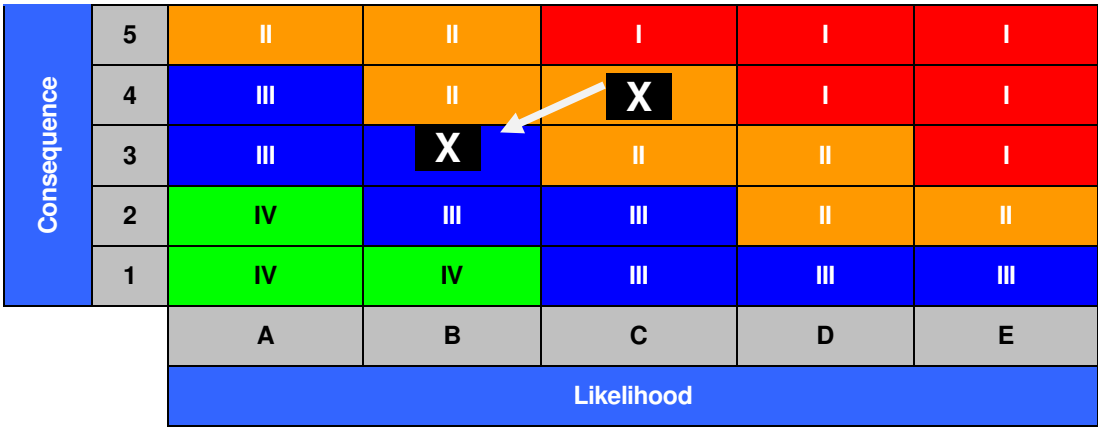

Figure 1 – Risk Matrix

5 Options

The following options were considered and evaluated.

Option 1 Do Nothing

Option 2 Replace on Condition

Option 3 Replace on Service Age

Option 4 Replace on Failure

Table 3 outlines the risks which will be addressed through implementation of each option along with ranking and recommendation.

	Risks Addressed Remarks			
	Regulatory Compliances	Australian Standard Compliances	OH&S Obligations	Present Value Cost
Option 1	No	No	No	Second Highest
Option 2	Yes	Yes	Yes	Lowest (recommended)
Option 3	Yes	Yes	Yes	Highest
Option 4	No	No	No	Third Highest

Table 3 – Summary of option analysis

5.1 Option 1 – Do nothing

The Do Nothing Option involves:

- continuing inspection and maintenance activities for CISF assets
- repair assets on failure instead of replacements.
- continuing with non-compliant (to Australian Standard and AusNet Services' Standards) assets
- progressive decline in service provision to consumers.

The do nothing option involves continuation of bad condition assets to be inspected and maintained but progressively fail and are not replaced.

This option will result in rising maintenance costs, rising risk costs (accidents and misadventures) and falling service to consumers. Further, compliance with regulatory obligations, including safety obligations, will not be maintained.

The NPV modelling has indicated that this option is the second most expensive option with net present cost and therefore this option is neither economic nor prudent.

5.2 Option 2 – Replace on condition

Implementing a condition / risk assessment based replacement program involves:

- Proactively replacing of the CISF assets, assessed with condition grades C4/C5 assets.
- Reducing the risks associated with major CISF failure significantly at an estimated direct cost of $10.4M.
- Continuing inspection and maintenance activities (including testing) for CISF systems in compliance to relevant Australian Standards.
- Reactively replacing assets which during inspections and maintenance activities are identified as defective.

A risk/ condition based replacement program greatly reduces exposure to significant financial and regulatory risks associated with failing CISF asset to demonstrate an appropriate level of due diligence. This option reduces potentially significant health and safety and financial liabilities by replacing poor condition assets which, following a risk assessment, have been deemed economically justified for replacement.

This option ensures that risks associated with CISF assets and age based degradation are addressed in the most economic manner. Additionally, this option will ensure that risks associated with failure of CISF assets are reduced which is especially important considering the possible health and safety consequence associated with any major CISF asset failure. Implementation of a risk/condition based replacement program will maintain the levels of performance and reliability.

The NPV modelling has indicated that this is the most economic option with net present cost of $13.0M and positive NPV of $1.0M.

This option addresses all of the key business drivers listed in the Program Drivers section with minimum expenditures and is therefore the preferred option.

5.3 Option 3 – Replace on service age

Implementing an age based replacement program involves:

- Proactively replacing the CISF assets which have exceeded the average regulatory / useful service life.
- Reducing the risks associated with major CISF failure significantly at an estimated direct minimum cost of $30M.
- Continuing the inspection and maintenance activities for CISF assets.
- Reactively replacing CISF assets which during inspections and maintenance activities are identified as defective.

An age based replacement program reduces exposure to significant financial and regulatory risks associated with failing CISF asset to demonstrate an appropriate level of risk reduction. This option reduces potentially significant health and safety and financial liabilities by replacing CISF assets which are above the mean age of CISF assets regulatory/ useful service life. Some of the assets may deteriorate before the regulatory life due to hostile work environment or other reasons.

Although this option addresses most of the business drivers, it requires significantly higher capex in comparison to Option 2. The NPV modelling has indicated that this option is the most expensive option.

This option does not demonstrate efficiency, is inconsistent with AusNet Services asset management approach and is not recommended.

5.4 Option 4 – Replace on failure

The Replace on failure option involves:

- Continuing inspection and maintenance activities for CISF assets.
- Reactively replacing failed assets or components during inspections or identified as defective.
- Continue with non-compliant (to Australian Standard and AusNet Services' Standards) assets.

This option involves leaving assets in-service until they fail. On failure of any significant component, the full asset is replaced. This option involves accepting risks associated with aged and non-compliant assets that have increasing probability of failure. Choosing this option will not assist with reducing risks and will not assist with maintaining acceptable levels of risks into future. Effectiveness of the CISF assets shall be compromised significantly if this option is implemented.

This option exposes AusNet Services to significant financial and regulatory risk by failing to demonstrate an appropriate level of due diligence. This option presents potentially significant health and safety and financial liabilities.

The NPV modelling has indicated that this option is the third most expensive option.

This option fails to address any of the key business drivers listed in the Program Drivers section and therefore not recommended.

6 Financial Analysis

Each option has been financially analysed using an NPV model.

Option 2 which is the condition/risk based replacement option achieves the greatest benefit for the lowest capital cost when compared to other options. These benefits are based on significant risk reduction (90%) achieved through targeted replacement of CISF assets containing the high risk of major failure.

The condition / risk based replacement option displays the lowest present value cost of $13.0M and the positive net present value cost of $1.0M.

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	-	(8,570)	(10,548)	-	(19,118)	**-**
Upgrade/ replace CISF assets, condition/risk based	(9,590)	(1,522)	(1,873)	-	(12,984)	**1,045**
Upgrade/ replace CISF assets, aged based	(29,843)	(1,428)	(1,758)	-	(33,029)	**1,741**
Upgrade/ replace CISF only after failure	(15,407)	(2,636)	(3,244)	-	(21,287)	**716**
	-	-	-	-	-	**-**

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

Table 4 – NPV Results

7 Recommended Action

The risk based replacement program, Option 2, is recommended. Detail of proposed works and sites have been provided in Table 5.

Description of Work with potential sites	Proposed Number of Sites	Unit Rate ($k)	Total Estimated Expenditure ($k)
Removal / replacement of asbestos tiles, cement sheets, wall claddings, etc	15	200	3,000
Replacement of rusted / poor condition building roofs	5	100	500
Replacement of switchyard surfaces, access roads, etc	3	400	1,200
Safety hand rails and chain wire mesh panels	5	100	500
Reinforcement / replacement of support structures, retainer walls, earth embankments	3	500	1,500
Replacement of SST, MDB and COB	3	900	2,700
Replacement of metallic cabinets and junction boxes and other outdoor cabinets / panels	5	70	350
Replacement of air conditioning and other minor buildings or site works	12	50	600
Total			**10.350**

Table 5 – Summary of proposed works

8 Reference Documents

- AMS 10-55 Civil Infrastructure.
- AMS 10-126 AC Station Service supplies.
- Live Asbestos Register in Lotus notes data base.
- AusNet Services' Station Design Manual (SDM), Volume 5, relevant sections as several sections are applicable for different civil works.
- Building codes of Australia.
- State Environmental Protection Policy – Waters of Victoria.
- State Environmental Protection Policy N – 1: Control of noise from Commerce, Industry, and Trade.