

OPTIONS EVALUATION REPORT (OER)



Cable 41 Tunnels Condition

OER 000000001088 revision 6.0

Ellipse project no.: P0008639

TRIM file: [TRIM No]

Project reason: Capability - Asset Replacement for end of life condition

Project category: Prescribed - Asset Renewal Strategies

Approvals

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Date submitted for approval	10 January 2017	

Change history

Revision	Date	Amendment
0	1 July 2016	Initial issue
1	12 September 2016	Revised for Updated Commercial Evaluation
2	28 October 2016	Revised for New SFAIRP/ALARP Methodology
3	7 December 2016	Update to format
4	8 December 2016	Added Ellipse project no.
5	10 January 2017	Revised related Needs/opportunities
6	10 January 2017	Revised related Needs/opportunities

1. Need/opportunity

The Cable 41 tunnels consist of two driven tunnels with entrance manholes at each end. The Western tunnel is 146 metres long and the Eastern tunnel is 197 metres long. Both tunnels are considered to be in “reasonably good condition” and that the likelihood of major or full collapse is very low. There is however some localised zones of concern. There are localised areas of tunnel crown fretting and timber lagging is not serving any purpose due to rot. These are described in detail in the [2013 Pells Sullivan Meynink \(PSM\) inspection report](#).

2. Related Needs/opportunities

Pre-requisite

- > There are no pre-requisite Needs.

Related

- > Need 1413 – Cable 41 Short Term Rating
 - Service provider resources for completion and scheduling of Cables projects should be considered.
- > Need DCN 42 – Capability of Cable 41 Sydney South to Beaconsfield
 - A component of this Need could involve a backfill replacement, which could be resource intensive. Parallel scheduling may not be possible.

Dependent

- > There are no dependent Needs.

3. Options

All dollar values in this document are expressed in un-escalated 2016/17 dollars.

Base Case

A Condition report from a tunnel engineering specialist has identified existing issues in the Cable 41 tunnels which require rectification. A summary of these can be found in Need/Opportunity Statement (NOS) [NOS 1088](#).

Under a Base Case ‘do nothing’ option, the associated risk cost from the issues identified in Table 1 is \$5.84m per annum. A breakdown of the Base Case risk cost by category is shown in Table 1.

Table 1 – Base Case risk cost by category (\$ million)

Risk Category	Annual Risk Cost
Insulation Breakdown due to cable failure as a result of cable damaged from infrastructure failure	5.81
Infrastructure failure damaging cable, cable repaired before insulation failure	0.03
Total	5.84

The value is very high because whilst damage to the cable is unlikely the consequence from a reliability perspective is catastrophic. Cable 41 is a critical circuit with long repair times.

Option A — Remediate Tunnel [OFR 1088A, OFS 1088A]

This option involves remediation of the following:

Areas of fretting of the tunnel walls and crown, to be remediated by shotcrete tunnel liner such as Tunnel Guard or Tekflex:

- > Tunnel 1 – Chainage 143m
- > Tunnel 2 – Chainage 1.4 to 4 metres

Timber lagging rotted and ineffective, to be replaced with man-made product (such as Modwood):

- > Tunnel 1 – 32 metres in total
- > Tunnel 2 – 19 metres in total

It is estimated that the total capital expenditure associated with the refurbishment outlined in this option is \$0.24m ±25%. Details can be found in Section 6 of Option Feasibility Study (OFS) [OFS 1088A](#).

Annualised savings of \$4k is realised through reduction in specialist inspection (from once in three years to once in five years)

The post investment risk cost is \$0.29m per annum. A breakdown of the Option A risk cost by category is shown in Table 2.

Table 2 – Option A risk cost by category (\$ million)

Risk Category	Annual Risk Cost
Insulation Breakdown due to cable failure as a result of cable damaged from infrastructure failure	0.29
Infrastructure failure damaging cable, cable repaired before insulation failure	0
Total	0.29

The total projected risk reduction as a result of implementing Option A is \$5.55m per annum. This is mainly due to the large Value of Customer Reliability (VCR) associated with Cable 41. Completing Option A would reduce the probability of infrastructure that could damage the cable.

Both the Base Case option and Option A outlined in Section 3 are considered to be technically feasible¹.

4. Evaluation

4.1 Commercial evaluation

The commercial evaluation of the technically feasible options is set out in Table 3. Details of the Net Present Value (NPV) calculation for Option A are provided in Attachment 1.

¹ An option is technically feasible if TransGrid reasonably considers that there is a high likelihood that the option, if developed, will provide the relevant service while complying with all relevant laws.

Table 3 — Commercial evaluation (\$ million)

Option	Description	Total capex	Annual opex	Annual post project risk cost	Economic NPV @10%	Financial NPV @10%	Rank
Base Case	Do nothing	N/A	N/A	5.84	N/A	N/A	2
A	Remediate tunnel	0.24	-	0.29	38.34	0.03	1

The commercial evaluation is based on:

- > A 10% discount rate
- > A life of the investment of 50 years and a corresponding residual/terminal value
- > An allowance for a reduction in OPEX costs from savings on specialist inspections, totalling \$0.004m per annum

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory Weighted Average Cost of Capital (WACC) of 6.75% and 13% appear in Table 4.

Table 4 — Discount rate sensitivities (\$ million)

Option	Description	Economic NPV @13%	Economic NPV @6.75%
A	Remediate tunnel	28.32	55.84

4.2 SFAIRP/ALARP evaluation

In the context of the Network Asset Risk Assessment Methodology, the SFAIRP (So Far As Is Reasonably Practicable)/ALARP (As Low As Reasonably Practical) principle is applicable to the following Key Hazardous Events:

- > Unplanned outage of High Voltage (HV) equipment

Options to reduce the network safety risk as per the risk treatment hierarchy have been considered in other lifecycle stages of the asset, and it has been determined that no reasonably practicable options exist to reduce the risk further than those capital investment options listed in Table 5.

Evaluation of the proposed options has been completed against the SFAIRP (So Far As Is Reasonably Practicable)/ALARP (As Low As Reasonably Practical) obligation, as required by the Electricity Supply (Safety and Network Management) Regulation 2014 and the Work Health and Safety Act 2011. The Key Hazardous Events and the disproportionality multipliers considered in the evaluation are as follows:

- > Unplanned outage of HV equipment – 6 times the environment (bushfire) risk, 6 times the safety risk and 10% of the reliability risk (applicable to safety)

Table 5 – Feasible options (\$ thousand)

Option	Description	CAPEX	Expected Life	Annualised CAPEX
Base	Do nothing	N/A	N/A	N/A
A	Remediate tunnel	240	50 years	5

Table 6 – Annual risk calculations (\$ thousand)

Option	Annual Residual Risk			Annual Risk Savings		
	Safety Risk	Reliability Risk	Bushfire Risk	Safety Risk	Reliability Risk	Bushfire Risk
Base	0	5,810	0	N/A	N/A	N/A
A	0	290	0	0	5,520	0

Table 7 – Reasonably practicable test (\$ thousand)

Option	Network Safety Risk Reduction ²	Annualised CAPEX	Reasonably practicable ³ ?
A	552	5	Yes

From the above evaluation, it is considered that Option A is reasonably practicable.

4.3 Preferred option

From the SFAIRP/ALARP evaluation, Option A is considered to be reasonably practicable and is required to be undertaken in order to satisfy the organisation’s SFAIRP/ALARP obligations.

Option A is also considered to be commercially viable (as per the commercial evaluation). For the aforementioned reasons, it is proposed that Option A be scoped in further detail.

Capital and operating expenditure

The estimated capital expenditure associated with the refurbishment outlined in this option is \$0.24m ±25%.

As a result of the line refurbishment works outlined in Option A operating expenditure could be reduced by an annualised \$4k by reducing the inspection from 3-yearly to 5-yearly.

Should the Option A (Tunnel Refurbishment) works not occur by the Need date, an increase in corrective maintenance and subsequent operating expenditure is expected.

Regulatory Investment Test

No Regulatory Investment Test for Transmission (RIT-T) analysis is required as the works are condition based.

5. Recommendation

From the above SFAIRP/ALARP evaluation in accordance with the regulatory requirements, and the commercial and technical evaluation of the available options, it is recommended that detailed scoping for the refurbishment of Cable 41 Tunnels as outlined under Option A is undertaken.

² The Network Safety Risk Reduction is calculated as 6 x Bushfire Risk Reduction + 6 x Safety Risk Reduction + 0.1 x Reliability Risk Reduction

³ Reasonably practicable is defined as whether the annualised CAPEX is less than the Network Safety Risk Reduction

Attachment 1 – Commercial evaluation report

Option A NPV calculation

Project_Option Name		Cable 41 Tunnel Condition			
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	\$0.03m	<i>NPV / Capital (Ratio)</i>	0.14	
NPV @ upper bound rate	13.00%	-\$0.02m	<i>Pay Back Period (Yrs)</i>	0.12 Yrs	
NPV @ lower bound rate (WACC)	6.75%	\$0.14m	<i>IRR%</i>	11.69%	
2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)					
NPV @ standard discount rate	10.00%	\$38.34m	<i>NPV / Capital (Ratio)</i>	-12.78	
NPV @ upper bound rate	13.00%	\$28.32m	<i>Pay Back Period (Yrs)</i>	Not measurable	
NPV @ lower bound rate (WACC)	6.75%	\$55.84m	<i>IRR%</i>	330.63%	
Benefits					
Risk cost	As Is	To Be	Benefit	<i>VCR Benefit</i>	\$5.52m
<i>Systems (reliability)</i>	\$5.81m	\$0.29m	\$5.52m	<i>ENS Penalty</i>	\$0.00m
<i>Financial</i>	\$0.03m	\$0.00m	\$0.03m	<i>All other risk benefits</i>	\$0.03m
<i>Operational/compliance</i>	\$0.00m	\$0.00m	\$0.00m	Total Risk benefits	\$5.55m
<i>People (safety)</i>	\$0.00m	\$0.00m	\$0.00m	Benefits in the financial NPV*	\$0.03m
<i>Environment</i>	\$0.00m	\$0.00m	\$0.00m	<i>*excludes VCR benefits</i>	
<i>Reputation</i>	\$0.00m	\$0.00m	\$0.00m	Benefits in the economic NPV**	\$5.55m
Total Risk benefits	\$5.84m	\$0.29m	\$5.55m	<i>**excludes ENS penalty</i>	
Cost savings and other benefits			\$0.00m		
Total Benefits			\$5.55m		
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			\$0.00m	Write-off cost	\$0.00m
Capital - initial \$m			-\$0.24m	Major Asset Life (Yrs)	50.00 Yrs
Residual Value - initial investment			\$0.11m	Re-investment capital	\$0.00m
Capitalisation period			3.00 Yrs	Start of the re-investment period	0.00 Yrs