

NEED/OPPORTUNITY STATEMENT (NOS)



Line 13 330kV Transmission Line Renewal

NOS- 000000001272 revision 2.0

Ellipse project no.: P0005449

TRIM file: [TRIM No]

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

Project category: Prescribed - Replacement

Approvals

Author	Robert Alcaro	Asset Strategist
Endorsed	Steve Stavropoulos	Transmission Lines and Cables Asset Manager
Approved	Lance Wee	Manager/Asset Strategy
Date submitted for approval	26 July 2016	

Change history

Revision	Date	Amendment
0	11 April 2016	Initial issue
1	27 July 2016	Update to 2016/17 dollars
2	24 November 2016	Revised to contain tower strength commentary and update to format

1. Background

Line 13 is a 330kV transmission line between Kemps Creek and Sydney South 330kV substations, with a route length of 24.2 km. The transmission line links generation entering Kemps Creek to Sydney metro area. The single circuit section of this line was constructed in 1963 and consists of 37 structures, a route length of 11.5 km. The line passes through urban areas of Sydney.

Condition assessment NACA-1272¹ performed in November 2015 has identified a number of issues with transmission line 13 which require rectification in the short – medium term to ensure that the asset remains operational in the long term. Corrosion of steel is the main contributing factor leading to a decline in the health of the asset.

This transmission line falls within a zone of low² steel corrosion, however is on the border of the medium² corrosion zone.

2. Need/opportunity

Condition assessment NACA-1272 has identified issues which require rectification, these are summarised in Table 1.

Table 1 – Transmission Line 13 Condition Issues

Issue	Extent (% line)	Cause	Impact
Buried concrete foundations	10%	Erosion of soil building up around footings	Accelerated corrosion of critical member
Insulator pin corrosion	90%	Pollution build up and deterioration of galvanising	Conductor drop
Conductor vibration dampers	10%	Damaged	Accelerated fatigue of conductor due to vibration
Corrosion of earth wire	10%	Zinc galvanising end of life	Conductor drop

The risk cost associated with the issues identified in Table 1 is \$0.35m per annum (refer Attachment 1). One of the most significant elements of concern is ground line corrosion of steel transmission tower legs at the footings. These are an item of concern as they are the critical load bearing members of the tower and cannot be easily remediated if the condition passes a stage where rectification work is not possible.

The single circuit transmission line structures used on Line 13 were designed to the standards at that time but were found to be a lower set of design criteria compared with newer structures. Following a number of structure failures in extreme wind events, investigations found that these single circuit suspension towers had design deficiencies in the governing load combinations when compared to more recent design philosophies and standards.

Strengthening of structures with utilisation over 85% at road crossings and public areas has occurred. As not all structures have been strengthened, it is essential that condition issues on these towers be addressed so that they do not reduce the capacity of the towers and further reduce the security of supply.

¹ [NACA-1272](#) on PDGS Need Site

² Steel corrosion rate as defined in AS 4312 – *Atmospheric corrosivity zones in Australia*

Corrosion of steel pins on ceramic insulators is also a significant issue. The pins on the underside of suspension insulator discs build up pollution and are not adequately washed by rain which leads to an increased rate of corrosion. A number of insulator failures leading to conductor drop have occurred due to the pins corroding through. Original (pre 1965) insulators are installed on the majority (75%) of Line 13 with insulators of the 1965-1974 vintage making up another 15%. These require replacement to reduce the risk of conductor drop as Line 13 passes through urban areas.

The corrosion issues associated with insulators and earthwire is consistent with other transmission lines of the same vintage in the region.

Damaged conductor dampers require replacement to ensure the long term health of the conductors is not impacted by vibration.

The benefit of addressing the condition issues on Transmission Line 13 is to continue providing the service at a lower risk of failure.

3. Related needs/opportunities

No related needs/opportunities have been identified.

4. Recommendation

It is recommended that options be considered to address the identified need/opportunity by 2023.

Attachment 1 - Risk costs summary

Summary of results is attached below. Refer to supporting document in PDGS for full risk assessment.

Current Option Assessment - Risk Summary



Project Name: Line 13

Option Name: 1272 - Base Case

Option Assessment Name: 1272 - Base Case - Assessment 1

Rev Reset Period: Next (2018-23)

Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr 1)	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Peo)	Risk (\$M) (Env)	Risk (\$M) (Rep)	
Conductor	153	Insulators	Conductor Drop (Conductor)	\$4.71	Insulator Failure	\$720.13	0.04%	\$0.27	\$0.00	\$0.00	\$0.00	\$0.06	\$0.20	\$0.00	
Conductor 2	153	Insulators	Unplanned Outage - HV (Conductor 2)	\$0.01	Structural Failure	\$1.84	0.04%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Conductor 3	153	Fittings	Conductor Drop (Conductor 3)	\$4.71	Fitting Failure	\$720.13	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Conductor 3	153	Fittings	Unplanned Outage - HV (Conductor 3)	\$0.01	Structural Failure	\$1.84	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Earth Wire	1	Earth Wire (inc Joints)	Earth Wire Drop (Earth Wire)	\$0.22	Break	\$0.22	0.02%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Earth Wire	1	Earth Wire (inc Joints)	Unplanned Outage - HV (Earth Wire)	\$0.01	Break	\$0.01	0.02%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Earth Wire 2	102	Fittings (inc Attachment)	Earth Wire Drop (Earth Wire 2)	\$1.16	Fitting Failure	\$118.44	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Earth Wire 2	102	Fittings (inc Attachment)	Unplanned Outage - HV (Earth Wire 2)	\$0.01	Structural Failure	\$1.23	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Structure	10	Earthing	Uncontrolled Electrical Contact / Discharge (Structure)	\$0.17	Earthing Failure	\$1.70	0.88%	\$0.01	\$0.00	\$0.00	\$0.00	\$0.01	\$0.00	\$0.00	
Structure	35	Steel Structure	Unplanned Outage - HV (Structure)	\$0.08	Structural Failure	\$2.93	0.04%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Structure	35	Steel Structure (inc Footings)	Conductor / Earth Wire / OPGW Drop (Structure)	\$4.92	Structural Failure	\$172.04	0.04%	\$0.06	\$0.00	\$0.00	\$0.00	\$0.01	\$0.04	\$0.00	
							\$16.01	\$0.35	\$0.00	\$0.01	\$0.09	\$0.25	\$0.00	\$0.00	
Total VCR Risk:							\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.01	\$0.09	\$0.25	\$0.00
Total ENS Risk:							\$0.00								

Number of Components

The number of components used in the - Risk costs summary model has been derived as follows:

- > **Steel Structures:** The extent of the steel structures on the transmission line with advanced corrosion condition issues identified in Table 1 (10%) multiplied by the total number of original structures (37).
- > **Steel Structure Earthing:** The number of steel structures on the line in areas readily accessible by members of the general public (10).
- > **Insulators:** The extent of insulators on the transmission line with advanced corrosion condition issues identified in Table 1 (90%) multiplied by the total number of suspension insulators on the line (3 per suspension structure).
- > **Earth Wire:** Length of earth wire on the transmission line multiplied portion with advanced corrosion condition issues identified in Table 1 (10%).

Probability of Failure

As per the - Risk costs summary model.

Consequence of Failure

As per the - Risk costs summary model.