

NEED/OPPORTUNITY STATEMENT (NOS)



Line 11 Suspension Structure Renewal

NOS- 000000001600 revision 2.0

Ellipse project no.: P0009497

TRIM file: [TRIM No]

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

Project category: Prescribed - Replacement

Approvals

Author	Edward Luk	Transmission Lines and Cables Analyst
Endorsed	Steve Stavropoulos	Transmission Lines and Cables Asset Manager
Approved	Lance Wee	Manager/Asset Strategy
Date submitted for approval	25 November 2016	

Change history

Revision	Date	Amendment
0	10 August 2016	Initial issue
1	21 October 2016	Update to 2016/17 dollars
2	25 November 2016	Update to format

1. Background

Line 11 is a single circuit steel tower 330kV transmission line between Dapto and Sydney South Substations. It is considered to have the highest level of corrosion among TransGrid's transmission lines and has a history of corrosion related defects affecting tower members, conductor/earthwire fittings, insulators and fasteners (nuts and bolts). It is considered to have the highest level of corrosion among TransGrid's transmission lines. This has led to a high and increasing requirement for inspection and maintenance along this transmission line to assess the structures' ability to withstand weather events that are the most likely cause of structure failure.

The Condition Assessment of Line 11 NACA-DCN220¹ undertaken in early 2016 and the assessment report by ICS (Inspection and Consultancy Services) completed in November/December 2015 have identified that all structures are showing varying signs of corrosion on numerous areas of the tower, ranging from minor first rust to over 50% rust and flaking rust in some cases. The detailed steelwork condition assessment (Line 11 SPCA) conducted by ICS inspected all tension (25) and a selection of suspension towers (26). In most severe locations, closest to the coast, rust is widespread and is seen to be bleeding through epoxy painted steelwork. Detailed findings from ICS are contained in the report "ICS TG-Line11 Surface Prep" available as supporting document under this need site DCN220 in PDGS.

There has been a very extensive history of repair/replacement works on Line 11. A number of towers have been painted pre 1990, while 20 towers were painted with epoxy paint in 1995. In 2006, seven structures were painted with Zinga in a trial in 2006 for proof of concept. In 2010 a project was initiated to paint steel towers on this line. Around 30 towers were partially painted before the contract was terminated in 2011 due to poor contractor performance. At contract termination there were 11 structures where the contractor had commenced surface preparation by removing rust and galvanising to bare metal.

Due to priority in addressing the aforementioned condition issues, 25 tension structures and 2 suspension structures deemed too difficult to replace for constructability reasons are being remediated under Need DCN220.

The general view from the ICS report was that all towers, previously painted or otherwise, would need to be addressed in the short – medium term (within the next 10 years) to ensure that the asset remains operational in the longer term. Corrosion of steel is the main contributing factor leading to a decline in the health of the asset.

2. Need/opportunity

Condition assessment NACA-DCN220 and the ICS steelwork condition assessment report have identified issues which require rectification, these are summarised in Table 1.

Table 1 – Transmission Line 11 Suspension Structure Condition Issues

Issue	Qty	Cause	Impact
Corrosion of tower steel members	127 towers	Zinc galvanising end of life	Steel corrosion, particularly of critical members, can lead to structural failure of tower

There is an opportunity to address other corrosion related condition issues with line components, including insulators and conductor/earthwire fittings associated with these structures.

The risk cost associated with the condition issues on Line 11 is \$2.03m per annum (refer Attachment 1).

¹ [NACA-DCN220](#) on PDGS

One significant element of concern is corrosion of tower steel members, which may result in structural failure. As some members are critical load bearing members of the tower, they cannot be easily remediated if the condition passes a stage where rectification work is not possible. As the line falls in a higher corrosion zone due to its proximity to the coast, NPV analysis has indicated that from a cost perspective, it will be more beneficial to remediate the towers within the next 5 to 10 years, due to the increased risk of failure as the condition deteriorates over time.

Corrosion of fasteners and fittings is as expected given the age of the asset as the sacrificial zinc galvanising layer on these items has reached end of life. These items generally had a significantly thinner layer of galvanising at the time of manufacturing compared with the steel tower members due to fabrication processes. Nuts/Bolts and pins are rusting with some nuts/bolts starting to explode losing their shape.

The benefit of addressing the tower condition issues on Line 11 is to continue providing the service at a lower risk of failure. In addressing these, associated condition issues with insulators and conductor/earthwire fittings can also be addressed. It is expected that, due to increased risk of failure over time as the condition of the asset deteriorates, remediation within the short – medium term is a more commercially viable option.

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 11 Suspension Structure Renewal

Option Name: 1600 - Base Case

Option Assessment Name: 1600 - 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	537	Insulators	Conductor Drop (Conductor)	\$4.30	Insulator Failure	\$2,309.74	0.01%	\$0.12		\$0.00	\$0.00	\$0.03	\$0.08	\$0.00	
Conductor	537	Insulators	Unplanned Outage - HV (Conductor)	\$0.01	Structural Failure	\$5.57	0.01%	\$0.00	\$0.00		\$0.00			\$0.00	
Conductor 2	537	Fittings	Conductor Drop (Conductor 2)	\$4.30	Fitting Failure	\$2,309.74	0.02%	\$0.42	\$0.00		\$0.00	\$0.12	\$0.30	\$0.00	
Conductor 2	537	Fittings	Unplanned Outage - HV (Conductor 2)	\$0.01	Structural Failure	\$5.57	0.02%	\$0.00	\$0.00		\$0.00			\$0.00	
Earth Wire	25	Earth Wire (inc Joints)	Earth Wire Drop (Earth Wire)	\$1.26	Break	\$31.43	0.00%	\$0.00	\$0.00		\$0.00	\$0.00	\$0.00	\$0.00	
Earth Wire	25	Earth Wire (inc Joints)	Unplanned Outage - HV (Earth Wire)	\$0.01	Break	\$0.26	0.00%	\$0.00	\$0.00		\$0.00			\$0.00	
Earth Wire 2	358	Fittings (inc Attachment)	Earth Wire Drop (Earth Wire 2)	\$1.26	Fitting Failure	\$450.08	0.18%	\$0.79	\$0.00		\$0.02	\$0.77	\$0.00	\$0.01	
Earth Wire 2	358	Fittings (inc Attachment)	Unplanned Outage - HV (Earth Wire 2)	\$0.01	Structural Failure	\$3.72	0.18%	\$0.01	\$0.00		\$0.00			\$0.00	
Structure	154	Steel Structure	Unplanned Outage - HV (Structure)	\$0.07	Structural Failure	\$11.14	0.10%	\$0.01	\$0.01		\$0.00			\$0.00	
Structure	154	Steel Structure (inc Footings)	Conductor / Earth Wire / OPGW Drop (Structure)	\$4.57	Structural Failure	\$703.96	0.10%	\$0.67		\$0.04	\$0.18	\$0.45		\$0.00	
Structure 2	0	Earthing	Uncontrolled Electrical Contact / Discharge (Structure 2)	\$0.68	Earthing Failure	\$0.00	0.00%	\$0.00		\$0.00	\$0.00			\$0.00	
								\$16.49	\$2.03	\$0.01	\$0.07	\$1.10	\$0.83	\$0.01	
								\$5,831.23							
								Total VCR Risk:		\$0.01		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 identified for renewal.
- > Insulators: Associated insulators on the identified structures.
- > Conductor/earthwire fittings: Associated fittings on the identified structures.

Probability of Failure

As per the Risk costs summary model.

Consequence of Failure

As per the Risk costs summary model.