

NEED/OPPORTUNITY STATEMENT (NOS)



Various Location Steelwork Renewal

NOS- 000000001358 revision 3.0

Ellipse project no.: P0007984

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	22 November 2016	

Change history

Revision	Date	Amendment
0	14 March 2016	Initial issue
1	14 November 2016	Updated risk costs and minor changes to risk methodology in attachment 1.
2	22 November 2016	Updated risk costs, scope and wording and attachment 2 removed.

1. Background

Corrosion of substation gantry steelwork has been identified as an emerging issue and investigations have been undertaken to quantify the work required and the hazards associated with corroded steelwork approaching its end of life. This needs statement covers holding down bolts and the steelwork itself.

The process undertaken to assess the condition of gantries steelwork and associated bolts was:

- > A desktop study of all substations to determine a ranking for those most likely to be affected by corrosion based on location with regard to the coast, the presence of other sources of corrosive atmosphere and age/exposure.
- > A review of the draft site ranking by Field Services staff to incorporate local knowledge
- > TWR 117 was issued in September 2014 to survey sites with the highest risk ranking to determine the visible corrosion of HD bolts (the section external to the footing).
- > Site visit by Project Services / Engineering to the highest risk sites to measure the corrosion of galvanising and member thickness
- > Development of a condition assessment for the sites including estimation of remaining life and associated probability of failure
- > Gantries are used to suspend conductors from transmission lines entering the substation as well as connections between transformers, switchbays and busbars. They are critical to the safe and reliable operation of the substation. The sites can contain up to 110 gantry columns and, depending on the gantry design, there may be 16 holding down bolts per column.
- > Base plates are located at the bottom of the steelwork and are fixed to the holding down bolts. Connection bolts are used to fasten gantry beam and member steelwork and are also critical to the reliability of the gantry.

The failure of the steelwork, holding down bolts, connection bolts or baseplates may result in injury to staff, damage to equipment, loss of supply and additional cost of nearby replacement. This would impact on more than one system element concurrently and require significant time to restore.

2. Need/opportunity

The results of the TWR and the detailed condition assessment for the 7 sites has identified a need to address the corrosion of the holding down bolts, base plates and Gantry Members/Columns at various sites.

For the purposes of the condition assessment, it was taken that the load/strength capacity of a gantry structure is within the design requirements with a loss of up to 10% of the overall members capacity or otherwise the overall bolt capacity. That is the gross bolt diameter for the arrangement less a total of 10% of material thickness. It is noted the current level of investigation is based on a number of reasonable assumptions and requires further analysis as options to address the need are analysed.

The steelwork and bolt condition must be addressed to ensure that the risk associated with failure of the bolts, resulting in falling of the gantry structure, is kept to an acceptable level. The risks associated with not addressing the condition include:

- > System – Extended supply outages could occur leading to reduced reliability of the adjacent network.
- > Financial – Significant costs may be incurred due to extensive rectification work and collateral damage to nearby equipment. The immediate treatment of Bolts will also reduce the risk of additional costs incurred for Bolts which have reached end of life leading to the replacement Bolts and the complete footing.

- > Operational – Extended outages within each of the sites following gantry collapse
- > People – The collapse of a structure could lead to injury through impact of steelwork or HV conductors
- > Environmental – The collapse of a gantry could lead to dropping of incoming transmission line conductors and potentially to a fire or injury to a member of the public.
- > Reputational – Extended outages and the impact of safety events may lead to reputational damage for TransGrid

The list of sites and the risk cost associated with not addressing the need (the do nothing base case) are included in Attachment 1.

Gantry column base plates are generally designed thicker than required and should have sufficient life even where some corrosion is evident. However, the solution to address the holding down bolts, and in particular any immediate action undertaken, should also consider the life of the base plates (through structural analysis if required) to ensure sufficient remaining life.

The timing required to address this need is driven by the necessity to prevent further bolt corrosion; which will lead to a need to perform expensive repairs (no method currently available) or replacement of gantry structures to avoid a failure. Unless the condition issues are addressed, the risk of failure will continue to increase with time.

In addition to the gantry steelwork, Upper Tumut is also showing signs of degraded gantry footings which could lead to failure if not addressed. Due to the synergies with completing this with the steelwork, it has also been included in this program.

Part of the steelwork at Wagga 132kV substation will be addressed in RP1, however the remaining steelwork also needs to be addressed and so consideration should be given for completing this RP2 program.

The urgency of this requirement suggests that initial action will be required to arrest further corrosion at some sites in the short term with later implementation of a permanent solution. The needs date for the immediate actions should be as soon as practicable, but an indicative date is June 2017. The final life extension works need to be completed to meet the additional time or life gained from the immediate actions. It is expected that the final required life extension solution be completed by 2023, or the date identified when calculating the failure probability for each site.

This need aligns with TransGrid's asset management strategy for substation infrastructure within the substations renewal and maintenance strategy (D2014/18645). Steelwork corrosion is identified as an emerging issue in the strategy and a solution to this need will address the sites currently identified.

3. Related needs/opportunities

- > NS-0495: Sydney East 330kV Substation – Corrosion of holding down bolts which is to be completed in RP1.

4. Recommendation

It is recommended that options be considered to address the identified need. It is expected that a two stage approach will be necessary to manage the immediate risks of failure.

Attachment 1 – Risk costs summary

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

Substation	Total Risk Cost (RPS) \$m
Sydney East	7.00
Sydney North	0.95
Sydney South	18.66
Albury	1.69
Dapto	8.71
Tomago	1.40
Hume	0.19
Wagga 132kV	0.58
Upper Tumut	1.01

Note: the above risk costs are based on average yearly probabilities across the next regulatory period. The risk cost is essentially zero until the critical point in steelwork corrosion, after which the risk cost increases significantly each year.