Discussion Paper

Pole Selection Guide for distribution applications

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Revision History

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0.1	First Draft	14/09/2012
0.2	Issue log comments addressed and minor text changes	25/02/2013
1	Final issue	25/02/2012
2	Final issue after addressing comments from Southern region	26/03/2013

Distribution List

DEPARTMENT	RECIPIENT	RECIPIENT STATUS	DATE ISSUED
Design & Construction Standards	Bradley Trethewey	Reviewer	25/02/2013
Subtransmission Engineering	Brian Glawson	Reviewer	25/02/2013
Design & Project Management	Vince Kelly/ Robert Corrigan	Reviewer	25/02/2013
Purchasing & Logistics	Peter Frew	Reviewer	25/02/2013
Distribution Works and Zone Substations	Richard Jagger	Reviewer	25/02/2013
Regional Operations	David Nardi	Reviewer	25/02/2013
Network Planning	David Bellew	Reviewer	25/02/2013
Network Support	Chris Dalitz	Reviewer	25/02/2013

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EXECUTIVE SUMMARY

This discussion paper presents a strategic view for the use of distribution pole types and target usage figures across the various depots within Essential Energy's footprint. Currently, timber poles account for 65%, steel for 25% and concrete for 10% of the total Essential Energy distribution pole usage. Research within the Standards team has determined that the use of concrete poles on the distribution network fails to deliver sustainable business benefits, and that timber poles are the least cost solution, with recognition that steel poles provide certain benefits[1]. This paper lists advantages in increasing timber pole usage from 65% to 80%, and reducing steel pole usage from 25% to 20% as well as removing concrete poles from distribution applications. Rationalising the pole types to timber and steel for the next distribution pole tender due for renewal in 2013 will facilitate better inventory control, lesser stock holding and associated cost saving. Adopting the recommendations of this discussion paper for a pole usage target of 80% timber poles and 20% steel poles will provide an approximate annual saving of $2M in direct pole purchase costs, and a $2M reduction in pole stock holding costs through improved inventory control.

While this paper does not cover subtransmission poles, guidance on subtransmission pole selection can be obtained from subtransmission design team.

Financial Considerations

Implementation of the recommendations in this discussion paper is anticipated to achieve a $4M cost reduction to the business ongoing per annum comprised of;

- $2M in direct pole purchase costs per annum;
- $2M reduction in pole stock holdings through improved inventory control per annum; and
- lower lifecycle costs associated with poles[1].

Consultation

In preparing this recommendation advice and comments have been sought from Logistics, Procurement, Regional Management and Design. Suggestions and improvements have been considered and implemented in the recommendations where appropriate.

[1] See embedded files for NPV calculations in the Issue Log section.

Recommendations

1. It is recommended that this pole selection guide is implemented across Essential Energy's footprint to achieve the proposed 80% timber and 20% steel pole usage for distribution applications. This will provide significant savings in direct pole purchase costs as well as reduction in pole stock holding costs.
2. It is recommended that concrete poles be removed from distribution applications.
3. It is recommended that for depots where timber is now recommended, that existing structures constructed with either concrete or steel poles are maintained with steel poles.
4. It is recommended that any Regional or Depot variations from the pole selection guide be allowed only after formal approval from the Chief Engineer Group.
5. It is recommended that case by case variations are reviewed by Chris Daliz - Senior Consulting Engineer.

INTRODUCTION

In the 2011/12 financial year, Essential Energy used 16,214 poles of varying types. Timber accounted for 10,500 or 65%, steel for 4,020 or 25% and concrete for 1,648 or 10% of poles used. Across Essential Energy the North Coast and South Eastern regions predominantly use timber poles. Steel poles are used in some sections of Northern, Southern and Far West regions. Concrete poles have been used mostly in the Far West region and western areas of Southern region since the mid to late 1980s. These regions followed the lead of State Electricity Commission of Victoria (SECV) who transitioned to concrete poles primarily due to termite associated failures of timber poles. The early designs of concrete poles in these regions were to SECV standards. Since the privatisation of SECV in mid 1990s, the Victorian utilities have transitioned back to mostly timber pole usage on account of lower[2] purchase price for timber poles and associated life cycle cost analysis.

There have been many failures of concrete poles installed on Essential Energy's network since the late 1980s, early 1990s through to the present. Failure of one concrete pole in an extreme weather event can trigger failures of a few more concrete poles on either side of the failed pole due to the "cascade effect". Furthermore, concrete poles are extremely heavy[2] and present transportation and manual handling issues.

[2] Refer to Table 1.

Table 1 provides a comparison between pole types. From Table 1, it is seen that concrete poles do not have the same benefits as timber and steel poles. Therefore, there is no distinct benefit in maintaining concrete poles in Distribution Standards. Standard timber and steel pole constructions for equivalent concrete pole constructions will assist in phasing out concrete poles from distribution applications. This paper examines opportunities for rationalisation of distribution pole types in preparation for the next tender[3] and provides a directive on the optimal use of timber and steel poles.

Table 1 – Comparison of pole types

Properties	Timber	Steel	Concrete
Purchase price	Lowest	More than twice that of timber	More than twice that of timber
Weight	Heavy (about twice that of steel)	Light	Very heavy (about 4 times that of steel)
Non conductive	Yes	Needs to be insulated up to 3 m above groundline with insulating cover or needs additional earthing	Needs additional earthing
Strength to weight ratio	Good	Good	Low
Tensile properties	Good	Good	Average
Shock loading performance	Good	Good	Poor
Chances of damage during transport	Low	Low	High (due to weight)
Ease of attaching fittings	Easy - can be drilled on site	Poles can be drilled or attachments can be banded	Attachments have to be banded
Affected by corrosion and high acid sulphate soils	No	Yes	Yes
Affected by termites	Yes, but CCA treatment reduces the incidence	No	No
Affected by bushfires	Yes	No effect on the pole. However the groundline coating needs to be repaired/replaced.	No
Prone to cascade failures	No	No	Yes
Renewable	Yes	No	No
Recyclable	CCA treatment means they have to be disposed off carefully	Yes	Yes, but recycling steel from concrete is cost prohibitive

[3] Networks NSW commenced a joint pole tender for timber, steel and concrete poles and crossarms in December 2012. The tender process is expected to complete in the third quarter of 2013.

CURRENT USAGE PATTERN FOR POLE TYPES BY REGIONS

Table 2 and Table 3 list the usage pattern for pole type vs. regions across the Network for 2011/12 financial year. From the tables, it is seen that timber poles account for about 90% of the total pole usage in the North Coast and South Eastern regions, 50 – 55% in the Northern and Southern regions and 17% in the Far West region[4]. Steel poles account for about 42% of the total pole usage in the Northern region, 26% in the Southern region and 34% in the Far West region. Concrete poles account for about 48% of the total pole usage in Far West region and 24% in the Southern region.

Table 2 – Pole types (nos.) vs. regions

Region	Timber	Steel	Concrete	Others	Total
North Coast	3,346	303	56	2	3,707
Northern	2,678	2,031	147	13	4,869
South Eastern	2,268	308	12	15	2,603
Southern	2,054	1,076	1,013	8	4,151
Far West	154	302	420	8	884
Total nos.	**10,500**	**4,020**	**1,648**	**46**	**16,214**
%	**64.76**	**24.79**	**10.16**	**0.09**	**100.00**

Table 3 – Pole types (%) vs. regions

Region	Timber	Steel	Concrete	Others
North Coast	90.26	8.17	1.51	0.05
Northern	55.00	41.71	3.02	0.3
South Eastern	87.13	11.83	0.46	0.3
Southern	49.48	25.92	24.40	0.15
Far West	17.42	34.16	47.51	0.15

[4] Within Far West the current application of timber poles is generally confined to urban usage within the boundaries of towns

In the 2011/12 financial year, timber poles accounted for about 65%, steel for 25% and concrete for 10% of the total pole usage. Increasing the timber pole usage to 80%, whilst reducing the steel pole usage to 20% and removing concrete poles from distribution applications will provide an approximate annual saving of $2M in direct pole purchase costs[5]. Further savings can be realised through improved inventory control and reduced stock holding[6].

PROPOSED POLE SELECTION GUIDE

Figure 1 shows the pole type to be chosen by depot. Also refer to CEOM7097 clause 3.5.9.4.

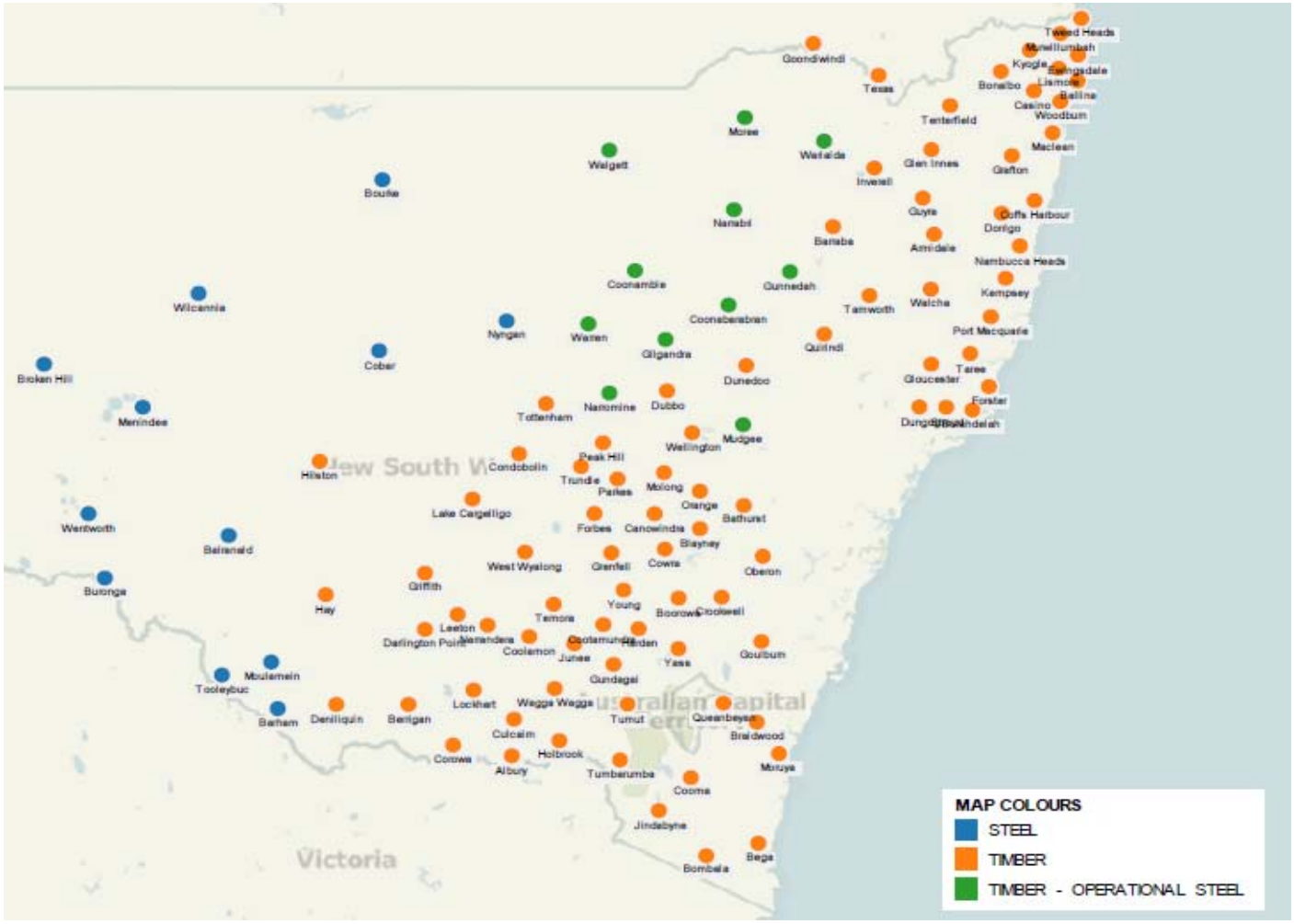

Figure 1 – Proposed Pole Selection Guide

[5] Achieving the pole usage target of 80% timber poles and 20% steel poles requires increasing the annual usage of timber poles by 2,500 from the current numbers, reducing steel poles by 800 from the current numbers and not using concrete poles.

[6] Currently Essential Energy holds $6M worth annual stock for poles. Rationalising the pole types to only timber and steel poles will reduce the annual stock holding to $4M as per information from Logistics group.

Operational poles include poles with operational equipment such as enclosed switches, 1-phase and 3-phase reclosers, 1-phase and 3-phase substations and links/EDOs but exclude SWER substations, SWER reclosers and regulators. For SWER substations, SWER reclosers and regulators only timber poles shall be used. Non-operational poles include 1-phase, 3-phase and SWER pin/angle poles. Customer meter box/switchboard shall only be mounted on timber poles.

The following tables provide details on the pole selection for depots of the various regions.

- Table 4 - Pole Selection Guide for North Coast region.
- Table 5 – Pole Selection Guide for Northern region.
- Table 6 – Pole Selection Guide for South Eastern region.
- Table 7 – Pole Selection Guide for Southern region.
- Table 8 – Pole Selection Guide for Far West region.

Table 4 – Pole Selection Guide for North Coast region

Depot	Non-operational	Operational
Ballina	Only timber poles shall be used. Steel poles can only be used for replacement of existing steel/concrete poles. For soils with soil resistivity below 100 ohm-m, pole substation constructions shall only use timber poles due to galvanic corrosion issues with steel substation poles in such soils.	
Bonalbo		
Bulahdelah		
Casino		
Coffs Harbour		
Dorrigo		
Dungog		
Ewingsdale		
Forster		
Gloucester		
Grafton		
Kempsey		
Kempsey		
Kyogle		
Lismore		
Maclean		
Murwillumbah		
Nambucca Heads		
Port Macquarie		
Stroud		
Taree		
Tweed Heads		
Woodburn		

Table 5 – Pole Selection Guide for Northern region

Depot	Non-operational	Operational
Armidale	Only timber poles shall be used. Steel poles can only be used for replacement of existing steel/concrete poles. For soils with soil resistivity below 100 ohm-m, pole substation constructions shall only use timber poles due to galvanic corrosion issues with steel substation poles in such soils.	
Barraba		
Dubbo		
Dunedoo		
Glen Innes		
Guyra		
Inverell		
Quirindi		
Tamworth		
Tenterfield		
Texas		
Walcha		
Wellington		
Coonabarabran	Only timber poles shall be used. Steel poles can only be used for replacement of existing steel/concrete poles. For soils with soil resistivity below 100 ohm-m, pole substation constructions shall only use timber poles due to galvanic corrosion issues with steel substation poles in such soils.	Steel poles shall be used. For soils with soil resistivity below 100 ohm-m, pole substation constructions shall only use timber poles due to galvanic corrosion issues with steel substation poles in such soils.
Coonamble		
Gilgandra		
Goondiwindi		
Gunnedah		
Moree		
Mudgee		
Narrabri		
Narromine		
Walgett		
Warialda		
Warren		

Table 6 – Pole Selection Guide for South Eastern region

Depot	Non-operational	Operational
Bathurst	Only timber poles shall be used. Steel poles can only be used for replacement of existing steel/concrete poles. For soils with soil resistivity below 100 ohm-m, pole substation constructions shall only use timber poles due to galvanic corrosion issues with steel substation poles in such soils.	
Bega		
Blayney		
Bombala		
Boorowa		
Braidwood		
Canowindra		
Cooma		
Crookwell		
Goulburn		
Gundagai		
Harden		
Molong		
Moruya		
Oberon		
Orange		
Queanbeyan		
Tumbarumba		
Tumut		
Yass		

Table 7 – Pole Selection Guide for Southern region

Depot	Non-operational	Operational
Albury	Only timber poles shall be used. Steel poles can only be used for replacement of existing steel/concrete poles. For soils with soil resistivity below 100 ohm-m, pole substation constructions shall only use timber poles due to galvanic corrosion issues with steel substation poles in such soils.	
Berrigan		
Condobolin		
Coolamon		
Cootamundra		
Corowa		
Cowra		
Culcairn		
Deniliquin		
Forbes		
Grenfell		
Holbrook		
Jindabyne		
Junee		
Lake Cargelligo		
Lockhart		
Parkes		
Peak Hill		
Temora		
Tottenham		
Trundle		
Wagga Wagga		
West Wyalong		
Young		
Darlington Point		
Griffith		
Hay		
Hillston		
Leeton		
Narrandera		

Table 8– Pole Selection Guide for Far West region

Depot	Non-operational	Operational
Balranald	Steel poles shall be used in all urban and rural applications including replacement of existing steel/concrete poles. Timber poles may be used in locations where they are currently being used[7]. For soils with soil resistivity below 100 ohm-m, pole substation constructions shall only use timber poles due to galvanic corrosion issues with steel substation poles in such soils.	
Barham		
Bourke		
Broken Hill		
Buronga		
Cobar		
Menindee		
Moulamein		
Nyngan		
Tooleybuc		
Wentworth		
Wilcannia		

[7] Based on last year usages for Far West, a small number of timber poles were being used in Barham, Bourke, Cobar, Nyngan, Tooleybuc and Wentworth depots. This practice can continue.

APPROVAL PROCESS FOR DEVIATION FROM THE POLE SELECTION GUIDE

For Fault and Emergency (F & E) situations with difficult to access locations where timber poles cannot be transported steel poles can be used without special approval. Logistics will maintain minimum inventory of steel poles across the regions where specialised equipment is available for steel pole installation.

Regional or depot deviations from the pole selection guide may be permitted in exceptional circumstances **only** after approval from the Chief Engineer group.

Case by case variations shall be assessed by Chris Dalitz - Senior Consulting Engineer in the circumstances including but not limited to:

- High Value operational and substation poles in areas with high termite activity[8].
- Locations where it would be difficult[9] to install a timber pole due to plant access issues. Example locations are narrow laneways, walkways and mountain tops. It shall be ensured that Step and Touch potential issues are addressed and any LV will generally be insulated service and/or ABC.

RISK AND BENEFIT ASSESSMENT

Standard timber and steel pole constructions can be used for existing concrete pole constructions. As per Australian Standards, both steel and concrete poles are classified as conductive poles. Steel poles proposed to be used as operational poles will have an insulating cover up to 3.0 m above groundline to safeguard against touch potential issues. While timber poles can be used in most applications, there is a low risk in using steel poles in areas where concrete poles have been used traditionally.

Based on the usages for 2011-12, the implementation of this pole selection guide across the Essential Energy footprint will result in an annual steel pole usage of about 3,200 across sections of the Northern region (Table 5), Southern region (Table 7) and Far West region (Table 8). This is approximately 20% of Essential Energy's total annual pole usage. This allows only a tiny number of steel poles to be used in the North Coast and South Eastern regions to achieve the required 20% steel pole usage target. Considering that these regions have predominantly used timber poles, it is expected that the pole selection guide can be implemented across these regions with a resultant low steel pole usage.

[8] High termite activity areas will be decided by Chris Dalitz - Senior Consulting Engineer on a case by case basis depending on the information provided during the approval process.

[9] Difficult to access locations will be decided by Chris Dalitz - Senior Consulting Engineer on a case by case basis depending on the information provided during the approval process.

The pole selection guide will assist in phasing out concrete poles from distribution applications. Achieving the pole usage target of 80% timber poles and 20% steel poles will provide an approximate annual saving of $2M in direct pole purchase costs and a $2M reduction in pole stock holding costs through better inventory control.

RECOMMENDATIONS

The benefits associated with rationalising Standard pole types far outweigh the risks associated with not having concrete poles for distribution applications. It is recommended that:

- the Standard pole types for distribution applications be rationalised to timber and steel poles for the next tender. This will facilitate better inventory control and lesser stock holding;
- concrete poles be phased out from distribution applications;
- pole selection guide be implemented across the Network to achieve the pole usage target of 80% timber poles and 20% steel poles. This will provide significant savings in direct pole purchase costs as well as reduction in pole stock holding costs;
- for depots where timber is now recommended, that existing structures constructed with either concrete or steel poles are maintained with steel poles;
- regional or depot variations from the pole selection guide be allowed only after formal approval from the Chief Engineer group.
- case by case varations are reviewed by Chris Daliz - Senior Consulting Engineer.

ISSUE LOG

This discussion paper was circulated to reviewers listed in the distribution list. The review period closed in January 2013. The attached file details the issue log based on the feedback received and response from the Standards team.

Issue log - Pole Selection Guide V2.xls

Attached are the analysis papers on condemned pole analysis formulated in response to the feedback received from Northern and Southern regions.

Macquarie Condemned Pole Ana

Southern Condemned Pole Ana

The attached file 'Pole types NPV comparison.xlsx' details the NPV comparison for pole types assuming timber pole lasts 36 years, concrete pole lasts 40 years and steel pole lasts 60 years. Timber pole offers the lowest NPV outcome.

Pole types NPV comparison.xlsx

The attached file 'Positive NPV calculations.xlsx' details positive NPV calculations for timber pole which provides lowest NPV for timber pole for a timber pole life of 23 years and higher.

Positive NPV calculations.xlsx