

SYDNEY TRAMWAY MUSEUM

SAFETY INSPECTION PROCEDURE FOR WORKING ON POLES

JUNE 2010

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1. Purpose

To provide STM with the decision making process to be used in deciding whether a pole is safe to climb, or to work on poles and street standards.

2. Scope

This applies to all STM personnel who are required to climb or work on poles.

Work on a pole includes doing line work either by climbing the pole, from a ladder or working from an elevating work platform (EWP).

Full pole assessment procedures involve the internal inspection of poles, the measurement of any internal defect, and calculation of residual strength.

3. Responsibilities

This procedure applies to all staff, members and contractors.

Before working on any pole, personnel must satisfy themselves that it is safe to work on the pole and that there is no danger of the pole collapsing during the course of working on the pole. Where work that is to be carried out on one or more poles will change the loading on poles nearby during the course of the work, these other poles must also be inspected in accordance with this procedure to ensure they are not in danger of collapse.

4. References

AS 1742 Manual of Uniform Traffic Control Devices

Occupational Health and Safety Regulation 2001

Pole Inspection and Treatment Procedures (STM6xxx)

Roads and Traffic Authority Guide Traffic Control at Worksites

Specification for Pole Installation and Removal (STM6XXX)

WorkCover Code of Practice for Working near Traffic and Mobile Plant

5. Definitions

CCA - Copper Chrome Arsenate

EWP - Elevated Work Platform

RNP - Royal National Park

RSMT - Rail Safety Management Team

STM - Sydney Tramway Museum, a trading name of South Pacific Electric Railway Co-Operative Society Limited.

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6. General Health and Safety Precautions

Work on poles is carried out in all types of terrain, within the Museum and on the RNP and Sutherland lines.

The Occupational Health and Safety Regulation 2001 requires you to take all reasonable precautions to ensure the safety and welfare of yourself and your fellow workers. It also lays the responsibility of the safety of all people that enter the work site with the person in charge on the site.

Some important things to remember are:

- Road safety, track safety and traffic control of moving plant, trams and foot traffic, including wearing of high-visibility vests when working on or near roadways;
- Electrical safety clearances;
- Personal safety items e.g. hard hat, gloves and eye protection as required; and
- Environment safety, preventing contamination of the surrounding environment.

6.1 Electrical Precautions

Electrical hazards can occur above or below ground level. The following sections list examples of these hazards;

6.1.1 Step and Touch Voltages

Always be aware that voltage gradients are possible in the event of conductor breakage or insulation breakdown. It is important to consider the step and touch voltage and take precautions to make sure they cannot hurt you.

6.1.1.1 Below Ground

- *Broken earth wires.* Earth wires forming part of an earthing system below ground can be damaged in many ways. If a break is detected do NOT attempt to rejoin. Full phase to earth voltage can exist between the several ends. Tell the Infrastructure Manager or Chief Engineer immediately.
- *Be aware of below ground electrical installations,* including communications cables that may be close to poles being worked on. Underground power cables forming part of an underground to overhead connection can exist at a shallow depth near power poles. These cables can be easily damaged by digging implements and this may cause a hazardous situation.

NOTE: Underground to overhead connection cables do NOT always run from the pole back to the adjacent Distribution Substation in a straight line, nor do they always radiate out from the pole at 90°, they sometimes coil around the pole to provide spare cable in case of a pole change over or re-termination and may be adjacent to poles that do not have these above ground cable installations on them. Be sure of their location before excavating. Hand excavate carefully around the cables. If there is a risk of cable damage, DO NOT PROCEED. The cable may have to be de-energised, or other precautions taken before work can proceed.

6.1.1.2 Above Ground

- *Conductors not properly fixed to the insulators* (i.e. broken tie). The conductors may fall to the crossarm or to the ground when disturbed. If a conductor contacts the crossarm or pole, the pole may remain alive without operating any protection devices. Check to make

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sure that all conductors are properly attached to insulators. Treat streetlight conductors as alive at all times unless they are proven to be de-energised and isolated.

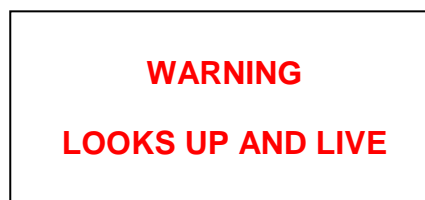
- *Trees or other conductive foreign objects*, e.g. pieces of fencing wire, in contact with conductors, metal conduits, or apparatus on poles may be alive. Check to ensure that no conductive objects are in contact with, or are likely to come in contact with live conductors.
- *Low ground clearance of conductors*. People, vehicles or plant may come in contact with conductors (take particular care with vehicles with radio aerials).
- *Broken earth wires above the ground*. Do NOT attempt to rejoin broken earth wires: full phase of earth voltage can exist between the several ends. Tell the Infrastructure Manager or Chief Engineer immediately.

6.2 Falling Objects

You must wear a hard hat when working at the base of a pole. NOTE that when working bent over or just looking down, there is generally more of the body exposed to falling objects than for any other working position.

Some objects that you need to look out for are:

- Loose sapwood;
- Loose streetlights;
- Loose nuts;
- Loose vertical construction; and
- Tools left on crossarms.



6.3 Operational Precautions

Traffic Management requirements must be observed in accordance with legislative requirements and AS 1742 Manual of Uniform Traffic Control Devices, the WorkCover Code of Practice for Working near Traffic and Mobile Plant, and the Roads and Traffic Authority Guide Traffic Control at Worksites.

7 Pole Condition

The condition of a pole is described as serviceable, conditionally serviceable or condemned (unserviceable).

A *Serviceable* pole is defined as having a greater than 50% residual strength and is safe to climb and to work on.

A *Conditionally Serviceable* pole has between 25% and 50% residual strength.

A *Condemned* pole has less than 25% residual strength.

Note: The condition and rating of a pole relates to the structure as a whole which includes a pole re-butt or pole reinforcement (e.g. a pole nail or splint), where applicable.

7.1 Conditionally Serviceable and Condemned Poles

These identified poles are not to be worked on unless they are adequately stayed or supported. They are identified by an industry standard tape with an orange band, with black crosses and wrapped around the pole. When condemned they will have the orange band plus a cross 'X', marked with white paint or waterproof lumber crayon on 2 faces of the pole. The orange band

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will be located between 2.4m and 3.0m above the ground and the crosses approximately 1.5m above the ground on the road side and footpath side faces of the pole.

NOTE: The old system of defective pole identification consisted of a diagonal slash such as ‘/’ or ‘\’ (a slanted slash) using white paint or waterproof lumber crayon on 2 faces of the pole approximately 1.5m above the ground. Poles found so marked must also be treated as defective.

These poles are NOT to be worked on unless they are adequately stayed or supported.

7.2 Staying or Supporting Condemned Poles

Staying or supporting condemned poles can be accomplished by various methods or by using a combination of methods, depending on the particular circumstances.

Condemned poles can be supported using an appropriate vehicle (e.g. Borer/Erector), lashing to a replacement pole or by utilising stays. Refer to **STM6XXX – Specification for Pole Installation and Removal** for additional information on support methods.

8 Procedures To Be Followed Before Working On A Pole

Before working on a wooden pole, you must follow the procedures described in the flow chart (see Attachment 1) and the associated notes and the remainder of this Network Standard. The flow chart has been developed to help you make a decision about whether or not you should work on a pole.

Refer to Section 9 *Rebutted and Reinforced Poles* below; and

Refer to Section 10 for *Pole Inspection Process* for steel and wooden poles.

Associated Notes to Attachment 1 – Flowchart

Does the pole have an orange band, sash, cross or termite disc or 3 segment Termite Tag?

You are looking for evidence that the pole has previously been identified as defective or as having termites in the pole.

A single slash (/) mark as shown below in Figure 1 is the old defective pole marking and if found should be taken to also indicate a defective pole.

A cross (X) mark as shown below in Figure 2 is the condemned pole marking and if found should be taken to also indicate a defective pole.

Poles known to have active termites are identified with a Termite Tag as illustrated in Figures 3 or with circular aluminium disc with a ‘T’ stamped into it.

Poles must NOT be climbed, unless adequately stayed or supported, if

- Active termites are present as indicated by a Termite tag; or
- You identify active termites during your inspection.

Figure 1 Old Defective pole marking

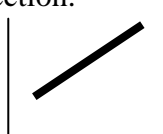
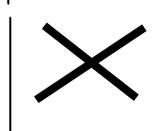


Figure 2 Condemned pole cross



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Figure 3 As found on a pole when termites are identified.



8.1 Above Ground Line Inspection

- a) Inspect pole for defect such as:
 - i. Vehicle damage;
 - ii. Loose pole cap;
 - iii. Lightning damage;
 - iv. Excessive splits (barrel checks);
 - v. Excessive knots and grub holes; and
 - vi. Loose sapwood.
- b) Inspect for fire damage (especially untreated burnt (charred) areas on CCA poles). All charred material must be removed to expose the remaining sound timber so that the exterior diameter measurement can be taken.

IMPORTANT: Refer to Section 12 Burn or Burning CCA Timber Poles for precautions where exposure to burnt CCA is possible.
- c) Inspect for foundation failures. For example, washed away the soil, or undercutting of the ground line. Is there, or has there recently been excavation work in close proximity to the pole? An open trench within 1.5 metres of a pole has the potential to destabilise the pole.
- d) Is the pole leaning or has it moved in the ground? Has it moved due to excessive load or due to weakening of the pole below the ground?
- e) Look for unusually tight or loose conductors, including service mains. This may indicate the pole is being held up by the conductors due to failure of the pole at or below the ground line;
- f) Is the pole's sinking depth OK? Is the pole disc about 2 metres or less above the ground (some smaller poles will have their disc about 2.3 metres above the ground)? Is there a 'tide' mark on the pole indicating the ground line has been lowered due to road works or similar activities?
- g) Inspect for termite activity in wooden poles;
- h) Test wooden poles by sounding as part of the above ground inspection. Wood poles are also sounded as part of the below ground inspection if you perform one. Do not strike any pole with active termites in it. Any pole with active termites must be treated as conditionally serviceable and reported to the Infrastructure Manager or Chief Engineer.
- i) If you identify areas of a pole that require internal inspection, tell the Infrastructure Manager or Chief Engineer immediately to request an inspection by a qualified person. These poles must NOT be climbed or worked on from an elevated work platform unless adequately stayed or supported.
- j) Inspect for excessive rot.

8.1.1 Does The Pole Look and Sound OK?

Continue with the inspection if the pole is considered satisfactory from the above ground line inspection carried out above. If not, do no further work on the pole and tell the Infrastructure Manager or Chief Engineer immediately.

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8.1.2 Is It A CCA Pole Less Than 15 Years Old?

Work may proceed if the pole is CCA treated and less than 15 years old and has passed the above ground inspection. CCA treated poles under 15 years of age have proven sufficiently resistant to fungal decay and termite attack to not require excavation and below ground inspection. However, any pole with active termites must be treated as conditionally serviceable and reported. If the pole is not CCA treated or over 15 years old, further inspection is necessary.

8.2 What Are You Going To Do On The Pole

The type of work you will be carrying out on the pole is indicative of the stress you will place on the pole. Telecommunications work, line work from an EWP. System Operation work and some types of service work may not place high stress on a pole, however you must carefully assess how you will carry out your work before you arrive at this decision. Most other types of work, e.g. line work from a platform, could stress a pole sufficiently that the pole may fail if in a weakened condition and therefore must be dug out and inspected.

8.2.1 High Pole Stress Work

Work that places ‘high stress’ on a pole includes:

- Work where the pole’s attached construction will be changed;
- Where the attached load on the pole will be changed; and
- Where the direction of the attached load will be changed.

Poles are placed under significant stress when personnel working near the pole head cause the pole to sway due to a dynamic load. A dynamic pole load is commonly generated when a pole’s construction is changed. For example, a rocking motion is created by personnel using a hand saw near the pole head, or by trying to free an item of equipment attached to the pole, such as an old crossarm. Where a dynamic load is likely to be applied to a pole, the associated work is classified as “High Stress Work”.

8.3 Below Ground Inspection of Unreinforced Wood Poles.

After following the flowchart in ATTACHMENT 1 (*Safety Inspection Procedure For Work On Wood Poles*) and it takes you to the point of requiring a below ground inspection then the following process is to be followed:

- a) Poles with concrete or bituminous paving at ground level **MUST** have this material removed for a below ground inspection to be carried out. If this cannot be done, these poles must be treated as conditionally serviceable and reported. You should be particularly wary of poles that have been concreted in at ground line. This practice encourages fungal decay and may hide a dangerous pole.
- b) Do not fully excavate around a pole initially in case the pole has become dangerously degraded. Excavate only sufficient soil to allow an external inspection of a strip of the below ground section of the pole. The initial excavation should be at least 200 mm deep, but no further than 350 mm, and in the neutral axis of the pole.
- c) Cut away ant preservative wrap bandage where fitted, to expose the below ground face of the pole. Refer to section 8.4
- d) Use a rounded point bar to test the soundness of the exposed timber as explained in point (f) below. The rounded point bar is used to strike the pole from the bottom of the excavation up to ground line in 50 mm steps.

Note any loss of sound timber on the below ground section of the pole.

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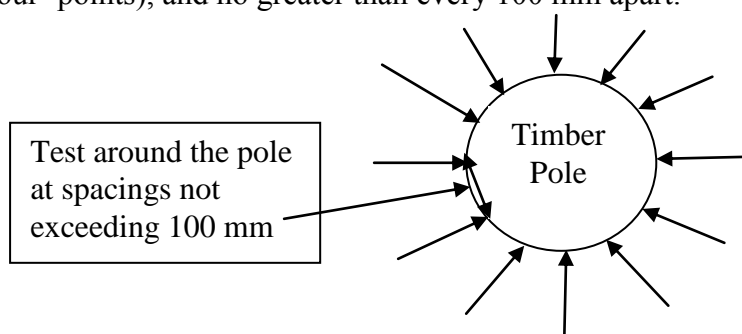
- e) Assess any loss of sound timber. If the loss of sound timber is 10% or more, of the ground line pole diameter on the excavated side of the pole, then the pole is to be treated as conditionally serviceable, backfilled and reported to the Infrastructure Manager or Chief Engineer.

For example: If a pole has an original ground line diameter of 300 mm, then a loss of 30 mm (i.e. 10%) on the excavated side would mean the pole would have to be rated as conditionally serviceable. Note that the depth of penetration of the bar indicates where the sound timber starts, and any soft or decayed timber must be discounted when assessing the reduced diameter.

- f) Excavation should only continue where adequate sound timber is found. Conditionally serviceable or potentially dangerous poles must be backfilled and the situation reported to the Infrastructure Manager or the Chief Engineer.
- g) Where the initial excavation indicates adequate sound timber, carefully continue the excavation so the section of the pole between ground line and 350 mm below ground line is fully exposed. Remove any existing bandage and dispose of in accordance with section 8.4 below. The below ground inspection consists primarily of an impact test with a rounded point bar (5 mm point radius and weighing approximately 6 kg), however it should be supplemented by sounding with a ballpein hammer to as far below ground as possible.

Procedure

Strike the pole firmly at the base of the excavation so the bar strikes the pole where it meets the soil. The bar should deflect off the pole if it is solid, with the point embedding itself into the soil at the base of the excavation. After testing at the base of the excavation, the bar should then be used to impact the pole immediately above this point, then test again every 50 mm up to ground line. The pole should be tested in this manner at least 12 times around its base (i.e. 'hour' points), and no greater than every 100 mm apart.



You must pay particular attention to the area of the pole at, and below, the bottom of the excavation. If severe decay exists deep below the excavation area, there is often detectable decay near the bottom of the excavation. A Pole with significant defect below the bottom of the excavation may also be loose in the ground, and you should be alert for any movement of the pole in-ground when struck with a bar at the base of the excavation.

By testing a pole in the manner described, the point of the bar will penetrate decayed timber to reveal the true extent of any sound timber, or lack thereof. Also, where the pole sounds hollow, the bar should be driven vigorously into the suspect area. This will result in the bar penetrating a thin wall or sound timber or bouncing off if adequate sound timber exists.

This method of testing will identify timber degradation on the external surface of the pole and internal defects close to the surface of the pole.

It is not necessary to hit the pole excessively hard unless a defect is suspected, in which case you may hit it as hard as you like. A bar with the correct point (5 mm radius) and weighing

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approximately 6 kg, will bounce off sound hardwood timber, but will penetrate defects existing close to the surface of the pole. This procedure is critical to enduring confidence in the soundness of the pole.

- a) Measure the minimum below ground diameter, discounting any decayed timber detected by the pointed bar.
- b) Inspect for fungal decay at the bottom of the excavation. If the pole is affected with fungal decay at a depth greater than 350 mm, treat the pole as conditionally serviceable and tell the Infrastructure Manager or the Chief Engineer.
- c) If you are satisfied that the pole is serviceable, backfill the excavation in steps of 100 mm, ramming each level until fully reinstated. Restate the surface around the pole leaving it neat and tidy, and in an “as found” condition.

8.3.1 Is The Pole OK?

Is the pole considered satisfactory from the checks carried out in accordance with section 8?

8.3.2 Pole OK to Work on, Check Pole as You Go Up

Your checks so far have indicated the pole is satisfactory in the ground line area. However you must continue inspecting the pole by careful observation as you ascend, continually looking for evidence of rot or termites. Any loose pole steps should be investigated, as they may indicate internal fungal decay or termite damage. If a possible defect is detected, it must be further investigated by sounding with a ballpein hammer, or the position reported and the pole treated as conditionally serviceable unless adequately stayed or supported.

8.4 Handling, Removal and Disposal of Used Bioguard Bandages

CAUTION

Precautions should be taken to avoid contact with the skin and eyes. When handling a Bioguard bandage or an Ausplast bandage synthetic rubber/PVC gloves must be worn.

Bioguard bandages previously applied to poles are to be removed as part of the below ground inspection. The bandage should be replaced by a qualified person at the next scheduled maintenance. However if the bandage is still substantially intact it may be applied back around the pole.

Note: Bioguard bandages that contain no residue from the chemical tablets are to be disposed of in general waste. A bandage containing chemical residue must be returned to the relevant authority. Any residue that falls out of the bandage may be put back around at the bottom on the excavation.

Ausmose “Ausplast” bandage is commonly utilised instead of the Bioguard bandage where the ground is persistently wet. The Ausplast bandage is biodegradable and no waste is expected to require removal at subsequent inspections however the paper backing may require removal in order to inspect the pole below ground line if it has only been recently installed and not degraded.

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9 Rebutted and Reinforced Poles

9.1 Rebutted Poles

Inspect rebutted poles as follows:

- Inspect the pole and fittings above the steel sleeve for any signs of deterioration or damage. In particular sound the wood pole in accordance with section 8.1 above.
- Inspect the machined down timber immediately above the sleeve for any sign of fungal decay or termites.
- Inspect the timber visible through the three inspection holes for any sign of fungal decay or termites.
- Inspect the drain hole and clear out if blocked. The space between the top of the concrete and the bottom of the pole should be probed through the drainage hole for any signs of deterioration.
- Inspect the steel sleeve of any signs of corrosion or termite activity.
- Where sounding indicates a defect, treat the pole as conditionally serviceable. The timber within the sleeve should be inspected via the existing inspection holes in the steel sleeve. If fungal decay is detected or there are active termites in the pole, it must be treated as conditionally serviceable and referred to the Infrastructure Manager or the Chief Engineer.

9.2 Reinforced Poles

Inspect reinforced poles as follows:

- Visually inspect the steel splint or nail for signs of rust or damage. Confirm the bands around the splint and pole are tight, or that the nail pulled tightly against pole by the bolts.
- Inspect the pole for active termites. You must pay particular attention to all checks and cracks in the pole, and along the edges of and behind the splint or nail.
- If no termites are found, thoroughly sound the pole from 300 mm above the ground line to as high as you can comfortably reach, paying particular attention to the area around and above the top of the reinforcing bands or bolts.
- If sounding indicates a defect in the area of the pole at or above the lower attaching bands or bolts, treat the pole as conditionally serviceable.

10 Pole Inspection Process

10.1 Steel Line Poles

Steel poles carrying the overhead wiring should be inspected by visually looking for rust around ground line and by striking it firmly with the flat face of a hammer so as to not damage the protective galvanised coating. The purpose of striking steel poles is to dislodge with internal and external rust and expose any perforations in the steel pole. Where rust is found above ground line the pole should be excavated to a depth of 100 mm and inspected for rust or damage. Where rust or damage extends beyond 100 mm excavate further to determine the full extent of the defect, but not beyond 350 mm. If any perforations are found in the steel pole it is to be treated as conditionally serviceable and reported to the Infrastructure Manager or Chief Engineer.

NOTE: Do not strike the pole too firmly as it will only damage galvanised or painted surfaces. To detect defects in steel poles, a gentle tap is sufficient.

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10.2 Wood Poles

Wood poles less than 200 mm diameter should be inspected as described in section 8.3 above but do not excavate deeper than 200 mm.

- a) Inspect for termite activity.
- b) Test the remainder of the pole with a rounded point bar in accordance with section 8.3.
- c) Inspect for external defects and investigate the extent of any found.
- d) Inspect for fungal decay at the bottom of the excavation:
 - If the pole is affected with fungal decay at a depth greater than 200 mm, treat the pole as conditionally serviceable and tell the Infrastructure Manager or the Chief Engineer.
 - If the below ground line external inspection reveals a diameter reduction of 10% or more, treat the pole as conditionally serviceable and tell the Infrastructure Manager or the Chief Engineer.
- e) Backfill the excavation in steps of 100 mm and ram each level until fully re-instated. Reinstated the surface around the pole leaving it neat and tidy, and in an 'as found' condition.

11 Stress Testing A Pole

A simple stress test as outlined below is available for small lightly loaded poles where at least one conductor remains attached to a pole, or where a rope can be attached without climbing the pole.

11.1 Rope Pull Test

The rope pull method involves attaching a rope to the head of the pole and attempting to pull the pole over. The rope can be thrown over the head of the pole, or push over using a link stick or similar, but the pole must not be climbed.

Attached a rope to the pole close to the head. You must not climb the pole to attach the rope. You can pull on conductors still attached if you have cut them away from the remote end (prove them de-energised first). Do not stand in a position where you may be struck if the pole fails. Pull as hard as one person can at right angles to the direction of the mains, i.e. in a direction where the movement of the pole is not restrained by wires or stays. However note that if it mains are still attached to the pole you must ensure that adjacent poles cannot be damaged by collapse of the pole under test. Also be aware that if the pole does not break when pulled, it may whip back and fall in the opposite direction, so ensure that the fall line in the direction being pulled and in the opposite direction, has been cleared and secured.

This test cannot take the place of below ground, pre-climbing inspection but can be used in addition to it.

12 Burnt or Burning CCA Timber Poles

Handling Copper Chrome Arsenate (CCA) treated timber that has been burnt, or attempting to extinguish CCA treated timber that is burning, presents hazards to the worker not found when working with other timber products.

Toxins normally locked in the timber cells during treatment are released, creating a hazard in the working environment. In **Appendix H (Burnt or Burning CCA Timber Poles) of the *Pole***

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Inspection and Treatment Procedures (STM6xxx) it provides advice to those workers who, in the course of their duties, may be exposed to either burning or burnt CCA treated timber.

Avoid the smoke fumes and contaminated charred material by staying well clear of the immediate area and up wind.

If you are required to be in the area when CCA treated timber is burning or while burnt material is being handled, you must be appropriately trained.

In general no worker or contractor is to handle or disturb burnt CCA treated material unless:

- The burnt material can be moved or contained at that time;
- They have received the necessary training; and
- They have the required personal protective equipment.

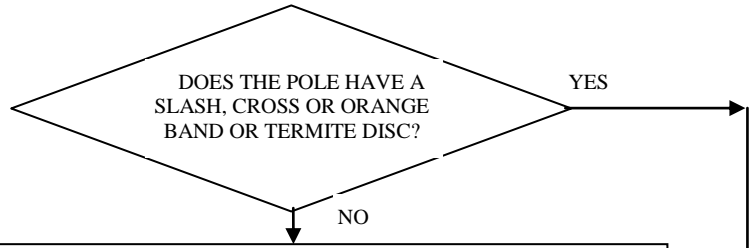
Only appropriately trained workers should disturb CCA treated timber that is burning or has been burnt. However all burnt or partially burnt CCA treated poles must be immediately reported to the Infrastructure Manager to ensure appropriate action is taken (i.e. containment or removal of the material).

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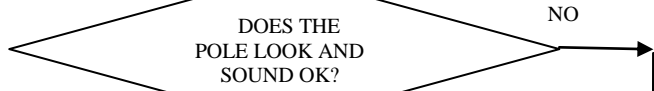
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ATTACHMENT 1 - SAFETY INSPECTION PROCEDURE FOR WORK ON WOOD POLES

STEP 1
Above ground
inspection and sounding



<p>Pole Condition</p> <ul style="list-style-type: none"> • Check for rot, termites and damage (vehicle, fire, storm, etc) • Check pole top for loose fittings that <p>Pole Loading</p> <ul style="list-style-type: none"> • Unusually tight or slack wires? (including service mains) • Poles leaning (moved in ground) 	<p>Pole Foundation</p> <ul style="list-style-type: none"> • Sinking depth OK? • Poor soil comparison? • Change in level (eg local may fall. location) <p>Sounding</p> <ul style="list-style-type: none"> • Sound with ball of ballpein hammer all around poles from groundline to your reach.
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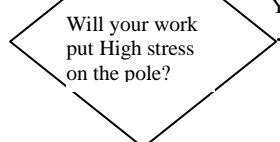
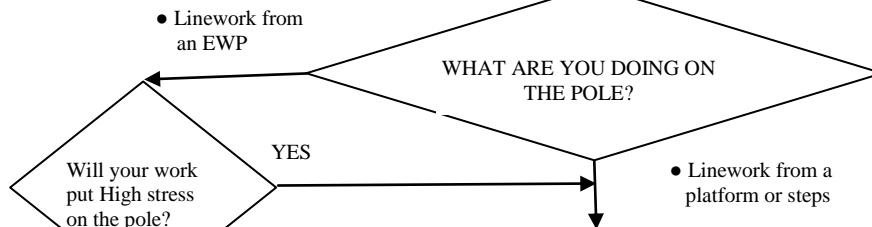
Examples of high stress work:

- removing all wires
- add or removing wires
- rough movement to cause the pole to

STEP 2
Below ground
inspection

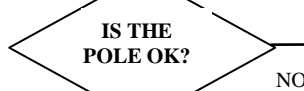
STEP 3
Backfill

REMEMBER
DO NOT disturb the termites
DO NOT drill the pole



Progressively excavate, inspect and test with a rounded point bar starting in the neutral axis then around the pole to a depth of 350mm. Excavate only to 200mm depth for poles less than 200mm diameter. Remove preservative wrap, scrape pole and inspect for rot and termites as you go. STOP IMMEDIATELY IF YOU BELIEVE THE POLE IS UNSAFE.

• Dispose of preservative wrap
• Progressively backfill and compact.



Report pole condition to Infra. Mge or Chief Engr.

Pole OK to work on
(Continue to check pole as you go up)

• DO NOT climb and work on the pole unless it is securely held
• DO NOT work on pole with EWP or from an adjacent pole unless it is restrained.