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Excavation Guide

Document Register

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Document Review

A document review shall be conducted not more than 5 years from the date of this revision, or at such time changes may be required due to a change of policy, scope, or technical content.

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1. Purpose

To ensure that a safe method of excavation is carried out when laying electrical cables and/or undertaking maintenance or emergency works on the electrical distribution network.

This document has been prepared by representatives of Wellington Electricity to provide guidance on safe practices for use by those undertaking excavation works on the Wellington Electricity network. This guide is recommended good practice by Wellington Electricity but it is not seen as a substitute for legislative or other regulatory requirements nor is it seen as a substitute for an individual work methodology.

2. Policy

It is the policy of Wellington Electricity that for any party engaged either directly or indirectly by Wellington Electricity; at least one person (providing direct supervision) in the work party carrying out excavation activities on or near Wellington Electricity underground cables shall be trained and experienced to a WTC level of not less than WTC 3.9 (EQM-001).

Hydrovac excavation operators will either have a WTC level of 3.9 or be under the supervision of a person holding this competency when working on or near Wellington Electricity underground cables. Hydrovac excavation equipment shall only be operated by a competent[1] person. The operator must have the knowledge, training and experience to perform the work, be familiar with any Worksafe requirements and the regulations that may apply to the work and have knowledge of potential and actual dangers to health and safety in the workplace.

If the requirements of this procedure cannot be followed then an approved alternative work methodology must be available on site indicating how the risks are to be managed.

3. Scope

This guide will apply to all contractors and subcontractors engaged directly or indirectly by Wellington Electricity, or pre-qualified by Wellington Electricity that are involved in:

- the laying of electrical cables;
- trenching, drilling, thrusting, jacking, bursting or directional boring operations near electrical cables;
- maintenance works on the electrical distribution network in relation to underground electrical cables;
- emergency works; and
- undertaking of general excavations.

4. References

Reference	Title
Legislation	Health and Safety at Work Act 2015
Legislation	Health and Safety Regulations 1995
Worksafe	Excavation Safety July 2016
Worksafe	Guide for Safety with Underground Services

[1] A competent person is a person who has acquired through training, qualification, or experiences the knowledge and skills to carry out a task and has thus been deemed competent by their employer.

Reference	Title
NZECP 34:2001	Electrical Safe Distances
NZECP 35:1993	Power Systems Earthing
AS 2865 2009	Confined Spaces
NZUAG	National Code of Practice for Utility Operators' Access to Transport Corridors
SM-EI	Safety Manual Electrical Industry, Parts 1,2 and 3
EEA	Guide to the identification of and work on cables
EEA	Guide to Safe Work with Cables
Wellington Electricity ESG-003	Safe Work Practices Manual
ENS-150	Installation of Cables and Ducts
Wellington Electricity EQM-001	Network Competency Standard
Wellington Electricity ENM-009	Close Approach Process
Wellington Electricity ESP-004	Asbestos Management Policy
Wellington Electricity	33/110kV Notification to Dig form
Wellington Electricity	WE* all need to get it right on site
Wellington Electricity	WE* all need to work safely
EEA	Guide for Electricity Supply Industry use of Mobile Plant

5. Health and Safety

5.1. General Safety Requirements

All personnel:

- are required to complete, document and participate in risk identification prior to starting work;
- are responsible for checking that the work site is safe and tidy while work is in progress;
- must wear full P.P.E with an arc thermal protection value of a minimum of 8 cal/cm2 (NFPA 70E) as per the Wellington Electricity Safe Work Practices Manual

Prior to commencing any excavation all reasonably practical steps should be made to determine the location of existing underground services (gas, electricity, water, sewer, fuel lines and telecommunications) using the "before u dig" (0800 248 344) process. If no plans and mark outs or locate and mark outs are available then the entire excavation shall be either dug by hand or carried out using hydrovac techniques.

Note: Not all embedded networks subscribe to the before you dig process so there may be existing services which are not necessarily provided as part of the plans.

5.2. Hazardous Substances Management

There remains the possibility that hazardous substances (such as asbestos containing materials) exist buried in the ground which may be exposed during the excavation work and will need to be managed. In

such instances, the appropriate regulatory and legislative requirements should be followed to manage these sites.

5.3. Confined Spaces

If there is ever a case of entering into confined space when undertaking excavation works, these should be managed in conjunction with Wellington Electricity's Safe Work Practices Manual (ESG-003).

The hazard identification and risk assessment can identify levels of risk that will deem the excavation a confined space under certain conditions.

A confined space is an enclosed or partially enclosed space that is at atmospheric pressure during occupancy and is not intended or designed as a place of work, and -

(a) is liable at any time to -
  i. Have an atmosphere which contains potentially harmful levels of contaminant;
  ii. Have an oxygen deficiency or excess; or
  iii. cause engulfment; and
(b) could have restricted means for entry and exit.

If the excavation's characteristics meet the defined criteria refer to AS 2865 2009 Confined spaces to find out the appropriate work methods, risk management, and emergency planning.

5.4. Other Network Assets

When conducting excavation works, it is important to be cognisant of the impact to the electrical infrastructure and also that of other network owners. Care should be taken to support other network assets (such as inline gas joints). Undermining assets for a prolonged period of time can result in assets failing, especially if they are also exposed to inclement weather or softened ground. If excavation works begin to uncover other network assets where concern is raised on the integrity of the asset, all further digging must stop immediately. Arrangements will then need to be made with the relevant network owner to visit site to determine the integrity of the exposed asset.

6. Excavations

6.1. Planning

During the planning and scoping of the work, the impetus is on the Wellington Electricity Engineer or Programme Manager in the first instance to ensure that plans are reviewed so that areas of high congestion can be avoided if at all possible.

Prior to excavating there shall be:

- An approved CAR (Corridor Access Request) and WAP (Works Access Permit) on site as per the requirements of the National Code of Practice for Utility Operators' Access to Transport Corridors and any additional requirements included by the relevant RCA (Road Controlling Authority);
- For emergency works these are to be submitted within 2 working days after the works have commenced.
- An approved and appropriate TMP (Traffic Management Plan) for the work site and a copy of the TMP on site, the worksite needs to be controlled by an appropriately qualified person e.g. STMS or TC;
- Investigate the practicability to de-energise and isolate the cable/cables prior to commencing the excavation. If this is not practicable then any risks must be managed via a documented excavation methodology which should be available on site.
- A suitably trained and competent person in charge of the worksite for works being undertaken for Wellington Electricity, this person shall hold as a minimum a current Wellington Electricity WTC 3.9 (Wellington Electricity EQM-001).
- Electricity Obstruction Plans - It is essential that any plan used is current at the time of excavation.
  Where plans are more than two weeks old they should not be used unless:
  - An alternative obstruction plan management process has been agreed in advance with

Wellington Electricity;
  - Where an alternative management plan is agreed by Wellington Electricity and an authorised contractor/subcontractor is working on a project that has a specific approved Corridor Access Request (CAR) in place, electricity obstruction plans issued on the application of that CAR can remain current for a period of up to two months or until the expiry of the CAR period, whichever is the lesser time,
- Should the conditions of the CAR change then new plans shall be requested.
- Conditions and obligations imposed by other Utilities on their respective obstruction plans shall be adhered to at all times.
- If the plans indicate that strategic underground cables or equipment are in the vicinity of the excavation area then additional measures may be required, refer to ENM-009 Close Approach Process for more details.

6.2. Close Approach Requirements

The Wellington Electricity Close Approach Process (ENM-009) makes specific reference to strategic cables and when a close approach consent and stand over is required. Strategic cables would be regarded as 33 kV cables as well as any 11 kV cables[2] or pilot cables that Wellington Electricity determines to be strategic in nature. For all low voltage cables and non-strategic 11kV cables, the minimum allowable approach distance is 500mm for non-warranted workers. If this distance is to be breached by externals parties (non-warranted), then formal consent will be required from Wellington Electricity and further mitigating controls (such as a stand over) may be requested.

6.3. Ground Penetrating Radar (GPR)

The following requirements are stipulated regarding the use of GPR when working around Wellington Electricity underground assets:

- The use of GPR will be mandatory when identifying and planning any new strategic/ sub-transmission cables routes.
- The use of GPR may be stipulated by the Asset and Planning Teams at WELL when drafting up project scopes.
- The Contracts Manager (aka Reactive Manger) at WELL will decide on the use of GPR during fault situations.

GPR is to be considered as a tool which may be used in conjunction with other techniques in order to help identify underground services.

6.4. Excavation Requirements

6.4.1 General Requirements

The following requirements apply to all excavations in which personnel are required to work:

- All work involving excavations must comply with the requirements of the Health and Safety at Work Act 2015 (HSWA) and all relevant regulations, including the Health and Safety in Employment Regulations 1995 (the HSE Regulations) and the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016 (the GRWM Regulations).
- Where excavations are approaching 1.5 metres in depth or where the excavation could become unstable, consideration needs to be given to utilising additional safety measures such as shoring.

For the purpose of this guide the term **"plans and mark out"** mean that underground services have been marked on the ground based on the information provided in the plans.

For the purpose of this guide the term **"locate and mark out"** refers to the location of underground electrical cables identified using an appropriate location device that introduces a signal into an underground electricity cable ~~core or sheath~~. The location of the cable has then been marked out on the ground.

[2] 11kV Strategic cables are decided on by WELL on a case by case basis.

For planned work Wellington Electricity's underground cables are to be identified utilising a locate and mark out process. If this is not practical, then guidance should be sought from the appropriate Wellington Electricity representative. In the first instance contractors should seek to utilise the approved utility representatives to undertake mark outs and locates.

Hydrovac techniques are the preferred method of carrying out pot holing, and excavation works, as the risk of damaging an underground service using these techniques is lower than when using an excavator (refer section 6.5 for more details).

For emergency work it may not be possible to obtain locate and mark outs for services other than Wellington Electricity's underground cables. All reasonably practicable efforts shall be made to identify other network assets using visual inspection of site surroundings for presence of gas metres, roadside warning markers, water valves, man hole covers, telecommunication cabinets and any other network assets in the vicinity of the works. Hand excavation with extreme care will be required after the first 150mm of surface layer is removed. Again, utilising hydrovac techniques lowers the risk of damaging underground services.

6.4.2 The 3m and 1m rules

Where underground services, have been identified by plans only, and the location of these services have been marked out on the ground, a 3 metre rule will apply. A 3 metre perimeter zone shall exist around the proposed excavation area, if the location of any services are marked out within the perimeter zone then a 3 metre corridor on either side of the marked out service shall exist (the actual location of the service may be anywhere within this 3 metre corridor).

For example in Figure 1, an underground cable has been identified as located 2 metres away from the proposed excavation area, in this scenario the 3 metre corridor will extend into the proposed excavation area by 1 metre from the indicated position of the underground cable.
Mechanical digging/excavation cannot take place within the top right hand section of the proposed excavation area highlighted in the diagram until the underground cable has been positively identified using approved pot holing techniques. If it is not practical to pot hole to confirm this underground cable, then the portion of the proposed excavation area within 3 metres of where the plans indicate the underground cable is located, shall be dug by hand or using hydrovac techniques.

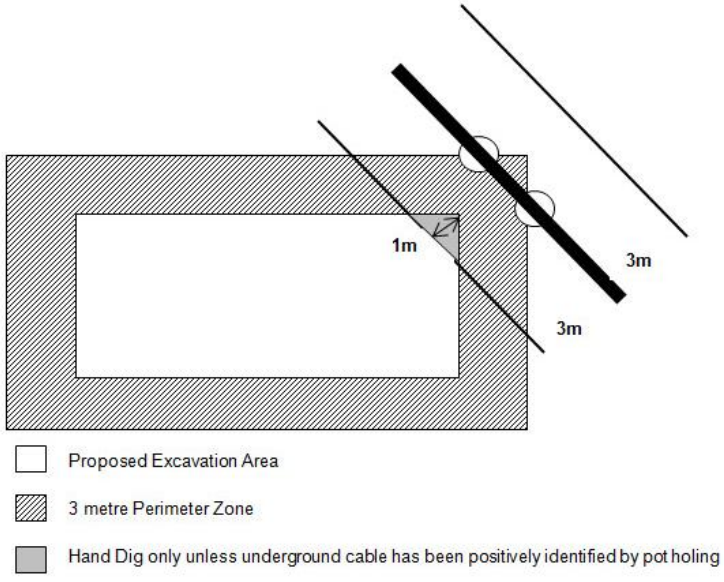

Figure 1 - The 3m rule

Where underground services have been identified by a locate and mark out (using the appropriate location device that utilises signal generation as a means of identifying the service), the perimeter zone can be reduced to 1 metre (this is known as the 1 metre rule). A 1 metre perimeter zone shall exist around the proposed excavation area, if the location of any services are marked out within the perimeter zone, then a 1 metre corridor either side of the marked out service shall exist (the actual location of the

service may be anywhere within this 2 metre corridor).

For example in Figure 2 an underground cable has been identified as located 0.5 metres away from the proposed excavation area, in this scenario the 1 metre rule will apply. The 1 metre corridor will extend into the proposed excavation area by 0.5 metres from the indicated position of the underground cable. Mechanical digging/excavation cannot take place within the top right hand section of the proposed excavation area highlighted in the diagram until the underground cable has been positively identified, using approved pot holing techniques. If it is not practical to pot hole to confirm the location of this underground cable, then the portion of the proposed excavation area that is within 1 metre of where the plans indicate the underground cable is shall be dug by hand or using hydrovac techniques.

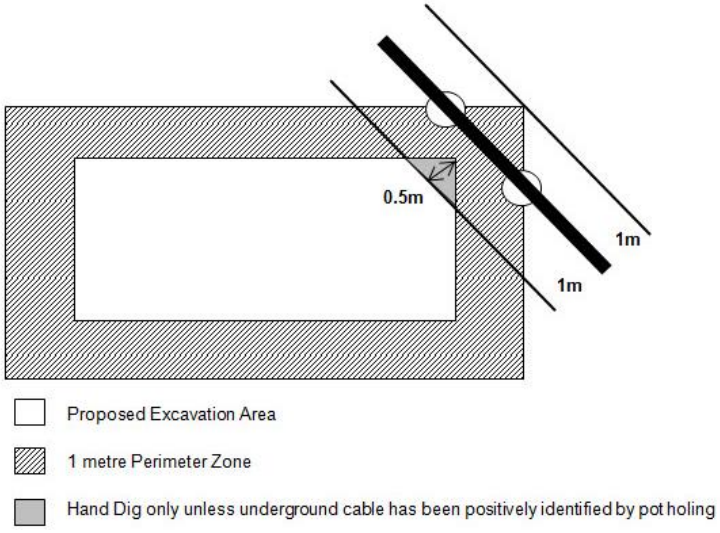

Figure 2 - The 1m rule

6.4.3 Other Considerations

The top surface layer of the ground may be removed utilising a mechanical digger/excavator (concrete/asphalt/compacted rock etc.) up to approximately 150mm, but extreme care is required as the underground services may not be buried at the expected depth (refer Wellington Electricity Standard Drawing END-2141 for electrical underground reticulation).

In the case of other infrastructure utility services it is preferred for the persons undertaking the underground service locations to be authorised by the utility service owner, for example the approved contractor carrying out these services on behalf of gas network owner. All individual utility excavation requirements shall be followed in addition to the Wellington Electricity requirements stipulated in this document.

- If the mechanical digger/excavator is fitted with a seat belt then this must be worn whilst operating the mechanical digger/excavator.
- Jackhammers or crowbars shall not be used to excavate cables (as a digging implement) due to the risk of them penetrating the cable. Mechanical excavation shall only be used with a toothless bucket (refer to AS/NZS 4836:2011 for further details).
- Excavations deeper than 1.5 metres or shallower than 1.5 metres in unstable ground must be properly supported in accordance with Worksafe's Excavation Safety Good Practice Guideline.
- Worksafe notification should be give when *"people have to work in an excavation that is more than 1.5 m deep and which is deeper than it is wide at the top, workers need to work in any kind of heading, excavation or drive where there is ground cover overhead, work in any excavation in which any face has a vertical height of more than 5 m and an average slope steeper than a ratio of 1 horizontal to 2 vertical ".*
- Ladders (or other suitable means) protruding 1 metre above ground level should be used for getting in and out of excavations as required.
- Consideration should be given to wearing a safety harness and lifeline in excavations deeper than 1.5 metres.
- In some cases a trench or excavation may become a "confined space" – in such instances see Section 5.3 of this document.

6.4.4 Plant, Equipment and Loads

The plant and equipment to be used in the excavation must be appropriate for the conditions and in good working order. Inspection and testing of plant and equipment must be completed in accordance with the inspection and testing procedure and evidence of regular maintenance is required to be available upon request.

Unattended plant such as a digger must be left with bucket fully lowered to the ground and when left overnight securely locked and positioned so as not to be a hazard for the general public.

6.4.5 Managing Open Excavations

Ground collapse is one of the main risks of excavation work. All excavations, no matter what depth, can be risky. Ground collapse can occur quickly and without warning, giving a worker virtually no time to escape, especially if the collapse is extensive. A buried worker is likely to die of suffocation before help arrives (either the head is buried, or the chest is so restricted by the ground's weight the worker cannot breathe).

If excavation work is planned without shoring, the continuing safety of the excavation will depend on the conditions arising during construction. If the conditions during construction are not as expected, or if conditions change during the course of the work (eg different soils, heavy rain/flooding) take immediate action to protect workers, other people and property. Excavations shallower than 1.5 m have been known to collapse. If a worker is in the excavation and bending over or crouching down at the time of the collapse, he or she may suffer serious injury. PCBUs must consider the risks associated with these excavations and determine if special precautions or work methods are necessary, for example shoring.

Managing the risk

There are three main types of controls to prevent ground collapse. Make sure to use one or more of the following controls to support all sides of the excavation:

- Benching and battering is the horizontal stepping or sloping of the face, side, or wall of an excavation.
- Shoring prevents collapse by maintaining positive pressure on the sides of the excavation, protecting workers.
- Shields do not ensure ground stability but protect workers from ground collapse, by preventing the collapsing material falling onto them.

No matter how deep an excavation is, if there is a risk of collapse, put controls in place to prevent this. Involve a competent person when selecting what ground collapse controls to apply.

Regular Inspection

The condition of soil surrounding excavations can change quickly when the soil dries out, the water table changes or water saturates the soil. A competent person should frequently check the soil condition and the state of shoring, benching, battering, and excavated faces for signs of earth fretting, slipping, slumping, or ground swelling. If necessary, the PCBU should repair the excavation or strengthen the shoring from above before allowing work below ground to continue.

Benching and Battering

Benching is a method of preventing ground collapse by excavating the sides of an excavation to form one or more horizontal steps with vertical surfaces between levels.

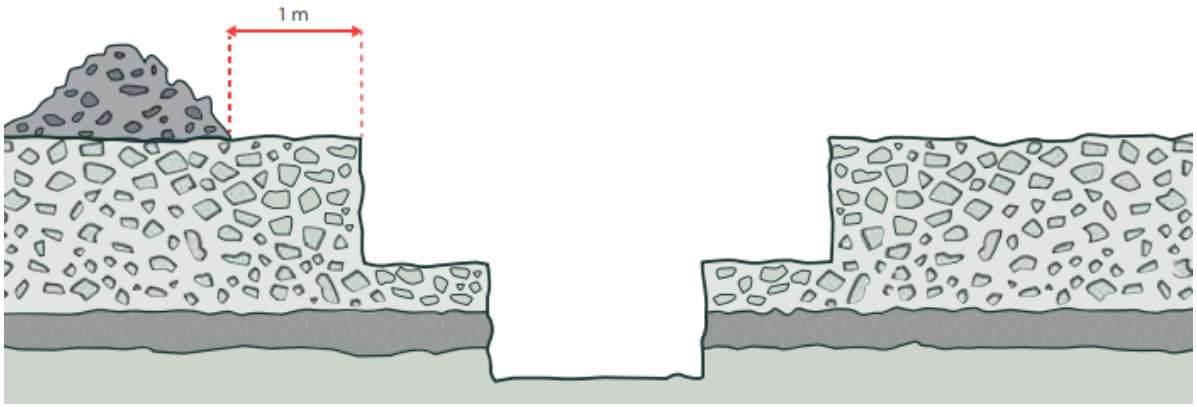

Figure 3 - Example of benching

Battering is where the wall of an excavation is sloped back to a predetermined angle to ensure stability. Battering reduces the risk of ground collapse by cutting the excavated face back to a safe slope.

Figure 4 - Example of battering

Shoring

Shoring provides support to excavated faces to prevent soil moving and ground collapsing. If the ground is not self-supporting, and benching or battering is not suitable, use shoring to manage the risk of a person being buried or trapped during excavation work. When choosing shoring as a control use certified proprietary or non-proprietary systems, within their rated load capacity limits according to manufacturer or supplier instructions. Involve a competent person when selecting what shoring to use. This is to make sure the shoring is fit for purpose. Otherwise, a competent person should design the shoring for the specific workplace conditions. If risks remain for those installing shoring, put other suitable controls in place to ensure the health and safety of workers entering the excavation.

Excavated Material and Loads Near Excavations

The influence of any loads near the excavation can cause ground collapse. Any excavated material and external actions applying a load to the ground nearby can affect the excavation's stability through the zone of influence. The zone is normally from the base of an excavated face to the surface. The zone's angle will depend on site-specific factors. Mechanical plant, vehicles, spoil, or heavy loads should not be in the zone of influence plus 1 m from an excavation unless specific design can show it can support the surcharge load.

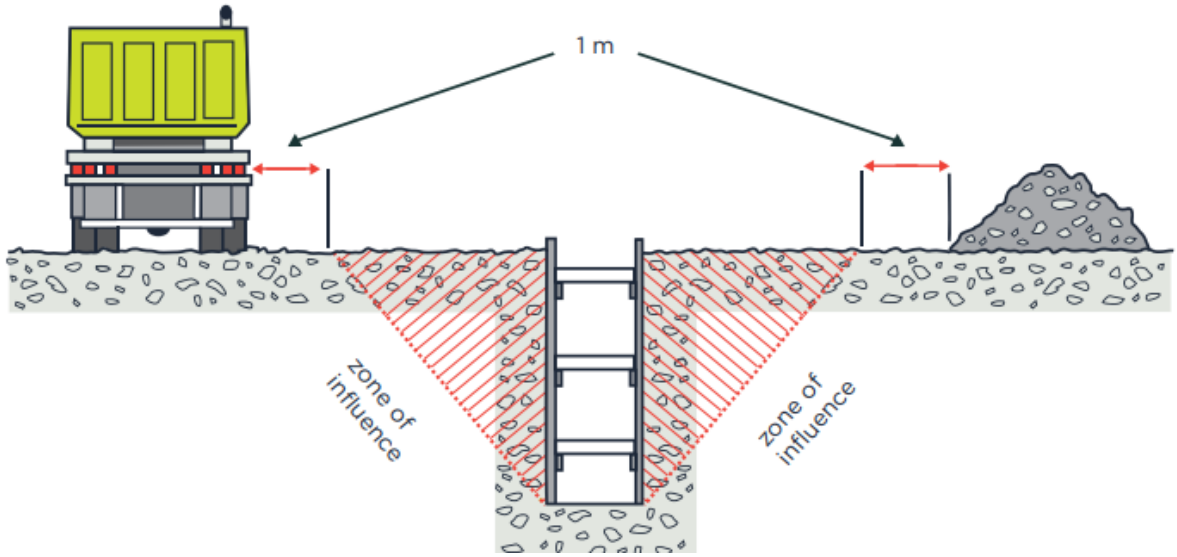

Figure 5 - A shored excavation designed to carry soil loads only

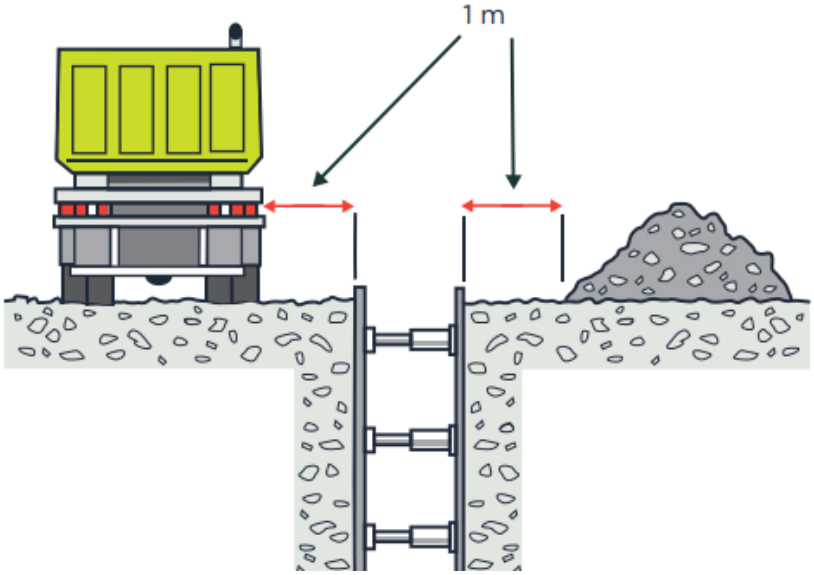

Figure 6 - A shored excavation designed to carry soil, vehicle and spoil loads

Placing or stacking spoil near an excavated face puts workers at risk because it adds an extra load where it is placed or stacked. For example, placing spoil near the excavated face may cause it to collapse.

More information on working safely in excavations can be found on the WorkSafe Good Practice Guide Excavation Safety, July 2016.

6.4.9 Excavations Adjacent to Buildings or Structures

Where it is intended to excavate alongside another structure, (Buildings, structure, concrete slabs etc.) the following precautions must be observed

- Never excavate below the level of the foundation of any adjacent structure, or within an area which would be inside the safe slope, unless adequate precautions have been taken to ensure that the stability of the excavation face and the building or structures above are not at risk either during or after excavating;
- If an excavation is likely to affect the stability of existing structures, advice from a registered engineer must be obtained before the excavation is started;
- Where pumping is being carried out to lower the ground water level, subsidence of adjacent

structures may result. The characteristics of the supporting soil may be changed by pumping, causing a loss of fines and reducing the load-bearing capacity of the soil. If such works are to be undertaken, expert advice (such as from a Geotech or Civil Engineer) should be obtained. When pumping ground water from an excavation environmental considerations are required, this may include but not be limited to the removal of the ground water from site, the installation of sump traps to prevent harm to ecosystems and any other requirements of the local RCA, GWRC, EPA, etc.

6.4.10 Daily Inspections

If the excavation is to be open for more than one day, daily site inspections must be conducted to ensure:

- There hasn't been any under-cutting of the trench wall;
- The trench supporting system has not been over-stressed;
- The trench wall is not fretting (i.e. the stability of the trench wall is not affected by excess ground water); and
- There are no visible cracks in the surface of the trench.
- The excavation needs to be barricaded to prevent any unauthorised entry by members of the public and animals. If the excavation is to be left open overnight particular attention is required to ensure the barricades will remain intact and in place in the event of high wind. Spoil that is left on site should be covered with polythene or similar to prevent spoil being windblown or washed into council storm water drains.
- Particular attention is required to ensure pedestrian traffic around the excavation area are not forced to cross a live lane unescorted at any time.

Depending on the nature of the excavation, inspections could be covered by the daily traffic management inspection. This should be determined after a risk assessment of the site has been conducted.

6.4.11 Directional Boring

If directional boring is conducted incorrectly, it can result in electrocution from a cable strike or damage to other underground assets, risking the safety of both workers and the public.

Where trenchless excavation is in use, the location of all utilities along the proposed route should be confirmed by trial holes. Wellington Electricity will specify the minimum clearances to be maintained between the drilling bits and the cable/cables for each case.

All directional boring machines must be earthed and fitted with a strike detector in the event that they strike an energised electrical asset. Earthing will be in the form of an earth spike. Tracks on vehicles are not an acceptable form of earthing.

6.5. Hydrovac Excavation Techniques

Hydrovac excavation is a means of soil extraction through vacuum when using pressurized water or air for breaking ground. This method of excavation is referred to as "soft excavation technology" and is commonly accepted as being equivalent or safer than hand digging around underground facilities.

The hydrovac excavation equipment shall be operated in accordance with the manufacturers operating instructions. The hydrovac excavation equipment must be operated in accordance with practices that provide appropriate levels of worker and public safety and prevent damage to buried utilities.

The tools used (dig wand / vacuum tube) must be specifically designed for excavating around buried utilities (e.g. rubberized coating on dig wand and rubberized sleeve attached to the end of the vacuum tube).

The Contractor using the hydrovac equipment shall obtain obstruction plans and where required locate and mark out services prior to the commencement of work.

The work area must be appropriately fenced off to protect the public and personnel, such as the use of high visibility cones and barriers.

Operators should where appropriate, shroud excavation areas with shade cloths to protect public from projectile rocks and spray

The pressurised air or water wands shall never remain motionless during excavation. Aiming directly at the underground utilities shall be avoided at all times.

A distance of 200mm shall be maintained between the end of the pressure wand nozzle and the underground utility and / or subsoil. The nozzle shall never be inserted into the subsoil while excavating within the vicinity of the Wellington Electricity Network.

When pressurised water wands are used, the maximum water pressure to be used at any time with a straight tip nozzle during excavation shall be 1,500psi. All pressure measurements are to be monitored using a pressure gauge mounted on the excavation machine. A straight tip nozzle is a single orifice fitting that can be inserted into the end of the wand used with a hydro-excavation machine so there is a single concentrated jet of water exiting from the tip of the nozzle.

The maximum water pressure to be used at any time with a spinning nozzle during excavation shall be 2,000psi. When a spinning tip nozzle is used, pressure measurements are to be monitored using a pressure gauge mounted on the excavation machine. A spinning tip nozzle consists of a conically shaped housing that contains a single exit point (to facilitate the flow of the liquid) as well as a rotor insert. The rotor insert has a series of blades such that when liquid is flowing through the nozzle, the rotor is forced to spin around the longitudinal axis of the nozzle. The rotor insert also contains three or more channels that force liquid to flow in different pathways through the rotor insert to the tip of the rotor which, as a result of the high pressure liquid is forced into contact with the nozzle housing. The liquid flowing through the nozzle is dispersed through the tip of the nozzle housing in a conical shape, having an angle of not less than 20°.

If heated water is used during excavation, the temperature and pressure of the water shall never exceed 40°C and 2,000psi respectively (for spinning tip nozzle).

At least two competent operators per unit shall be used for hydrovac excavation at all times – one to operate the air or water lance and one to operate the vacuum hose.

A handheld remote emergency shutoff switch shall be accessible to one of the operators at all times while hydrovac excavation is being carried out.

A third person must be used as a spotter while hydrovac excavation is being undertaken on more complex sites.

As a minimum, the work supervisor should have a basic understanding of electrical theory.

The preferred work method when using hydrovac equipment in the vicinity of the Wellington Electricity underground network is to work with the network equipment de-energised.

6.5.1 Damaged or Suspect Cables

When the Electricity network is damaged or suspected to be damaged, the network in the vicinity of the excavation should be de-energised prior to the excavation process. Any damage to the Electricity network from the excavation process or discovered during the process shall result in an immediate stop of works, remove all personnel from the area and keep others clear. This should then be reported to Wellington Electricity (0800 248 148) as soon as possible but before backfilling.

6.5.2 Boom Movement and Maintaining Safe Limits from Power Lines

Boom movement must be monitored to ensure that safe distances are maintained as required by NZECP 34:2001. It is the responsibility of all those involved with hydrovac operations to communicate with one another when any boom movement is required in the vicinity of overhead power lines. This includes during initial set-up or to reposition the boom.

If any part of the plant could encroach within 4 metres of the overhead power lines a written close approach consent (refer to ENM-009) is required from Wellington Electricity.

6.6. Temporary Support of Cables

6.6.1 Temporary Support of Paper Insulated Lead Covered (PILC) Cables

When trenching beneath PILC cables a temporary support may be required to prevent deflection and damage to the mechanical and electrical properties of the cable.

Prior to trenching beneath the electric distribution cable the Contractor is to install a temporary support if the unsupported span of cable in the trench exceeds 1.0 metre in length. The spacing intervals of the supporting slings must not exceed 800mm. Closer spacing intervals may be required to support cable joints.

A slip over split duct or equivalent shall be used for mechanical protection between the sling and the cable outer sheathing.

The installation of temporary supports for cables can only be undertaken by competent[3] workers authorised to work on the Wellington Electricity network. Contact Wellington Electricity for more information.

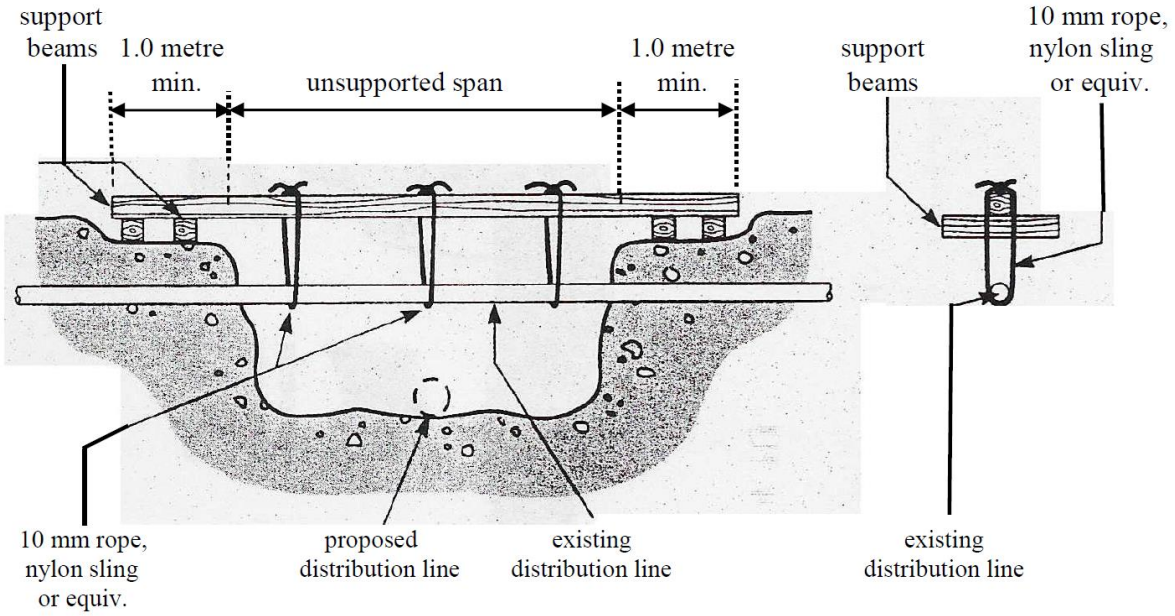

Figure 7 – Temporary Support of PILC Cables

6.6.2 Temporary Support of 33kV Gas and Oil Filled Cables

The requirements for temporary support will be determined by Wellington Electricity as part of the stand over service that is compulsory when working within 1.5m of the Wellington Electricity 33kV underground network.

Note: The EEA has indicated in its Guide to Safe Work with Cables that Live PILC cables, both HV and LV, and pressurised cables must not be handled under any circumstance. For the purposes of working on the Wellington Electricity network, this means that the cables should not be moved whilst Live.[4]

[3] If the cable is an energised PILC cable, a minimum competency of a cable jointer is required.
If the cable is de-energised PILC or XLPE (energised or de-energised) then a WTC 3.0/ 3.9 is required.
[4] The definitions of "handled" have been clarified with the EEA as meaning:
"…handling relates to mean circumstances where the cable is moved or otherwise manipulated…"

6.7. Equipotential Zone Protection

Equipotential bonding is the preferred method of protecting workers and members of the public from injuries due to electrical contact and step voltage potential when working on energised electrical apparatus. The aim is to keep all workers, equipment and plant at the same potential to mitigate the risk of current flow.

Equipotential bonding is required if electrical underground cables are shown:

- In the intended excavation area or within a 3 metre perimeter zone of the intended excavation area if the underground cable/cables have been identified using plans only.
- In the intended excavation area or within a 1 metre perimeter zone of the intended excavation area if the underground electrical cable/cables have been identified using a mark out (using an appropriate location device).

The equipotential bonded work zone incorporates a system of conductive bonding clamps and conductors capable of maintaining the work zone at an equalised potential at all times. These connections include, but are not limited to the bonding of all conductive objects or equipment such as the high pressure water gun, the suction tube, the hydrovac truck chassis and the ground mat(s).

Before any worker participating in the excavation (i.e. water gun operator or suction tube operator) leaves the equipotential bonded work zone, the water must be turned off. This needs to happen every time the ground mat(s) are repositioned or a worker needs to step off the grounding mat(s). All hydrovac personnel must stay on the ground mat(s) during the work procedure.

Workers must take care not to touch any non-bonded conductive object in the immediate work area when the water gun and or the suction tube are inside the excavation. Figures 8 and 9 below illustrate the recommended set-up using equipotential bonding equipment.

Temporary earthing is the mechanical connection of equipment to a recognised effective earth or system neutral. When this method is used for protection of workers the capacity of such earthing equipment must be capable of carrying system fault currents at the site where it is employed.

When equipotential bonding is required on the Wellington Electricity network, the minimum bonding conductor size shall be 25 mm^2 copper or equivalent. All clamps and connections made to create the equipotential zone shall have a similar conductivity. Equipotential bonding to an effective earth is required in all instances.

Note that for the temporary earth, the minimum earthing conductor size shall be 70 mm^2 copper or equivalent. All clamps used shall have a similar fault current rating. Extreme care needs to be exercised when driving in a temporary earth spike to avoid contact with the existing underground utility services.

Hydrovac operators are typically not qualified to connect any form of bonding or earthing to the system earth. In these situations Wellington Electricity or its approved contractors shall be contacted for guidance.

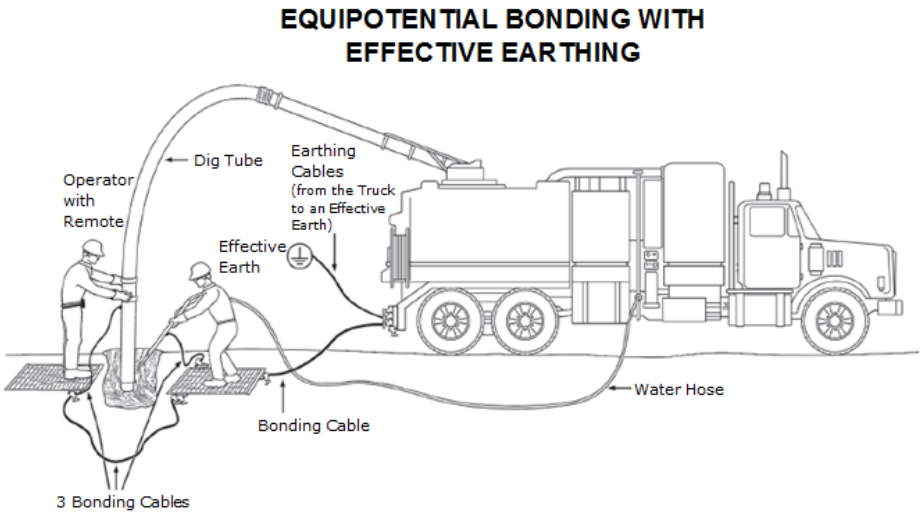

Figure 8 - Equipotential Bonding of HydrovacEquipment

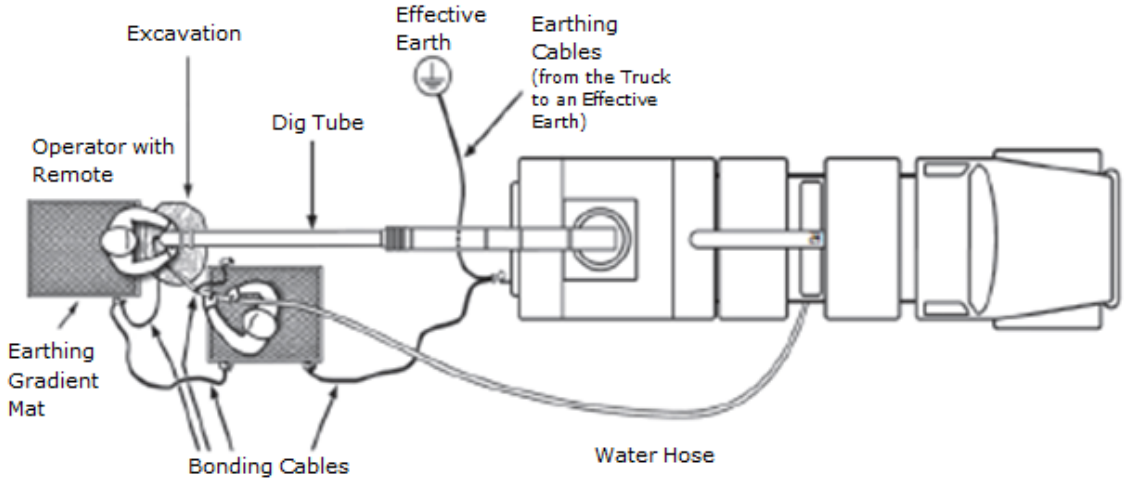

Figure 9 - Plan View

Note: In some instances, the use of large grounding mats may not be practical. In these cases the preferred solution would be to make use of smaller flexible grounding mats.

6.7.1 Earthing of Mobile Plant

Mobile plant is defined by the EEA as any equipment fitted with a jib or boom, any equipment or device capable of raising or lowering a load, and any equipment or device capable of projecting a tool bit, including cranes, elevating work platforms, excavators, tip trucks, boring machines or similar plant.

Earths shall be applied to mobile plant if there is any risk of inadvertent flashover or contact with live equipment, including buried cables and shall be applied where the planned work is at or less than 4 metres from live equipment. Plant operators standing alongside the mobile plant to control or operate it shall stand on either a conductive mat bonded to the mobile plant, an insulating mat or dielectric footwear may be worn. Earthing of mobile plant means a temporarily applied conductive connection between mobile plant and earth. The earth cable should be suitably bonded, preferably bolted to the chassis of the mobile plant. The earth cable shall be covered and be a minimum of 70mm cross sectional area if copper. The clamping location should have clean surfaces on both mating parts to ensure an effective electrical and mechanical connection. The earth cable shall be connected to the earth rod (or substation/asset earth bank depending on the location and type of work), the earth rod shall be driven a minimum of 500mm into the ground (check to ensure no underground services are in the vicinity of where the earth rod is to be installed prior to installing the earth rod).

Work in the vicinity of live overhead conductors - work may proceed when earthing is impracticable provided a suitable MAD greater than the minimum permissible reduced MAD specified for the voltage in SM-EI 3.712 has been agreed with the asset owner and safety precautions have been specified and implemented, and the supervisor and the asset owner agree that the likelihood of inadvertent overhead conductor-to-plant contact or flashover is negligible, and all other employees/workers remain well clear of the plant while it is operating.

Work in the vicinity of live underground cables – when working where no suitable earth connection is available, such as tar seal or concrete sites and there is no exposed soil suitable for driven earths, then the asset owner must be contacted prior to work proceeding. Work may then be able to proceed with additional controls implemented, these controls could be that all employees remain well clear of the mobile plant or it may be that employees wear dielectric footwear. The memorandum released by Asset Engineering in May 2019 regarding overhead worksite earthing requirements provides good practice guides in terms of applying worksite temporary earthing and may be used in these scenarios.

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