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Excavation Standard

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Document Register

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Revision Register

Revision	Issued	Reason for revision	Change reference	Supersedes
1	18/07/2016	Hydro vacuum excavation is now permitted in accordance with ENG-116		0

End of Revision Register

Document Review

A document review shall be conducted not more than 3 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 uniform and safe method of excavation and reinstatement is carried out when laying electrical cables and/or undertaking maintenance or emergency works on the electrical distribution network.

2. Policy

It is the policy of Wellington Electricity that any persons engaged to carry 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).

3. Scope

This procedure 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 or directional boring operations near electrical cables;
- maintenance works on the electrical distribution network; and
- emergency works

4. References

Reference	Title	Page
Legislation	Health and Safety at Work Act 2015	
Legislation	Health and Safety Regulations 1995	
Worksafe	Approved code of practice for Safety in Excavation and Shafts for Foundations	
Worksafe	Guide for Safety with Underground Services	
NZECF 34:2001	Electrical Safe Distances	
NZUAG	National Code of Practice for Utility Operators' Access to Transport Corridors	
AS/NZS 4836:2011	Safe working on or near low-voltage electrical installations and equipment	
SM-EI	Safety Manual Electrical Industry, Parts 1,2 and 3	
EEA	Guide to the identification of and work on 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	

Reference	Title	Page
ENG-116	Hydro-vac Excavation Procedure	
Wellington Electricity	WE* all need to get it right on site	
Wellington Electricity	WE* all need to work safely	
End Of References		

5. Excavation

5.1. Safety

All personnel:

- are required to complete and document 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 every possible attempt must be made to determine the location of existing underground services (gas, electricity, water, sewer, and telecommunications) using the “before u dig” (0800 248 344) process. If no plans and mark outs are available then the entire excavation shall be dug by hand.

For emergency work it may not be possible to obtain mark outs for other than electrical services. In this instance hand excavation with extreme care will be required after the first 150mm of surface layer is removed. Reasonable efforts shall be made to identify other network assets using visual inspection of site surroundings for presence of Gas meters, water valves, Man hole covers, telecommunication cabinets and any other network assets in the vicinity of the works.

Wellington Electricity underground services that are identified by plans but not marked out, that are shown as within the excavation area or are within a 3 meter perimeter zone of the excavation area (the 3 meter zone extends around the entire excavation area) shall be identified by pot holing prior to utilising mechanical digger/excavator.

If it is not practical to pot hole to confirm these underground services then the portion of the excavation that is within 3 meters of where the plans indicate the underground services are, shall be dug by hand. Where a mark out has taken place (using the appropriate location device) the perimeter zone can be reduced to one meter. If it is not practical to pot hole to confirm these underground services then the portion of the excavation within the 1 meter zone shall be dug by hand.

The 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, the individual utility excavation requirements shall be followed in addition to the above Wellington Electricity requirements.

The illustration below shows an underground service that has been identified during a mark out. The mark out has not identified any underground services within the excavation area but the mark out has identified an underground service as being within the 1 meter perimeter zone. The planned excavation area is in the centre of the illustration and the 1 meter perimeter zone is shown as the shaded area on the outside of the excavation area. In this situation either:

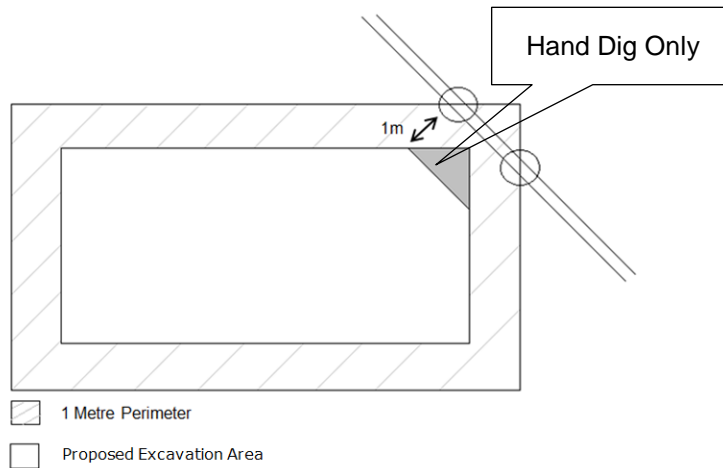
- The underground service that has been identified during the mark out is pot holed to confirm the location is outside the excavation area, if the underground service has been confirmed as being

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outside the excavation area by pot holing then the excavation area may be excavated utilising a mechanical digger/excavator; or

- The section of the excavation area that is within 1 meter of the underground service is hand dug to confirm the underground service is not within the proposed excavation area. When it has confirmed that the underground service is not located within the excavation area, then the excavation area may be excavated utilising a mechanical digger/excavator.

The excavation up to the dark grey shaded area may be excavated utilising a mechanical digger/excavator and the remaining part of the excavation area (the dark grey shaded area) shall be finished by hand digging.



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 due to the risk of their penetrating the cable. Mechanical excavation shall only be used with a toothless bucket (refer to AS/NZS 4836:2011 for further details).

WorkSafe must be notified in writing of any excavation operations likely to exceed 1.5 metres in depth prior to work commencing. Excavations deeper than 1.5 metres or shallower than 1.5 metres in unstable ground must be properly supported in accordance with Code of Practice for Safety in 'Excavation and Shafts for Foundations'.

Ladders (or other suitable means) protruding 1 metre above ground level should be used for getting in and out of difficult excavations.

Consideration should be given to wearing a safety harness and lifeline in excavations deeper than 1.5 metres.

Ground work can be extremely hazardous with such hazards as trench collapse, objects falling onto people, vehicles or personnel falling into the excavation and undermining of nearby structures.

In some cases a trench or excavation may become a "confined space"

5.2. Planning

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 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 plan.
- 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). For the avoidance of doubt a WTC is required when excavating below 300mm of the finished ground line in the vicinity of Wellington Electricity cables.
- 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.

5.3. 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 on site prior to works commencing.

Unattended plant 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.

5.4. Mobile Plant Near Conductors

General

Mobile plant working near electric overhead lines can damage the line and be hazardous for the plant operator, the mobile plant and people in the vicinity.

Conductors can be displaced from their normal position by wind or temperature change. This requires special consideration by mobile plant operators.

Minimum Approach Distance

The distance between any live overhead electric line and any part of any mobile plant or load carried shall be "AT LEAST 4.0 METRES", unless the operator has received written consent from the overhead electric line owner allowing a reduced distance.

5.5. Excavations

Excavated or other loose material must be effectively stored or retained not closer than 600 mm from the edge of the face unless the face is specially shored to allow for the increased load, and suitable toe boards or other safeguards are provided (Figs 1, 2 and 3).

The plant operator must not get close enough to the excavation edge to cause collapse or undermine the stability of permanent or temporary structures (buildings, scaffolds etc.).

Mechanical plant, vehicles or any heavy loads must not approach closer than:

- (a) 600mm from the edge of an excavation which is battered to a safe slope; or
- (b) What would be the edge of the face if battered to a safe slope unless the actual face is specially shored to allow for the full effect of the additional load?

Fig.1 Excavation with battered faces

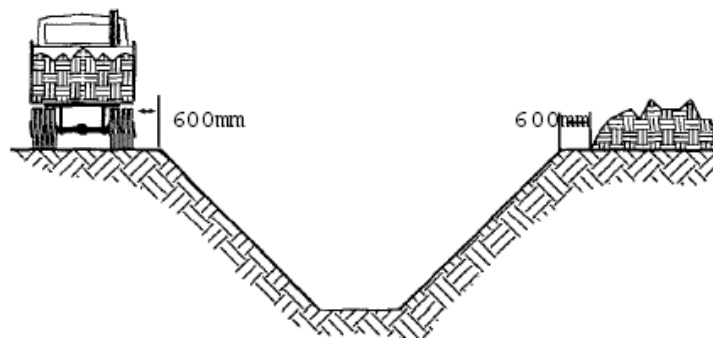


Fig.2 Excavation with shored faces.

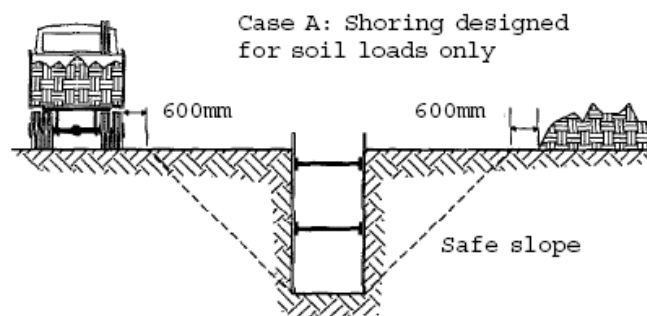
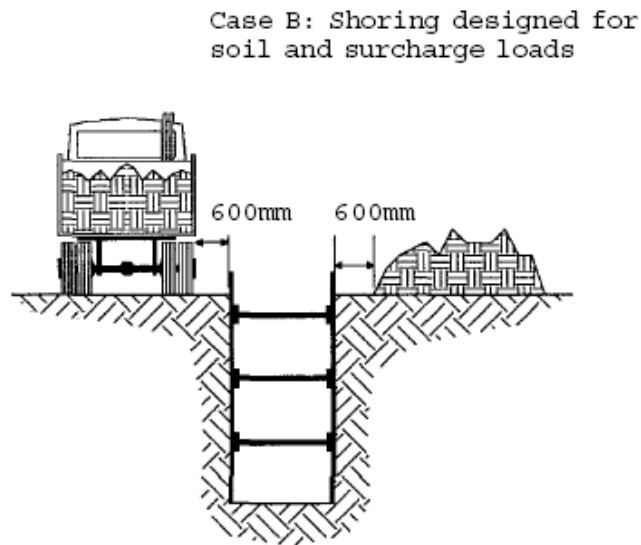


Fig.3 Excavation with shoring designed for surcharge loads.



General requirements

The following requirements apply to all excavations in which personal are required to work.

All work involving excavations must comply with the requirements in the HSE Act and the HSE Regulations. Notification must be given to Worksafe if the trench is deeper than 1.5 meters on any face and which is deeper than it is wide at the top.

Where excavations are approaching 1.5 meters (i.e. 1.4 meters and above) consideration needs to be given to utilising shoring techniques.

Excavations to be shored

Excavations Shallower than 1.5 metres

Excavations shallower than 1.5 m have been known to collapse. If personnel are in the trench and bending over at the time of the collapse, he or she may suffer serious injury. Employers are to consider such excavations and determine if special precautions or work methods are necessary.

Excavations 1.5 metres or Deeper

Excavations greater than or equal to 1.5 m deep are particularly hazardous and must be shored unless:

- The face is cut back to a safe slope and the material in the face will remain stable under all anticipated conditions of work and weather; or
- Shoring is impracticable or unreasonable, and safety precautions certified by a registered engineer to be adequate, have been taken.

Every site supervisor shall take all practicable steps to ensure that any shoring used in any excavation at the place of work –

- Consists of materials that are suitable for the purpose for which they are to be used, of sound quality, and adequate in strength for the particular use; and
- Has bracings, jacks, and struts that are securely held to prevent accidental displacement, and packing's and wedges that are held by nails or spikes; and
- Is placed in a proper manner by an experienced person under competent supervision; and
- Is not altered, dismantled, or interfered with except on the instructions of the employer or a representative of the employer.

Excavations and trenching involving earthworks can collapse, causing serious injury to people in and around the excavation or trench. Injuries can also occur if workers enter or exit the trench or excavation incorrectly.

No person is permitted into an unprotected trench or shaft under any circumstances. Trenches must be battered, benched or shored in line with the code of practice. If these options are not possible workers may be protected by using trench shields.

Measures need to be taken to minimise the depth of the excavation or trench where possible, as well as minimise the number of people in the trench and the amount of time they spend inside the trench or excavation.

Consideration must be given to face excavation where this can cause collapse or undermine the stability of permanent or temporary structures (buildings, concrete pads/paths, scaffolds etc.).

Excavation and trenching operations will be planned so that spotters and other control people are provided where required, and their view of workers in the trench remains unobstructed.

Modes of Failure

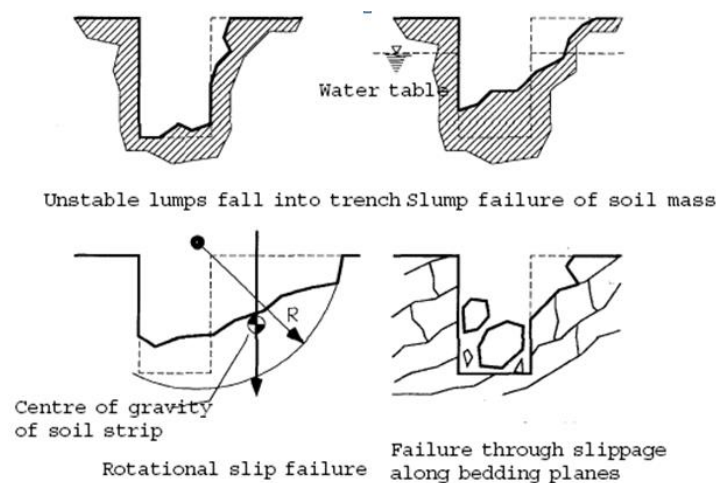
It should be noted that all excavations, no matter what depth, may be hazardous.

Modes of failure will depend on the depth, the soil type or soil types if layered, bedding planes, vibration, the presence of moisture, rain, or a high water table level, any superimposed loading close to the edge of the excavation, the time the excavation is open, and any previous disturbance of the soil.

While some types of soil often look stable and may stand for quite a long time, a false sense of security can build up. Experienced employees have been the victims in trench collapses.

Some common failure modes are shown in Fig. 4.

Fig.4 Common Modes of Failure

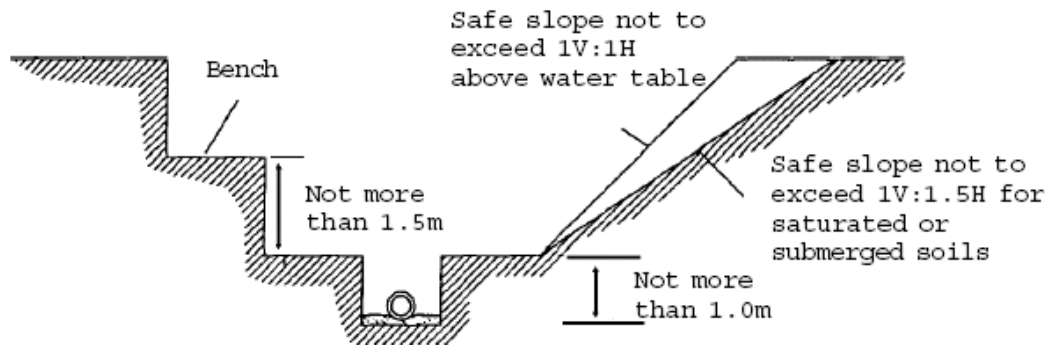


Safe Slopes in Excavations

Unless the stability of the excavated face is determined by a registered engineer or a competent person (experienced in excavations), the safe slope shall not exceed:

- 1V : 1H or the angle of repose, whichever is flatter, for soils above ground water table;
- 1V : 1.5H or the angle of repose, whichever is flatter, for saturated or submerged soils, or for excavations greater than 3 m in depth;
- Where the slope of an excavation is benched, the maximum height between benches should not exceed 1.5 m, excepting the bench adjacent to the work area, which should not exceed 1 m (Fig. 5). Overall, the total width of the benched excavation should not be less than required in (a) or (b) above.

Fig.5 Excavation faces benched and battered to a safe slope.



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 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, EPA, etc.

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.

5.6. 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.

5.7. Hydro Vacuum Excavation Techniques

Wellington Electricity has a vacuum excavation procedure (ENG-116). For further information on vacuum excavation requirements refer to procedure ENG-116. All other underground excavation work must comply with the WorkSafe Guide for Safety with Underground Services.

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