



TRENCHING AND EXCAVATION MANAGEMENT

Core Operating Procedure

Business Management Systems (BMS) Group

Document No.: HEQ-PCE-00471

**POWERING FUTURES,
CREATING LEGACIES.**

DOCUMENT VERSION CONTROL

Note: Most recent change to this document is highlighted in grey.

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6	22/03/2016	Updates to Section 4, Section 6.3.1, Section 8 and Section 8.2.	Brian Olsen
5	03/06/2015	Update to Section 8.7 which is the inclusion of clear process around working in gullies/manholes to cover the risk of proximity of works.	Brian Olsen
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3	17/04/2013	In relation to excavation and correct batter slopes, further details have now been provided using diagrams.	Laureen Constable
2	16/11/2012	Metadata amendment.	Laureen Constable
1	19/07/2012	Inclusion into the BMS.	Laureen Constable

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1. PURPOSE

The purpose of this Core Operating Procedure (COP) is to manage health, safety and environmental risks associated with excavation and trenching work.

2. SCOPE

This document encompasses all BMD Group subsidiaries including BMD Constructions, BMD Urban, Empower, JMac Constructions and Urbex. For ease of reference, the term BMD is used throughout this document to reference the 'Group'.

This Core Operating Procedure applies to open excavation, trenching and shoring operations.

It does not cover the following for which a separate construction method statement should be conducted before performing this type of work:

- Bulk excavation operations for civil construction
- Sinking of shafts or piers
- Trenching and excavations in caissons and other works under raised atmospheric pressures
- Trenching works in loose, unconsolidated environments such as stockpiles, spoil piles and spillage
- Tunnels or tunnel work.

3. INTRODUCTION

Any work connected with an excavation is classified as 'construction work' under the WHS Regulations and therefore the relevant requirements relating to construction work must be complied with. 'Excavation work' is defined in the WHS Regulations as work undertaken to:

- make an excavation; or,
- fill or partly fill an excavation.

4. ROLES AND RESPONSIBILITIES

Project Manager

- Ensure excavation operations are risk assessed prior to project commencement and at task level.
- Ensure 'Before You Dig Australia' and 'Permit to Work' documentation is completed prior to work commencing.
- Complete emergency response documentation.
- Ensure works are carried out as per the [Trenching and Excavation minimum standards](#).
- Ensure all workers involved in excavation operations are competent and understand the requirements of any related [Work Method Statements](#) (WMS) [Job Hazard Analysis](#) (JHA).
- Ensure any defective equipment is withdrawn and quarantined immediately.
- Ensure preventative maintenance and periodic inspection of all excavation and trenching equipment is conducted and recorded in the [Trenching and Excavation Inspection Checklist](#).
- Ensure all competent workers involved in excavation operations are recorded in the [Project Training & Competency Register](#).

HSE Personnel
• Ensure all excavation operations conform with local legislative requirements. • Ensure preventative maintenance and periodic inspections of all excavation and trenching equipment is conducted and recorded in the Trenching and Excavation Inspection Checklist.
Workers
• Must be competent in excavation operations and have appropriate licences and certificates where appropriate. • Be involved in risk assessment of excavation operations they are likely to be involved in. • Complete mobile plant, vehicle and equipment risk assessments and checklists as required. • Understand, sign off and follow any related WMS and emergency training requirements.

5. EXCAVATION AND TRENCHING OPERATIONS¹



5.1. Minimum excavation and trenching guidelines

- The excavation has a safe means of access and egress
- The shoring is designed by a suitably qualified engineer and there are relevant drawings indicating the methods to be used
- Trenches and Excavations deeper than 1.5m battered, benched, or shored
- Trenches and Excavation less than 1.5m deep have stabilisation methods installed where there is an engulfment risk
- Trenches/penetrations such as bore piles, storm water pits, man poles etc. must be effectively barricade at all times and securely covered
- The trench is regularly inspected to ensure controls are used and remain adequate and recorded on the [Trenching and Excavation Inspection Checklist](#) or the Weekly HSE Inspection as required
- Barriers, signage, and fencing has been established in and around the trench. Materials stacked 1m from zone of influence
- Above ground and underground services have been identified with BMD service markers and made safe
- The confined spaces aspects have been suitably identified, controlled, and are continually monitored
- The risks involved with mobile plant working in and around the excavation have been assessed and controlled
- The safety of the surrounding structures and areas has been assessed daily and details of the inspection documented. Geotechnical report available (if required)
- Emergency procedures have been established for the excavation
- Workers within the excavation are adequately trained and instructed in emergency procedures.
- Possible water sources have been identified and control measures implemented to remove the risk of flooding due to water infused soil instability

¹ FSC Audit Criteria H 7.2

- Workplace Security: the work area must be secured from unauthorised access (including inadvertent entry). Consideration must be given to risks to health and safety arising from unauthorised access to the work area; and the likelihood of unauthorised access occurring. All ladders shall be removed at the end of the shift where appropriate.

6. ASSESSING AND MANAGING RISK

Excavation and trenching activities must not take place until risks have been assessed and adequate controls put in place. Refer to the [Risk Management](#) standard for more detail.

6.1. Identifying hazards

Typical hazards to check for are:

- underground essential services including gas, water, sewerage, telecommunications, electricity, chemicals, and fuel or refrigerant in pipes or lines - information about the location of these and other underground services, such as drainage pipes and soak wells, storage tanks, in and adjacent to the workplace, must be established before directing or allowing excavation work to commence
- the fall or dislodgement of earth or rock
- falls and falling objects
- inappropriate placement of excavated materials, plant, or other loads
- the instability of any adjoining structure caused by the excavation
- any previous disturbance of the ground including previous excavation
- the instability of the excavation due to persons or plant working adjacent to the excavation
- the presence of or possible inrush of water or other liquid
- hazardous manual tasks
- hazardous chemicals (these may be present in the soil where excavation work is to be carried out);
- hazardous atmosphere in an excavation (e.g., using solvent for PVC pipes in poorly vented trenches)
- Vibration
- overhead essential services (power lines) and ground mounted essential services (transformers, gas, and water meters).

6.2. Assessing the risks

When assessing the risks associated with excavation work, consider the following:

- local site conditions, including access, ground slope, adjacent buildings and structures, water courses (including underground) and trees
- depth of the excavation
- soil properties, including variable soil types, stability, shear strength, cohesion, presence of ground water, effect of exposure to the elements
- fractures or faults in rocks, including joints, bedding planes, dip and strike directions and angles, clay seams
- any specialised plant or work methods required (for example, ground support)
- the methods of transport, haul routes and disposal
- what exposures might occur, such as noise or UV rays
- the number of people involved
- the possibility of unauthorised access to the work area
- local weather conditions
- length of time the excavation will be open
- Access/egress into the excavation.

6.3. Managing risk

Where possible the risk should be removed. If risk remains, it must be minimised (ALARP).

6.3.1. Work Method Statements

If the excavation work involves high risk construction work, a WMS must be prepared before the high-risk construction work starts.

One WMS can be prepared to cover all the high-risk construction work being carried out at the workplace by a worker or contractor. E.g., excavation work might involve a number of types of high-risk construction work, such as:

- a risk of a person falling more than 2 metres, and
- a trench with an excavated depth greater than 1.5 metres, and
- the use of mobile powered plant.

Hazards and Controls identified in the WMS should be specific to activity and not generic statements (e.g. in case of trenching – shoring to be used instead of the generic batter, bench or shore)². Handwritten changes to existing WMS are acceptable, this document must have the version number changed, also details of changes, update version number and date of change recorded in 'Review and Monitoring' section of the WMS, all persons involved in the activity must review and re-sign onto the WMS³.

When the activity is being conducted the method of controls outlined in the WMS will be further complemented in the field based JHA.

7. PLANNING

All trenching and excavation work must be carefully planned. Part of the planning process involves assessing ground conditions. This can be done by using:

- Boreholes
- Trial pits
- Information from previous or current work in the area.

Note: *If none of these are possible, ground conditions can only be assessed when excavation begins.*

For all excavations deeper than 1.5 metres, a person who in a supervisory position holds a minimum Certificate 3 in Civil Construction must assess ground conditions, adjacent buildings, structures/materials/foundations and locations. Risk register to include assessment and controls of the above.

A [Trenching & Excavation Permit](#) must be issued when excavations are:

- greater than or equal to 1.5m deep
- less than 1.5m deep and ground conditions require stabilisation methods (benching, battering, shoring, etc.)

For all works under the Permit the [Trenching and Excavation Checklist](#) must be completed and the excavation regularly monitored to ensure controls are effective. The permit must be location specific and will be valid for no more than **14 days**. All workers involved in the works must read, understand and sign the permit.

Permit Issuer: - A person in a Supervisory position who holds a minimum Cert 3 in Civil Construction or qualified engineer.

² FSC Audit Criteria H 7.2

³ FSC Audit Criteria FP 4.3

Training and Competency requirements for the completion of permits is outlined in the [HSEQ Training and Competency Management](#) standard.

7.1. Environmental issues

Excavation work near natural watercourses must not pollute the water. Pollution can be prevented by:

- Locating spoil heaps away from the water's edge
- Preventing rubbish and materials from accumulating on downhill slopes
- Using sediment control structures if discharge water is likely to carry a significant sediment load.

Note: Controls must also be in place to prevent the site producing excess noise, dust, and fumes.

Before beginning work in an area that may have cultural or ecological value, the Project Manager must ensure the site has been assessed and appropriate measures are in place to maintain the values identified.

7.2. Surrounding communities

The Project Manager must make sure the impact of trenching and excavation activities on the surrounding community is assessed before work begins.

Note: A dilapidation survey may be required.

The level of assessment required and issues to be considered depend on whether the excavation is within a BMD controlled area or under the influence of others. Issues to consider include:

- Work hours
- Site access and security
- Noise
- Traffic disruption.

Appropriate control measures must be included in the site's Integrated Project Management Plan (IPMP).

7.3. Excavation equipment

Excavation equipment must be selected with consideration to the work to be done and the location of the work site (particularly when the work is to be carried out in a public area).

The following minimum requirements apply to excavation equipment:

- All ride-on tracked, wheeled or rubber-tyred vehicles entering the excavation must be fitted with certified FOPS cabs or canopies and "where a risk assessment is performed and has determined the risk for falling objects and overturning and the risk is determined as unacceptable"
- Tracked, wheeled and rubber-tyred heavy equipment working around the excavation must also be fitted with a ROPS cab or canopy
- All electrical and fuel-powered equipment introduced into a trench must be in good mechanical and electrical order.

7.3.1. Transporting excavation equipment

- All equipment must be transported to the work site on an appropriate trailer, truck, or carrier
- All excavation equipment must be inspected before it is allowed onto the worksite.

7.4. Site contamination

Contaminated sites require special management during excavation and trenching operations.

The Project Manager must make sure any material imported as fill or exported as waste material has been evaluated for contamination.

In some circumstances, exporting contaminated material from a site requires Local/State Government approvals, and these must be obtained before any of the material can leave the site.

7.4.1. Acid sulphate soils

Acid sulphate soils are common in low-lying coastal areas and represent a significant environmental threat when unearthed.

The Project Manager must ensure the potential of encountering acid sulphate soils during trenching and excavation operations has been assessed.

7.5. Access and egress

Safe and suitable methods of access and egress must be provided wherever personnel are working in a trench or excavation⁴. These must be spaced as per local legislation and recorded in the appropriate WMS. If access to and from a trench more than 1.5m deep, is by ladders, a ladder must be installed in every 9m of the length of the trench in the part of the trench where a person will be working. Ladders must extend at least 1 metre above the top of the excavation.

In trenches which have been benched or battered, access to and from a trench more than 1.5m deep may be by other means. Ramps, and or steps, may be cut into sides of trench to facilitate access and egress.

Steps are the last acceptable method as they have to comply with the Australian standard for steps.

The sides of excavations and trenches should be made relatively free of hazards such as, rocks, clumps of spoil and other debris, so as to reduce the risks of slips, trips, and falls by personnel working in the vicinity.

7.5.1. Working room

Because space in an excavation is usually limited, care must be taken to make sure there is enough separation between workers and tasks to avoid injury.

Workers must also be separated from all active digging faces and active dumps to avoid being struck by falling material or any part of the excavator/backhoe.

7.5.2. Working alone

Personnel must never work alone unless there is either a dedicated stand-by person or another person close by who can provide help.

The Project Manager must ensure risk assessments consider personnel working alone in excavations and the supervision requirements of local legislation.

7.5.3. Backfilling

Backfilling operations must also be considered to ensure they are conducted safely and efficiently and achieve the planned standards of compaction.

The following issues must be considered:

- Placement of material while personnel are in the trench

⁴ FSC Audit Criteria H 7.1

- Movement of machines above and around the trench
- Removal of shoring to ensure workers are not exposed to unsupported trench walls
- Vibration effects from compaction equipment
- Exhaust gases from compaction equipment
- Manually lifting compaction equipment in and out of the trench
- Marking services with underground marking tapes and surface markings according to local legislative requirements.

7.6. Emergency and rescue procedures

The Project Manager must ensure a plan is prepared to deal with any emergency situation arising from excavation and trenching works and captured in the [Emergency Response Plan](#)⁵.

As a minimum, the plan must consider:

- The safe and rapid evacuation of workers or others
- Emergency communications
- Appropriate medical treatment of injured people
- Location of rescue equipment, including shoring material
- Location of pumps
- Gas monitoring equipment
- Access for rescue vehicles and workers.

All workers on site must be made aware of the plan and how it relates to their particular work area⁶.

All workers must be made aware they have a responsibility to stop excavation work any time they consider it unsafe to continue.

Refer to the [Emergency Response Management](#) standard.

8. IMPLEMENTING EXCAVATION AND TRENCHING OPERATIONS

Planning, selection and consideration of excavation equipment limitations, duties, responsibilities and risks shall be understood and communicated by all workers involved in the operations, with the specific method (e.g. benching every 1 m) documented in the relevant [Work Method Statement](#) and [Job Hazard Analysis Card](#)⁷. Safe systems of work should include the following:

- Planning of the operation
- Selection, provision, and use of suitable equipment
- Maintenance, examination and testing of equipment
- Provision of suitably trained and competent workers involved in the operations and defined responsibilities
- Emergency and evacuation procedures in place and all workers trained in the system⁸
- Consideration for safety of workers and others not involved in the operation.
- Workers and contractors must be competent to carry out excavation and trenching operations on site in accordance with statutory requirements and a competency review shall ensure the capabilities of contractors as recorded in the Project Training and Competency Register
- Training on the correct selection and installation of Shoring and Ground support.

⁵ FSC Audit Criteria H 7.9

⁶ FSC Audit Criteria H 7.10

⁷ FSC Audit Criteria H 7.4

⁸ FSC Audit Criteria H 7.9 & H 7.10

Victorian OHS Regulations requires written notification to WorkSafe, three (3) days prior to commencing any construction excavation of sufficient dimensions or depth to allow a person entry, or if this poses a risk to any person. This is defined as the following type of excavations:

- a shaft (two metres or deeper)
- a trench (1.5 metres or deeper)
- a tunnel that a person can enter.

8.1. Minimum requirements for excavations/trenches

The requirements for inspections, exclusions/barricading and permits are outlined in the [Trenching and Excavation Requirements](#).

8.2. Shoring and ground support requirements

8.2.1. Regular inspections

Trenches and excavations greater than 1.5m or for excavation less than 1.5m deep when stabilisation methods are necessary must be inspected at the beginning of each shift or after a change in conditions (e.g. rain event) to ensure the effectiveness of controls are in accordance with the drawing/plan/permit and recorded on the [Trenching and Excavation Inspection Checklist](#). Where necessary, repair the excavation or strengthen the shoring system from above before allowing work below ground to continue.

Additional inspections must be conducted:

- after any fall of the sides or working face
- after blasting
- after any substantial rain event which may have led to water ingress
- after any changes in ground conditions are encountered
- after any hazardous substances or materials are encountered.

8.2.2. Depth less than 1.5m

Depending on local legislation, excavations less than 1.5m deep does not need to be shored, benched, or battered. Stabilisation methods such as battering, benching or shoring are required if there is an engulfment risk to workers.

The level of risk to workers and the public must still be assessed by considering:

- Exposure to the public
- Protection and barricading required
- Expected duration of exposure
- Proximity of heavy equipment to workers in or around the trench
- Distance of the water table from the trench bottom
- Effect of de-watering on the stability of the trench.

Where a geotechnical engineer assessment is required to confirm stabilisation, this must be attached to the [Trenching and Excavation Permit](#).

8.2.3. Depth of 1.5m or more

Excavations of 1.5 m or more must be shored, benched, or battered on all sides of the trench or a geotechnical engineer assessment must be undertaken and a written statement detailing:

- Type of ground encountered

- Calculations used in deciding the method of protection required
- Any particular issues that need to be addressed.

This statement must be attached to the [Trenching and Excavation Permit](#).

8.2.4. Narrow trenches, ditches and small holes

Shoring, benching, and battering is not required if it is impossible for a worker to fully enter the trench, ditch, or round penetration, irrespective of the depth of the excavation.

These narrow excavations still constitute a hazard for other reasons, and must still be controlled (e.g. by covering, barricading).

8.2.5. Open surface penetrations

Surface or ground penetrations such as bored holes or excavations for installation of Storm Water Pits, Manholes, Electrical Pits, must have an encapsulating physical barricade with penetration covered and sign posted. All penetration covers must be adequately secured in place to prevent accidental relocation/movement allowing for the potential for people to fall into the penetration.

Covers over bored holes must be (as a minimum) steel mesh which extends 500mm past all edges of the hole and be securely pinned in each corner to prevent accidental movement. All other covers must (as minimum) be of structural material such as marine ply, signed with adequate information and secured in place.



8.2.6. Backfilling

Where space and conditions permit, benching and battering can be used as substitutes for shoring.

A geo-technical engineer must give written certification⁹ if:

- The overall slope of a benched or battered wall exceeds 45° to the horizontal
- A bench cut into the side of a trench is higher than its width.

8.2.7. Geotechnical engineering report

Where the risk cannot be controlled by stabilisation methods (battering, benching, shoring, etc.) written advice from a geotechnical engineer that all sides of the trench are safe from collapse must be obtained for all vertical

⁹ FSC Audit Criteria H 7.8

faces of a trench/excavation higher than 1.5m. The advice may be subject to a condition that stated natural occurrences may create risk of collapse and must state the period of time to which the advice applies.

8.3. Shoring¹⁰

Shoring is a positive ground support system that can be used when the location or depth of an excavation makes battering and/or benching impracticable, also for supporting existing services, structures and/or pavement within the zone of influence. It should always be designed for the specific workplace conditions by a qualified engineer (and detailed plans or drawings will be available for the installation and verification). All changes made to design plans/drawings, use and/or installation must be authorised and signed off by qualified engineer.

Shoring is to be installed under the supervision of a person who holds a minimum Certificate 3 in Civil Construction and all workers must have read, understood and acknowledged the shoring installation guide attached to the [Trenching and Excavation Permit](#) (acknowledgement by signing the permit).

Shoring is the provision of support for excavated face(s) to prevent the movement of soil and therefore ground collapse. It is a common method of ground support in trench excavation where unstable ground conditions, such as soft ground or ground liable to be wet during excavation such as sand, silt or soft moist clay are often encountered.

Where ground is not self-supporting and benching or battering are not practical or effective control measures, shoring should be used. Shoring should also be used when there is a risk of a person being buried, struck, or trapped by dislodged or falling material which forms the side of, or is adjacent to, the excavation work.

Where such a risk also exists for those installing shoring, other appropriate control measures must be in place to ensure the health and safety of persons entering the excavation.

Shoring the face of an excavation should progress as the excavation work progresses. Where earthmoving machinery is used risk assessment should be used to determine whether any part of the trench may be left unsupported.

The system of work included in the WMS should ensure workers do not enter any part of the excavation that is not protected. They should not work ahead of the shoring protection if it is being progressively installed.

The basic types of shoring are hydraulically operated metal shoring and timber shoring. The most common shoring used consists of hydraulic jacks and steel struts, walls, and sheeting. Sometimes aluminium or timber components are used.

8.4. Shields and boxes

A shield is a structure, usually manufactured from steel, which is able to withstand the forces imposed by a ground collapse and protect workers within it. Shields can be permanently installed or portable and designed to move along as work progresses.

Many different shield system configurations are available for hire or purchase. Figure 1 shows a typical trench shield.

¹⁰ FSC Audit Criteria H 7.5

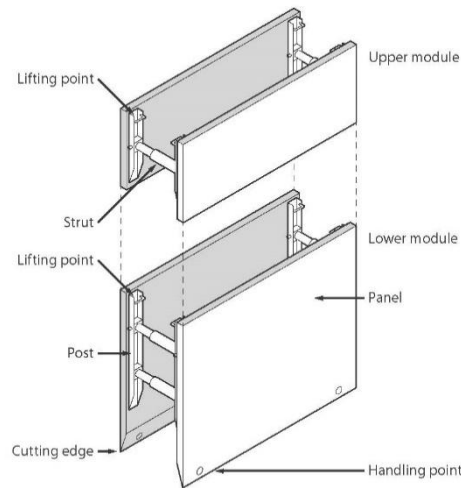


Figure 1: Typical trench shield

Shields and boxes used in trenches are often referred to as trench shields or trench boxes and are designed and constructed to withstand the earth pressures of particular trench depths and ground types. They incorporate specific lifting points for installation and removal.

Shoring boxes must be used in accordance with manufacturer's/suppliers' instructions for the installation, use, removal, and maintenance. Trench boxes should be installed to the bottom of the trench. However, dependant on the risks identified in a site-specific risk assessment, trench boxes may be able to be installed at a maximum of 300mm above the trench floor so as to minimise the possibility of voids developing around the bedding and haunch zones of pipelines when the trench boxes are removed during the backfill process. For any heights above 300mm from the bottom of the excavation, the trench box must be securely located on a stable bench assess by a geotechnical expert of being able to withstand the downward pressure.

Trench shields and boxes differ from shoring as shoring is designed to prevent collapse whereas shielding and boxes are only designed to protect workers if a collapse occurs.

Trench shields and boxes are useful where other forms of support are not reasonably practicable to install. They are mainly used in open areas where access is available for an excavator or backhoe to lower and raise the boxes or shields into and out of a trench using an authorised dogman. They are generally not suitable as access is difficult and ground conditions prevent the use of lifting equipment.

Steel boxes for trench work can be light or heavy-duty construction depending on the depth of the trench and ground conditions. Trench shields and boxes should be designed by a qualified engineer and be pre-manufactured to job specific dimensions.

Used correctly, shields and boxes can provide a safe workspace for workers needing to enter an excavation. Trench shields and boxes should be adequately maintained, or they may fail unexpectedly, particularly if they have been abused or misused. The manufacturer's instructions for the installation, use, removal and maintenance of shields and boxes should always be followed, also no personnel are to be inside the box or shield whilst being moved.

Trench boxes should not be subjected to loads exceeding those which the system was designed to withstand, remembering that aluminium is not designed to be pulled or lifted sideways (e.g. dragging). Earth pressures are reduced when correct benching and battering practices are used.

Shields and boxes should be stored and transported in accordance with the manufacturer's instructions. Heavy duty equipment may require disassembly for transport.

Boxes should be regularly inspected for damage by a person in a Supervisory position who holds a minimum Certificate 3 in Civil Construction. They should only be altered or modified with the approval of a qualified engineer).

Shoring and trench shields/boxes must extend at least 300mm above the edge of the excavation or a fender board of the same height must be provided. Edge protection must be installed to control the risk of a worker or other person falling into the excavation. This can be achieved by either using the support system itself, for example using trench box extensions or trench sheets longer than the trench depth or installing handrails to the trench box or trench sheets. (See Figure 2). Inserting guard rails and toe boards into the ground immediately next to the supported excavation side may also be considered.

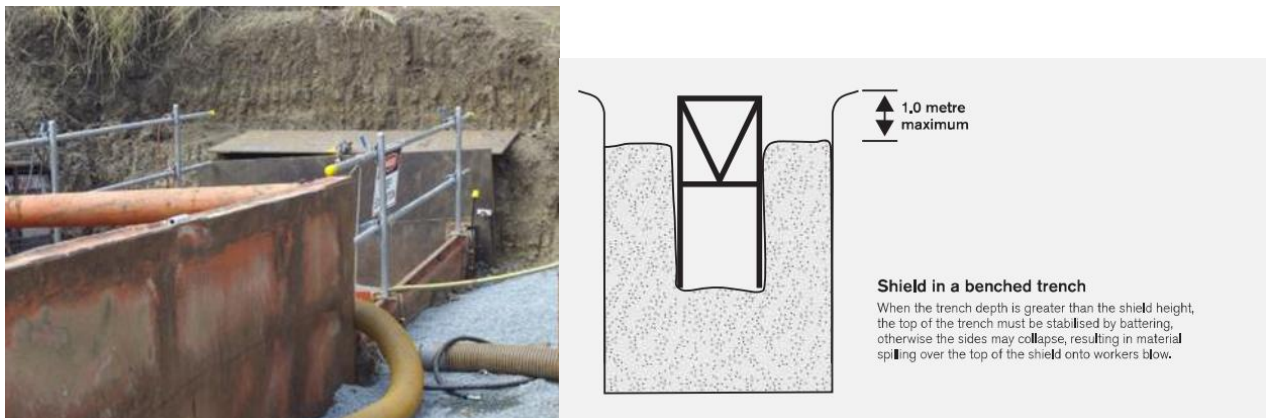


Figure 2: Trench shield

8.5. Benching and battering

Benching and battering of excavation walls can minimise the risk of soil or rock slipping onto the excavation. Control measures should be determined by a person in a Supervisory position who holds a minimum Certificate 3 in Civil Construction and be relative to the soil type, the moisture content of the soil, the planned height of the excavated face and any surcharge loads acting on the excavated face.

It is not necessary to bench or batter the face of excavations for which a geotechnical engineer determines are in stable rock or has assessed that there is no risk of collapse. When benching or battering the walls of an excavation, an angle of repose of 45 degrees should not be exceeded unless designed by geotechnical engineer and certified in writing; also, the height of each batter should not exceed 1.5 metres.

If excavation work is planned to be carried out without positive ground support (that is, 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 (e.g. different soils, heavy rain/flooding) action should be taken immediately to protect workers, other persons, and property. Implement appropriate control measures such as temporarily suspending work until the ground is stable or, if necessary, providing positive ground support.

Benching is the creation of a series of steps in the vertical wall of an excavation to reduce the wall height and ensure stability (see Figure 3). Benching is a method of preventing collapse by excavating the sides of an excavation to form one or more horizontal levels or steps with vertical surfaces between levels.

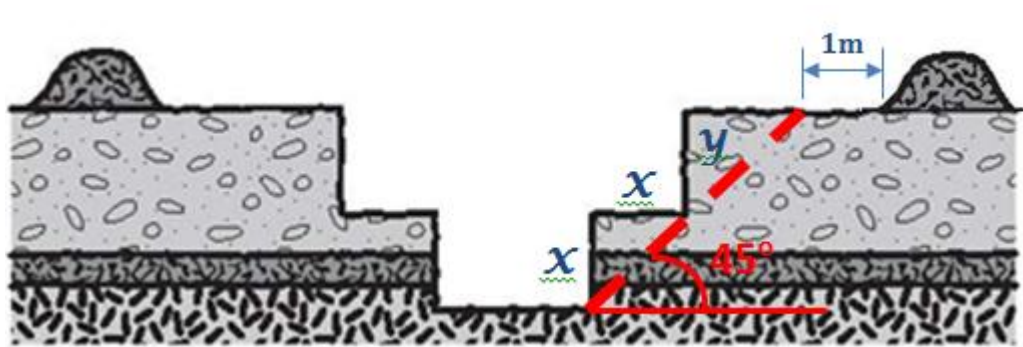


Figure 3: Benching

Benching should extend to the angle of repose (45°) from the base of the trench/excavation e.g., if you maintain a 1.5m vertical face (x), then the first batter should extend 1.5m and the top batter (y) cannot be greater than x. Excavated material or stockpiles need to remain 1m back from the angle of repose.

Battering is where the wall of an excavation is sloped back to a predetermined angle to ensure stability (see Figure 4). Battering prevents ground collapse by cutting the excavated face back to a safe slope. Battering should commence from the bottom of the excavation at 45° (unless approved by a geotechnical engineer) and in some circumstances it may be appropriate to use a combination of the two methods on an excavation (see Figure 5).

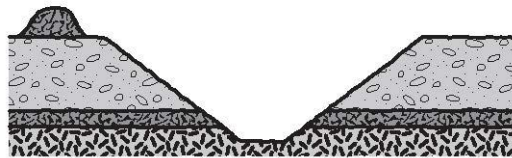


Figure 4: Battering

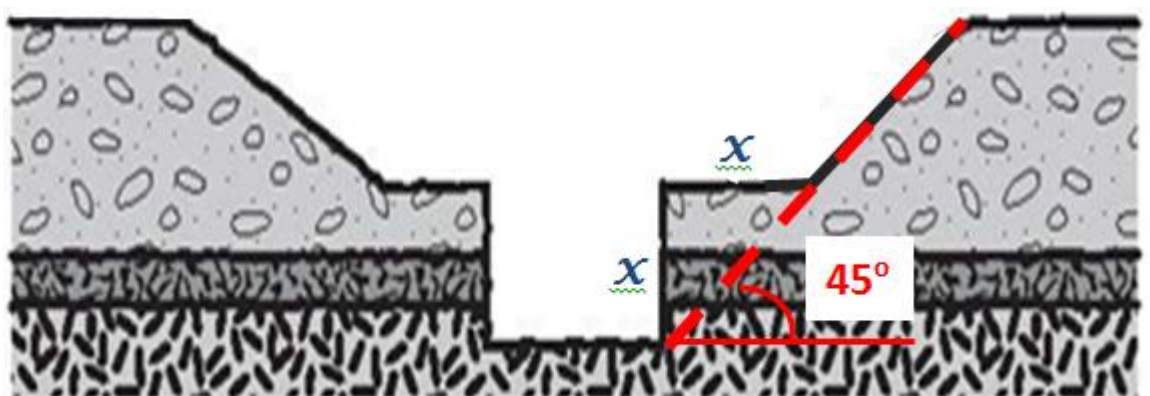


Figure 5: Combination of benching and battering controls

The combination of benching and battering should extend to the angle of repose (45°) from the base of the trench/excavation e.g. if you maintain a 1.5m vertical face (x), then the first batter should extend 1.5m and the batter should then maintain the same angle of repose at 1:1 or 45° .

Benches should be wide enough to stabilise the slopes and to prevent material from the top falling down to the working area. They should also be sloped to reduce the possibility of water scouring.

The size and type of any earthmoving machinery to be used and any related haul routes should be considered when designing the face slopes and widths of benches.

8.6. Excavated material and loads near excavation

Mechanical plant, vehicles, storage of materials (including excavated material) or any other heavy loads should not be operated or located in the 'zone of influence' of an excavation unless the ground support system installed has been designed by a geo technical engineer, to carry such loads.

The zone of influence is determined by a person in a Supervisory position who holds a minimum Certificate 3 in Civil Construction and will depend on the ground conditions. It is the zone in which there may be an influence on the excavation, including possible ground collapse. The zone of influence and chosen controls is to be further defined in the [Trenching and Excavation Permit](#).

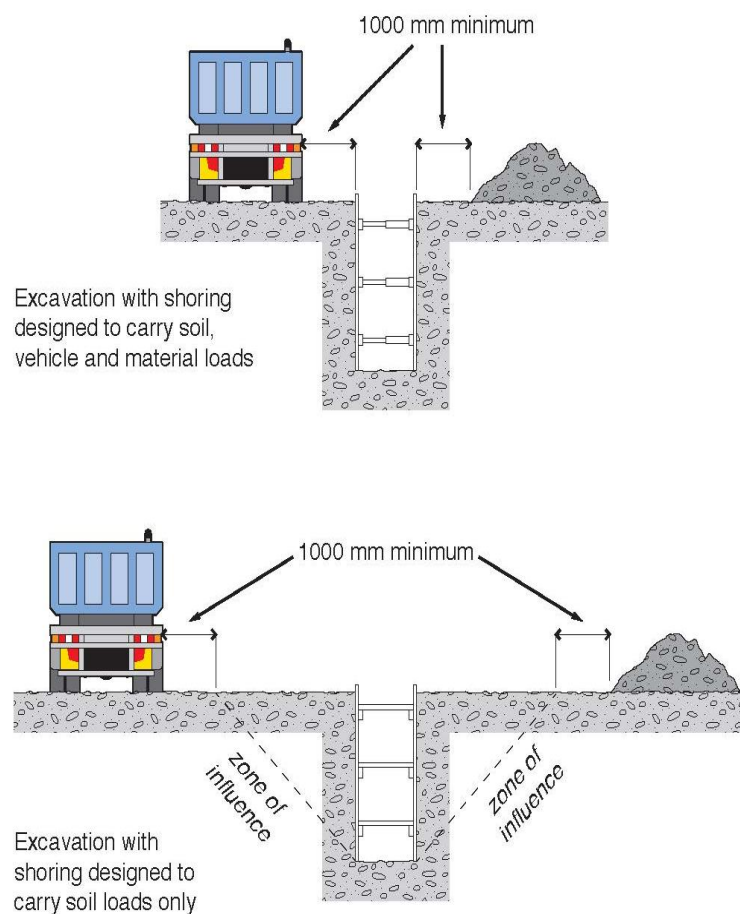


Figure 6

To reduce the risk of ground collapse, excavated or loose material should be effectively stored or retained away from the excavation. Excavated material should be placed outside the zone of influence. Alternatively, a ground support system should be designed and installed to carry the additional loads, including any ground water pressures, saturated soil conditions and saturated materials.

If excavating in sloping ground decide which side of the excavation to place the excavated material. Things to consider include:

- ground conditions
- access to the excavation
- existing underground services
- the need for earthmoving machinery or vehicles to work or move along beside the excavation
- service installation and backfilling requirements, and
- any manual work being undertaken in the excavation.

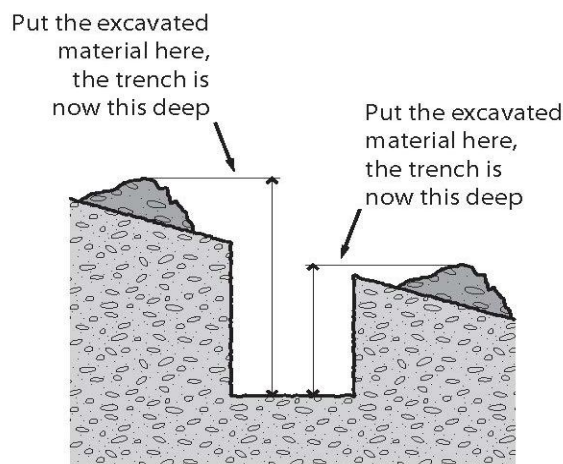


Figure 7

8.7. Separation method

Any part of a trench or excavation where a person could fall from one level to another level must be delineated as soon as possible after excavation and as identified in the JHA and recorded in the WMS¹¹.

Delineation must be located at least 1 metre from the zone of influence. Materials must not be stacked in the space between the barrier and the trench edge.

When outlined in the work method statement entrances to the excavation will be clearly marked with signs to highlight the excavation hazard and any particular hazards encountered within the excavation (such as a confined space).

Vehicles passing close to a trench (e.g. at site boundaries) can cause damage through heavy loads and vibration. Traffic barriers must be used to keep vehicle traffic from approaching the trench edge¹².

¹¹ FSC Audit Criteria H 7.4

¹² FSC Audit Criteria H 7.7

8.7.1. Ladders

Ladders must extend at least 1 metre above the top of the excavation. A ladder used for the work must have a load rating of at least 120kg; and is manufactured for industrial use; and is used only for the purpose it was designed and is not to support a weight greater than that for which it was designed. The ladder should be secured at or near the top to prevent it moving or secured at the bottom to prevent it from moving. The person using the ladder must maintain 3 points of contact at all times; or be using a fall arrest harness system which is not attached to the ladder.

8.7.2. Gangways and walkways

Where gangways or walkways are needed for access across a trench or excavation where a person could fall more than 1.8 metres, they must meet the following conditions:

- Guard rails must be no less than 900mm or more than 1100mm above the walkway
- A rail must be fitted between the handrail and the toe board with a gap of no more than 450mm between it and the top of the toe board or the top rail (unless there is a sheet of sturdy mesh, sheeting or other material between the top rail and the toe board)
- Toe boards must be fitted and extend at least 100mm above the surface of the walkway. The gap between the toe board and the walkway must not be more than 10mm
- Walkways with guard rails on both sides must be at least 500mm wide
- Walkways without guardrails on both sides must be at least 600mm wide.

8.7.3. Public access

Particular care must be taken wherever the general public may have access to a trench.

In remote locations, or where the general public may not have access, the Project Manager must ensure the excavation is marked and protected as required by local legislation.

8.8. Gully pit/manhole

Prior to starting gully works an assessment of the works and the location of the work area is to be undertaken.

The site management team must select the required controls using the steps below from top to bottom:

- Elimination – can the works be done in isolation to other activities e.g., are pavement works needing to be done next to the gully work area.
- Rerouting – if possible, can vehicles use a different route away from gully works.
- Separation – if the above controls cannot be met then clear separation between workers and vehicles must be in place. Refer below for specific requirements.

Where the above cannot be met the following must be put in place:

- Establish physical barrier or
- Physically delineate / establish 1 metre exclusion zones from workers
- Appropriate signage.

See photos of examples below:



8.9. Confined spaces

All confined spaces associated with excavation and trenching operations are identified at commencement of the project. Steps are taken to control and continually monitor the implemented measures for conformance to the required WMS and ensure the safety of all confined space workers¹³.

For more detail refer to the [Confined Spaces Management](#) COP.

8.9.1. Ventilation, harmful gases and fumes

If mechanical ventilation equipment is needed to establish and maintain a safe environment:

- The equipment must be regularly monitored
- The controls, including any remote power supply, must be identified, and tagged to prevent any unauthorised or accidental interference.

Hazards can be caused by:

- Exhaust gases from external equipment entering the excavation
- Exhaust gases from equipment inside the excavation not being carried away by natural ventilation.

8.10. Airborne and soil contamination

Heavy metals, hydrocarbons, insecticides, asbestos, silica dust, combustible material, and biologically harmful material from buried wastes can all contaminate soil.

If any contaminant is known to be present or is encountered during the excavation process, a system to eliminate or control the hazard must be investigated and put in place.

¹³ FSC Audit Criteria H 7.6

8.11. Water management

Provision must be made for managing water entering the excavation and draining water from the works and carried out in a way that does not cause flooding or water penetration to any adjacent building¹⁴.

Sources of water include:

- Seepage
- Flooding from other existing watercourses
- Flooding from storm events
- Flooding from burst water mains and sewers in the excavation.

Note: Be aware of tidal or stream effects in coastal or fluvial environments.

8.12. Surcharged loads and material storage

The Project Manager must make sure no materials are placed, stacked, or moved near the edge of excavation work that could:

- Cause the excavation to collapse
- Fall on personnel working in the excavation.

The selection and design of shoring must consider likely surcharged loads, including construction machinery and other traffic.

8.13. Identifying above ground and underground services

When excavating all above ground and underground services that could be contacted during the course of the operation (including site access) any risks must be identified, made safe and monitored¹⁵.

8.13.1. Excavation underneath electrical conductors

Specific WMS must be developed for excavating around or underneath overhead power lines, structures, or services. These procedures require the use of a spotter.

Refer to [Working Near Services Management](#) COP.

8.13.2. Excavation near underground live services

Any works conducted within 10 metres of a live service that pose a risk of contact with or damage to the service requires a [Working Near Services Permit](#). The Project Manager must ensure an approved excavation procedure is prepared to meet this requirement and includes the following details:

- Precisely locating existing live services by potholing or exposing the service by hand
- Marking the position of live services
- Relocating these services
- Excavation methods; the use of non-destructive excavation methodology (vacuum excavation) should be considered when excavating around services
- Permits
- Use of spotters/controllers
- Removal of material below the live service (if required).

¹⁴ FSC Audit Criteria 7.9

¹⁵ FSC Audit Criteria H 7.3

9. DEFINITIONS

Workers	Workers, contractors, subcontractors, labour hire workers.
Hazard	Any situation with the potential to cause injury / illness to people or damage to equipment, property, the environment, or community.
Inspection	The process of visually surveying the workplace with the intent of identifying, controlling and correcting hazards that may be present or have the potential to impact on the workplace.
Inspection Checklist	Pre-determined written criteria to assist the inspection team identify common hazards likely to be present in the workplace. Used by the team to record the findings of the inspection.
Qualified Engineer	Professional Engineer who holds a four-year professional engineering degree. With the exception of person selecting Shoring who must a Specialist Supplier or Geotechnical Engineer).
Lifting Team	A team of workers who are trained, competent and knowledgeable in the task and use of lifting equipment and operations relevant to the lifting task at hand and assigned with defined responsibilities.
Live Service	Existing utilities or systems that remain active and operational while construction work is taking place
Permit Issuer	A person in a Supervisory position who holds a minimum Certificate 3 in Civil or qualified engineer.
WMS	Work Method Statement – incorporating the elements identified in the JHA and providing a Work Method Statement for conducting the identified task at hand.
PPE	Personal Protective Equipment.
Angle of Repose	The slope at which dumped or excavated material is naturally stable and does not fall away.
Batter or Slope	The angle of an excavation in relation to the horizontal.
Benching	The horizontal stepping of the face, side, or wall of an excavation.
Excavation	A trench, tunnel, or shaft, but does not include- A mine; or A water bore to which the Water Act 2000 applies; or A trench for use as a place of interment.
Open Excavation	An excavation where the width is equal to or greater than the depth.
FOPS	Falling Object Protection System. A protective structure over an operating cabin of a vehicle designed to prevent objects falling from above entering the operator's station. Often integrated with a ROPS cabin but may be installed as a stand-alone system.
Geo-technical Engineer	An engineer whose qualifications are acceptable for membership in the Institution of Engineers, Australia and who has qualifications and experience in soil stability, soil mechanics and excavations.
ROPS	Roll Over Protection System. A protective structure over an operating cabin of a vehicle designed to maintain a safety zone around the operator's station in the event of a vehicle roll over.

Shoring	The use of timber, steel, or other structural material to support an excavation in order to prevent collapse so that construction can proceed.
Trench	An excavation open along its length with a depth greater than it's width.
Zone of Influence	The volume of soil around the excavation affected by any external load (e.g. vehicles, plant, excavated material) The zone of influence extends some 30 degrees from the horizontal for sands and 45 degrees for other material.

10. REFERENCES

-  [National Standard for Construction Work \[NOHSC: 1016 \(2005\)\]](#)
-  [AS/NZS ISO 45001:2018 Occupational Health and Safety Management Systems](#)
-  [Before You Dig](#)
-  [AS 5047-2005 Hydraulic shoring and trench lining equipment](#)
-  [AS/NZS IEC 60825.1:2011 Safety of laser products - Equipment classification and requirements](#)
-  [AS/NZS IEC 60825.14:2011 Safety of laser products - A user's guide](#)
-  [AS 3798-2007 Guidelines on earthworks for commercial and residential developments](#)
-  [AS 4744.1-2000 Steel shoring and trench lining - Design](#)
-  [AS/NZS 2648.1:1995 Underground marking tape - Non-detectable tape](#)
-  [AS 1657-1992 Fixed platforms, walkways, stairways, and ladders - Design, construction, and installation](#)
-  [AS/NZS 1800:1998 Occupational protective helmets - Selection, care, and use](#)
-  [Work Health & Safety Act 2011](#)
-  [Work Health & Safety Regulation 2011](#)
-  [Workplace Health and Safety Queensland](#)
-  [Environmental Protection Act](#)
-  [Environmental Protection Regulation \(2008\)](#)
-  [SafeWork NSW](#)
-  [WorkSafe Victoria](#)
-  [SafeWork SA](#)
-  [NT WorkSafe](#)
-  [Safe Work Australia](#)
-  [Safe Work Australia Code of Practice - Excavation Work](#)
-  [Working safely with trees](#)
-  [Underground assets, Guide for undertaking work near](#)

Associated Documents

-  [Confined Spaces Management COP](#)
-  [Emergency Response Management Standard](#)
-  [Isolation and Tagging Management COP](#)
-  [Risk Management Standard](#)
-  [Site Specific Risk Register](#)
-  [Traffic Management COP](#)
-  [Trenching and Excavation Inspection Checklist](#)
-  [Trenching and Excavation Minimum Standards](#)
-  [Trenching and Excavation Permit](#)
-  [Working Near or Over Water Management COP](#)

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