



Excavations and Penetrations



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1. INTRODUCTION

The purpose of this guide manual is to describe the processes for managing the risks associated with excavation work. This document describes general requirements, excavation risk reduction, excavation stability, barriers and signage.

This document applies to both CSBP and non-CSBP personnel.

2. DEFINITIONS

Excavation Work

Excavation Work is defined as any work involving the removal of soil or rock from a site to form an open face, hole or cavity using tools or machinery.

An excavation/penetration certificate shall be issued with a permit when the excavation is greater than 150mm.

Penetration Work

Penetration Work is defined as any work which penetrates into a blind space (cannot be visually inspected prior to the penetration) or involves mechanically penetrating materials defined in the below list:

- Cement flooring/slabs
- Plinths
- Bund walls
- Bund floors
- Roadways
- Concrete/Bitumen walkways

Shoring

Shoring includes the use of timber, steel or other structural material to support an excavation in order to prevent collapse.

Battering

The process of forming the face or side or wall of an excavation to an angle, usually less than the natural angle of repose, to prevent earth slippage.

Benching

A horizontal stepping of the face, side or wall of an excavation.

Competent Person

A person who has acquired through training, qualification or experience, or a combination of these, the knowledge and skill required to perform the specific tasks.

3. RESPONSIBILITIES

3.1 MANAGER

Managers (however named) are responsible for:

1. Providing a safe system of work where persons are not exposed to hazards associated with excavations.
2. Ensuring that information, instruction, training and supervision of all personnel is provided to enable them to safely perform their work.
3. Ensuring risk assessments are conducted by competent personnel before the commencement of work and appropriate control measures are selected.

3.2 ACCOUNTABLE PERSON (FOR CONTRACTORS)

Accountable Person is responsible for:

1. Establishing where practicable, systems of work which eliminate the requirement to perform work in excavations.
2. Ensuring all personnel know and follow established procedures for excavations.
3. Establishing the exact location of other underground services prior to any excavation works.
4. Ensuring JSA's are developed and approved prior to the commencement of work and checking that required controls are in place when work is being undertaken.
5. Reviewing and signing completed JSA's.
6. Ensuring risk assessments are re-validated at any time the scope of work changes or the risk increases.
7. Ensuring only trained, competent personnel perform excavation work.
8. Ensuring that a competent person maintains supervision of personnel performing excavation work.
9. Ensuring that management of excess excavated material has been considered, including temporary storage, in accordance with the Solid Waste Management procedure ([CSBP-GM-ENV-060-02](#)).

3.3 PLANNER / SCHEDULER

Planners or Schedulers are responsible for:

1. Ensuring that the requirements of this procedure are included during the planning of the task (including maintenance shutdowns) by considering the hierarchy of control for the work being planned and making provision for appropriate controls to be available.

3.4 EMERGENCY MANAGEMENT SUPERVISOR

The ER Superintendent or his designee is responsible for:

1. Ensuring emergency services personnel are trained in rescue techniques.
2. Ensuring appropriate rescue equipment is available for performing a rescue.

3.5 EMPLOYEES

All employees are responsible for ensuring they:

1. Participate in the development of the Job Safety Analysis (JSA) and comply fully with its requirements.
2. Do not commence work unless all control measures identified on the JSA are in place.
3. Review and re-sign the JSA if the scope of work or conditions change or the task ceases for any reason for an extended period of time and recommences.
4. Following the conditions specified in the Work Permit, JSA and Confined Space Risk Assessment.

4. EXCAVATION PROCEDURE

4.1 GENERAL REQUIREMENTS

- a. All excavations to a depth greater than 150 mm require an Excavation/Penetration Certificate ([CSBP-PF2470](#)). This Certificate requires the Field Engineering Designate to clearly state the conditions under which the excavation is to take place. As a minimum the below should be addressed as part of the process.
 1. Existing services shall be fully exposed and identified, using hand excavation or vacuum truck only, along the proposed route of any new services. The hand excavation shall completely expose any existing services for the full width of the proposed excavation.
 2. An excavation will be considered a confined space if it meets the definition of a confined space within the document Confined Spaces ([CSBP-GM-11-031-52](#)), regardless of the depth of the excavation.
 3. Machine excavation is not permitted within 1 vertical metre either side of existing or identified services.
 4. Consideration must be given to any gas testing requirements; refer to Gas Testing ([CSBP-GM-11-031-33](#)).
 5. Excavations that may result in contact or interference with contaminated soil or groundwater require prior input from an Occupational Hygienist and a member of the Environment Department in accordance with the relevant site's approved Site Management Plan (SMP), such as the Arsenic Site Management Plan for CSBP Kwinana ([CSBP-GM-ENV-023-02](#)). An approved SMP is required by the Department of Water and Environmental Regulation (DWER) when it considers that specifying restrictions in the site classification does not

provide adequate control on the long term use of the site. The SMP defines how the site is to be managed or monitored to ensure the risks from contamination remain at an acceptable level.

6. Any excess material generated from excavations must be suitably contained and sampled by the Environment Department for analysis in a laboratory to determine suitable reuse or disposal methods.

Note: Laboratory analysis may take up to 10 days depending on the nature and location of the analysis. Analysis and potential offsite disposal costs should be considered prior to the commencement of work.

7. A Risk Assessment (Job Safety Analysis) will be carried out before applying for a permit or certificate. For larger excavations a Team Based Risk Assessment (TBRA) may be more appropriate.

b. The Permit Holder taking responsibility for the task must ensure that:

1. A Work Permit is obtained from the appropriate area. Refer to Work Permit System ([CSBP-GM-11-031-51](#)). A Job Safety Analysis ([CSBP-GM-11-031-23](#)) is completed and all Team members have been briefed on the controls to be put in place.
2. All work is planned according to engineering requirements/specifications.
3. Hard barriers are erected to isolate the hazard along with suitable signage warning of the hazard.
4. There are adequate warning lights around the excavation during hours of darkness.
5. All personnel have safe access to plant and equipment at all times.
6. The Occupational Hygienist and Environmental Department are notified if the excavation has the potential to intercept groundwater in known contaminated areas. Additional PPE must be worn and water samples may need to be taken and sent to the laboratory for analysis in accordance with the Arsenic Site Management Plan - CSBP Kwinana ([CSBP-GM-ENV-023-02](#)).
7. The Environment Department is notified if the excavation will generate excess material as sampling and analysis may be required to determine a management path.

4.2 COMENCING AN EXCAVATION

Precautions must be taken during an excavation to ensure that all hazards associated with the initial digging process are controlled.

1. The use of a vacuum truck or hand digging must be assessed to ensure that the excavation does not become unstable as the depth increases (see 4.3.1 excavation shoring).
2. When using a vacuum truck for an excavation extra precautions must be taken due to the fall potential hazard. As the depth of the excavation increases, the stability of the edges decreases. The operator of the vacuum hose must be restrained so that there is no potential to fall into the excavation. This risk can be controlled with the use of harnesses and lanyards as detailed in the Working at Height Guide Manual (refer to [CSBP-GM-11-031-02](#)).

4.3 EXCAVATION RISK REDUCTION

All excavation work must be risk assessed and any identified hazards must be reduced by any of the following:

1. Temporary support system
2. Battering
3. Benching
4. Other forms of retaining structures

4.4 EXCAVATION STABILITY

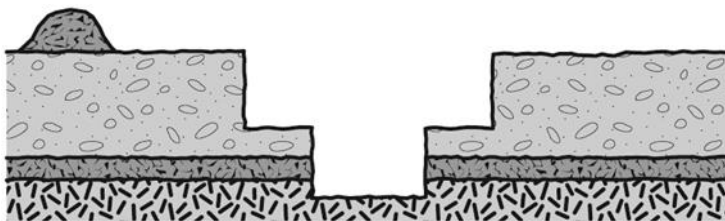
4.4.1 BATTERING

Battering is where the wall of an excavation is sloped back to a predetermined angle to ensure stability (see Figure 10). Battering prevents ground collapse by cutting the excavated face back to a safe slope.



4.4.2 BENCHING

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.



4.4.3 EXCAVATION SHORING

Any excavations that:

1. presents a risk of earthwork falling/dislodging or
2. requires a person to work in an excavated area that is at least 1.5 metres deep

Must be shored in a manner which will prevent it from collapsing or moving.

4.4.4 UNDERCUT EXCAVATION SIDES

Excavation supports or wider excavation may be necessary to make the excavation safe for workers if the side of the excavation has been undercut.

4.4.5 NAILS OR SPIKES STICKING OUT OF TIMBERS

Unnecessary or unused nails or spikes must be removed from all excavation timbers as they present a hazard to personnel working within excavations.

4.4.6 LOADS SUPPORTED BY WALINGS

Walings are provided in an excavation support system to hold back the side or horizontal pressure exerted by the material in the excavation walls.

When waling's are also used to support a platform which will carry personnel or material, extra structural timber are essential to prevent the waling's slipping down the sheeting. This prevents the toms from dislodging which could lead to a collapse of the support system.

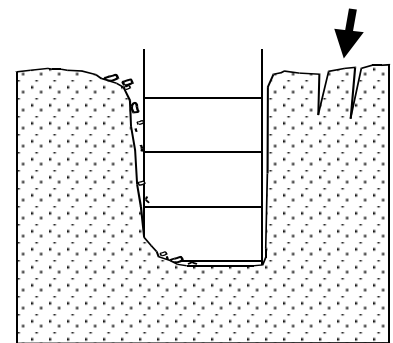
4.4.7 OTHER EXCAVATION HAZARDS

The following are examples of hazardous situations or activities that are associated with excavations.

In the event that any of the following hazards are identified, work must stop and corrective actions must be taken immediately to eliminate the hazard.

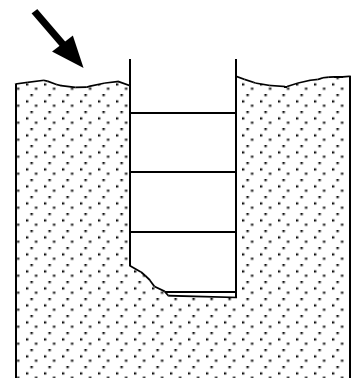
1. CRACKS NEAR AND PARALLEL TO THE EDGE OF THE EXCAVATION

Cracks indicate that the ground support system has shifted. The support may be inadequate or incorrectly placed. Collapse may occur suddenly.



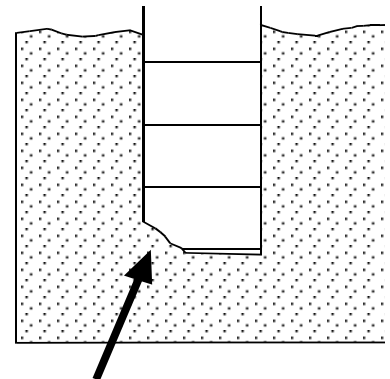
2. SUBSIDENCE ALONGSIDE THE EXCAVATION

This means there has been soil movement below the surface that increases the pressure against the supports. Soil movement may be caused by seepage behind the support.



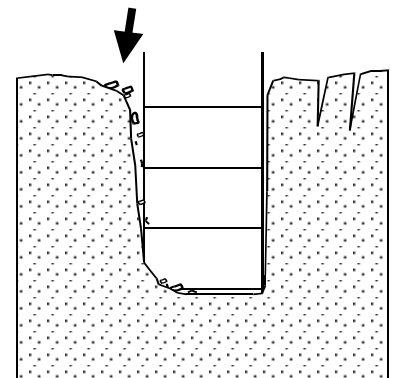
3. WATER SWELLING OR UPLIFT OF THE EXCAVATION BOTTOM

This indicates soil movement at the toe of the support system. The danger is that if support timbers are undermined they may kick-in and cause a sudden collapse.
This indicates a wet, unstable soil where an adequate trench support system is vital for safety.



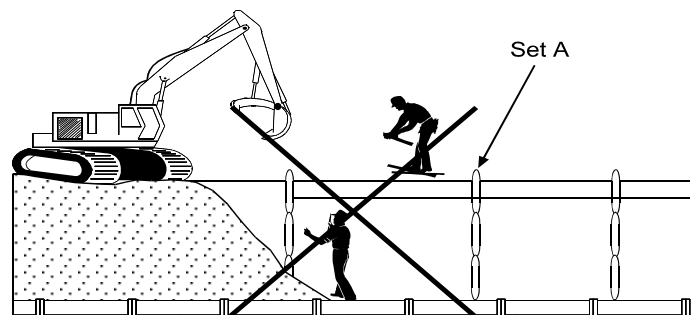
4. SURFACE SOIL FALLING INTO THE EXCAVATION

This indicates an unstable soil. Workers in the trench are in danger from falling material which may cause eye or body injury.
Support timbers should project a minimum of 200 mm minimum above ground level.



5. WORKER IN EXCAVATION OUTSIDE THE SUPPORT SYSTEM

Work should be performed from within the safety of the trench support system both when installing and removing timbers.



The workers in the trench in a dangerous situation. Workers should not be in front of set A while an excavator is backfilli

4.5 STABILITY OF ADJACENT BUILDINGS/STRUCTURES

If an excavation is likely to adversely affect the stability of any building, structure or road it must not commence until the aforementioned are protected by means of shoring or other appropriate means.

Every effort must be made to ensure these buildings and footings are not disturbed in any way, for example whilst digging, undercutting supporting soil or any other factor that could affect the existing structure.

4.6 EXCAVATIONS IN OR NEAR PREVIOUSLY DUG GROUND

When an excavation is to be completed parallel to a previously dug service the soil maybe waterlogged leading to less wall stability and potential collapse. This situation requires special attention as it may not be obvious.

4.7 WATER ENTERING AN EXCAVATION

Water will cause loss of strength in clay, silt and gravelly soils which may cause an excavation to collapse without warning.

All surface drainage must be directed away from the excavation during construction. Consideration must be given to seepage from underground water (especially in known contaminated areas onsite), pipes and other sources of water. Additional PPE must be worn as a precaution and work must cease if groundwater is seeping up from a known contaminated area onsite. The Occupational Hygienist and Environmental Department must be notified so water samples can be taken and sent to the laboratory for analysis in accordance with the Arsenic Site Management Plan - CSBP Kwinana ([CSBP-GM-ENV-023-02](#)).

4.8 PIPES IN OR ADJACENT TO EXCAVATIONS

Where pipes are alongside or crossing an excavation there is a hazard from potential pipe failure. Some gases are heavier than air and will collect as an unseen hazard in the bottom of the excavation.

This situation should be brought to the attention of the Field Engineering.

In this situation temporary support for the pipe is required along with a ladder adjacent to the hazard to allow quick escape.

4.9 EXCAVATION BARRIERS

If any excavation presents a potential fall risk to personnel working in the excavation or in adjacent areas then hard barriers are required to isolate the hazard.

Hard barriers must incorporate a top and mid (kick plate/board may be required, this requirement must be individually assessed for each excavation) rails similar to those required for working at height handrails.

4.10 EXCAVATION SIGNAGE

Excavation signage must be erected around the hazard and warn of the risk present. Below is an example of the type of sign required.



4.11 LOCATION OF PLANT, MATERIAL AND LOADS TO AN EXCAVATION

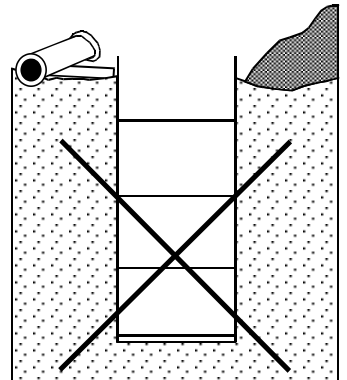
The person in control of the excavation process must ensure that no plant, material or other loads are placed near the excavated area in a position that may cause the sides of the excavation to collapse or the aforementioned to fall into the excavation.

The following are examples of hazardous situations or activities that involve the above.

In the event that any of the following hazards are identified, work must stop and corrective actions must be taken immediately to eliminate the hazard.

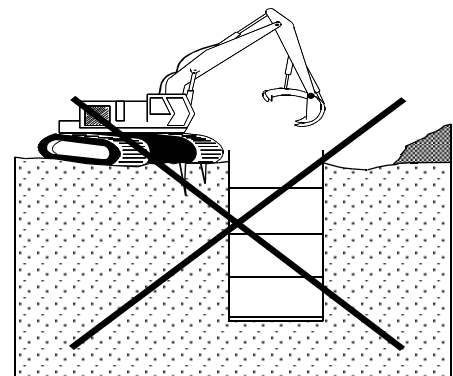
1. EXCAVATED MATERIAL, PIPES, TOOLS OR TIMBER TOO CLOSE TO THE EDGE OF THE EXCAVATION

These are a hazard likely to injure workers in the trench if accidentally knocked or otherwise fall into the trench.
Heaps close to the trench add load to the trench face. The probability of cave-in without warning is increased.
Heaps should not be closer to the edge than one third of the trench depth.



2. MACHINES MOVING TOO CLOSE TO EDGE OF EXCAVATION

The machine may damage the support system. Where close working is unavoidable because of space limitation, the support system must be designed to cope with the extra loading due to the machine.



3. NEARBY MACHINES CAUSING VIBRATIONS

These may be stationary plant machines such as compressor or pile driver. Vibrations also may be due to adjacent railway traffic, road vehicles or mobile compactors further along the excavation or at adjacent road works.

The support system must be adequate to cope with the extra load the vibrations may cause.

4.12 WORKING IN AN EXCAVATION

Entries/exits to and from excavations must be controlled in order to reduce the risk of falling. Fixed ladders shall be used where practicable and all personnel shall maintain three points of contact at all times.

Personnel must not use support timbers to access or egress excavations as falls may occur or the support structure may be weakened.

A second person is required to be present if work is to be performed in excavations that are classed as a confined spaces (regardless of depth) or at least 1.5 meters in depth.

5. PENETRATION PROCEDURE

5.1

5.2 GENERAL REQUIREMENTS

- a. All penetrations as defined by section 2 require an Excavation/Penetration Certificate ([CSBP-PF2470](#)). This Certificate requires the Field Engineering Designate to clearly state the conditions under which the penetration is to take place. As a minimum the below should be addressed as part of the process.
 1. Existing services shall be identified in the surface that is to be penetrated using a service locator (e.g. stud finder, boroscope, current detector).
 2. Penetration is not permitted within 200mm of an identified service unless authorised by Field Engineering Designate.
 3. Consideration must be given to any gas testing requirements; refer to Gas Testing ([CSBP-GM-11-031-33](#)).
 4. Environmental and industrial hygiene consideration must be considered when penetrating material which contains or is likely to contain asbestos.
 5. Consideration of containment integrity following penetrations into bunds shall be given.
 6. A Risk Assessment (Job Safety Analysis) will be carried out before applying for a permit or certificate. For larger penetrations a Team Based Risk Assessment (TBRA) may be more appropriate.
- b. The Permit Holder taking responsibility for the task must ensure that:

1. A Work Permit is obtained from the appropriate area. Refer to Work Permit System ([CSBP-GM-11-031-51](#)). A Job Safety Analysis ([CSBP-GM-11-031-23](#)) is completed and all Team members have been briefed on the controls to be put in place.
2. All work is planned according to engineering requirements/specifications.
3. All personnel have safe access to plant and equipment at all times.
4. The Occupational Hygienist and Environmental Department are notified if the penetration has the potential to intercept asbestos. Additional PPE must be worn and samples may need to be taken and sent to the laboratory for analysis.

5.3 COMENCING AN PENETRATION

Precautions must be taken during a penetration to ensure that all hazards associated with process are controlled.

1. Drilling into double brick shall be completed one course at a time
2. Where possible, energy sources shall be isolated prior to the penetration commencing
3. Where a partial penetration is required, drilling equipment shall be fitted with a correctly set depth gauge
4. For larger penetrations consideration shall be given to tooling which minimises ergonomic and dust generation hazards (water cooled concrete corer).

6. REFERENCES

Basic Safety Rules (CSBP-GM-11-035-02)

Confined Space (CSBP-GM-11-031-52)

Arsenic Site Management Plan - CSBP Kwinana (CSBP-GM-ENV-023-02).

Solid Waste Management (CSBP-GM-ENV-060-02)

Gas Testing ([CSBP-GM-11-031-33](#)).

Work Permit System (CSBP-GM-11-031-51).

A Job Safety Analysis (CSBP-GM-11-031-23)

Occupational Safety and Health Act 1984

Occupational Safety and Health Regulations 1996

Code of Practice 'Excavation Work' 2015 (Safe Work Australia)

Code of Practice 'Excavation' 2005 (Commission for Occupational Safety and Health)



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