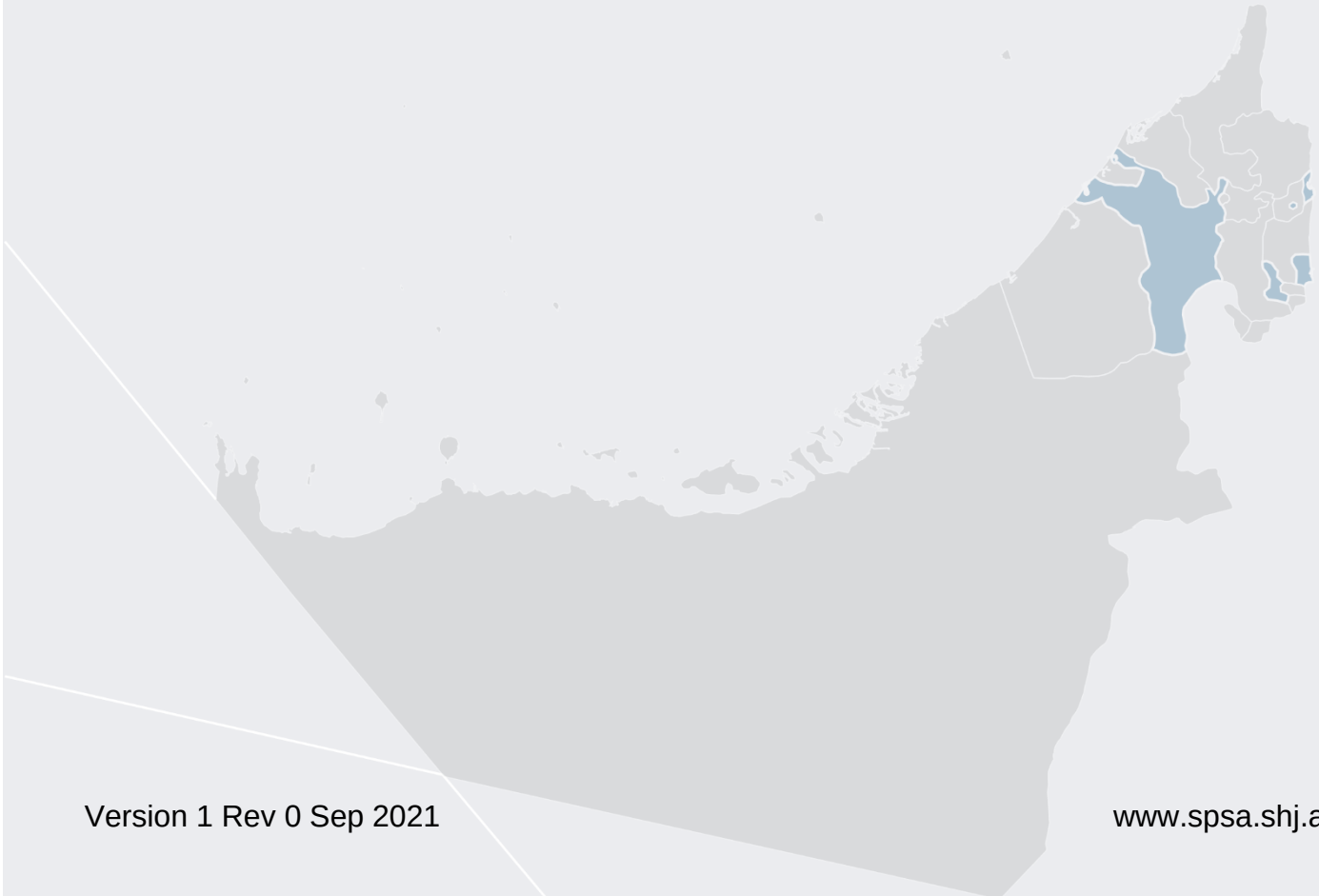
نظام الشارقة للسلامة والصحة المهنية
Occupational Safety & Health Sharjah

حكومة الشارقة
هيئة الوقاية والسلامة
Government of Sharjah
Prevention And Safety Authority

Code of Practice

Safe Excavation

OSHJ-Cop-08



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1 Introduction

Excavation is the process of moving earth, rock or other materials with tools, equipment or explosives, it includes earthwork, trenching, wall shafts, tunnelling and underground works.

Excavation work is an essential element of the construction process in relation to the construction of foundations, drainage work and underground services of all kinds. Beside construction, excavation is also common in archaeological work, road works, maintenance work, and other activities where there is a need to loosen and take out materials leaving space above or below ground.

2 Purpose and Scope

This Code of Practice (CoP) has been developed to provide information to entities to assist them in complying with the requirements of the Occupational Safety and Health System in Sharjah.

This Code of Practice (CoP) defines the minimum acceptable requirements of the Occupational Safety and Health System in Sharjah, and entities can apply practices higher than, but not lower than those mentioned in this document, as they demonstrate the lowest acceptable level of compliance in the Emirate of Sharjah.

3 Definitions and Abbreviations

Entities:	Government Entities: Government departments, authorities or establishments and the like in the Emirate. Private Entities: Establishments, companies, enterprises and economic activities operating in the Emirate in general.
Risk:	Is the combination of likelihood of the hazard causing the loss and the severity of that loss (consequences).
Risk Management:	The forecasting and evaluation of risks together with the identification of procedures to avoid or minimise their impact.
Risk Assessment:	The systematic identification of workplace hazards and evaluation of the risks associated. This process takes existing control measures into account and identifies and recommends further control measures where required.
Hazard:	Anything that has the potential to cause harm or loss (injury, disease, ill-health, property damage etc).
Competence:	The combination of training, skills, experience and knowledge that a person has and their ability to apply all of them to perform their work.
Excavation:	Excavation means a hole in the earth or face of the earth formed by removing sand, soil, rock or other material.
Trench:	Is a narrow excavation in relation to its length made below the surface of the ground.
Barricade:	A physical barrier, usually temporary, erected or placed to restrict the entry of persons to an area and/or prevent personnel being exposed to a hazard.

Underground Services: Underground utility services to residential and commercial premises which are hidden and isolated from damage under normal conditions.

4 Roles and Responsibilities

4.1 Entity Responsibilities

- Identify all reasonably foreseeable hazards involving excavation work, these hazards shall be adequately risk assessed;
- Ensure effective procedures are in place to manage excavation work activities;
- Ensure resources are available to implement adequate control measures required for excavation work activities;
- Provide adequate information, instruction, supervision and training for employees involved in excavation work and ensure employees are competent;
- Ensure equipment provided for excavation work activities is adequately selected for the task;
- Ensure adequate barricading is installed;
- Ensure that adequate emergency procedures are in place.

4.2 Employee Responsibilities

- Not endanger themselves or others;
- Follow precautionary control measures to ensure work activities associated with excavation are performed safely and without risk to health;
- Cooperate with the entity and receive safety information, instruction, supervision and training;
- Report any activity or defect relating to work equipment which they know is likely to endanger the safety of themselves or that of any other person.

5 Requirements

The entity shall ensure that excavation works are planned, organised, controlled, monitored and reviewed to achieve safe and healthy working conditions.

Everyone controlling excavation work has safety and health responsibilities. Checking that working conditions are safe and healthy before work begins and ensuring that the proposed work is not going to put others at risk requires planning and organisation.

Due to the hazards associated with excavation work the management of risk is imperative, this can only be achieved through effective communication, robust controls and co-ordination at all levels.

5.1 Planning

The entity shall plan excavation work and take all reasonably practicable precautions to ensure the safety of employees and others, planning requires consideration of the following factors, including but not limited to:

- Assessment of the site;
- Site survey and plans;
- Location of services;
- Safe systems of work;
- Risk assessment.

5.2 Risk Assessment

The entity shall assess the risks associated with excavation work and take all reasonably practicable precautions to ensure the safety of employees and others who could be affected by excavation work activities.

The risk assessment shall take into consideration the following factors, including but not limited to:

- Collapse of the sides;
- Over running of vehicles;
- Persons falling into the excavation;
- Materials falling into the excavation;
- Underground services;
- Access and egress;
- Hazardous atmospheres;
- Undermining adjacent structures;
- Flooding;
- Buried services;
- Barricading;
- Information, instruction, supervision and training;
- Provision of personal protective equipment;
- Emergency procedures and response.

Further information on risk assessment can be found in OSHJ-CoP-01: Risk Management and Control

5.3 Safe Systems of Work

The entity shall ensure that once all the significant risks have been identified, a safe system of work shall be developed and documented. The precautions required to create a safe system of work will depend on the nature of the excavation and the hazards identified during the risk assessment. Once the safe system of work has been developed it needs to be implemented and monitored.

A safe system of work for excavation work includes three basic elements, which complement each other and should always be used together, including:

- Planning excavation and earthworks;
- Locating underground services and identifying them;
- Safe digging practices and procedures.

Where excavation work requires additional control measures, a permit to work shall be used to adequately control the excavation work. A written permit to work system should result in a higher standard of safety and supervision.

The permit to work system shall also apply to contractors and subcontractors. Excavation work shall not be carried out unless it is authorised and properly supervised by a competent person who has knowledge of the work to be carried out, the risks involved and the precautions to be taken.

Further information on permit to work can be found in OSHJ-GL-16: Permit to Work.

5.4 Ground Conditions

Soil varies in its nature from place to place and so does its properties, therefore control measures change for different types of soil. A guide to determining the appropriate precautions against collapse is the angle at which a type of soil will stand without collapsing, this is called the “Angle of Repose”.

Information on angles of repose can be found in **Appendix 1: Angles of Repose**

For all excavations or trenches, a survey of soil prior to excavation by a competent person will usually provide sufficient information for suitable methods of excavation and support to be determined.

Information on ground conditions may be obtained from trial pits or boreholes. Such investigations are undertaken during preliminary site surveys.

The location of the water table is also significant. If the water table is going to be exposed by the excavation, careful consideration will need to be given to how it may affect the stability of the excavation sides.

5.5 Underground Services

Underground services can be easily damaged during excavation work if the proper precautions are not taken. Underground service plans can be used to see whether the place intended for digging will involve working near buried underground services. Signs of services including manholes, valve covers, street-lights etc. should indicate the presence of pipes and cables before starting to dig.

Contact with services can be avoided by proper planning and execution, a safe system of work depends upon the use of:

- Cable or other service plans;
- Cable and service locators and safe digging practices.

Whenever possible, keep excavations far away from existing services.

The main types of detectors available for locating underground services are:

- Hum detectors;
- Radio frequency detectors;
- Transmitter receiver instruments;
- Metal detectors;
- Ground probing radar;
- Radio frequency identification.

Further information on the use of locating, identifying and marking underground services can be found in OSHJ-CoP-09: Overhead and Underground Services.

5.6 Safe Digging Practice

Where a locating device has been used to determine position and route, excavation may proceed with trial holes dug using suitable hand tools as necessary, to confirm the position of any buried services. Special care should be taken when digging above or close to the assumed line of such a service.

Before digging, the entity shall ensure the following, including but not limited to:

- The person who is going to supervise the digging on site has service plans and is trained in how to use them;
- All workers involved in the digging know about safe digging practice and emergency procedures and that they are properly supervised;
- The locator is used to trace as accurately as possible the actual line of any pipe or cable or to confirm that there are no pipes or cables in the way and the ground has been marked accordingly;
- All services should be assumed to be live until disconnected and proven;
- There is an emergency plan to deal with damage to cables or pipes;
- Have a system for notifying the service provider in all circumstances;
- Erect suitable signs to warn everyone of hazards.

Excavation using safe digging practice involves the following, including but not limited to:

- Hand dig trial holes to confirm the position of the pipes or cables. This is particularly important in the case of plastic pipes which cannot be detected by normal locating equipment;

- Hand dig near buried pipes or cables, using spades and shovels rather than picks and forks which are more likely to pierce cables;
- Keep a careful watch for evidence of pipes or cables during digging and repeat checks with the locator. If unidentified services are found, stop work until further checks can be made to confirm it is safe to proceed;
- Treat all pipes or cables as 'live' unless it is known otherwise. What looks like a rusty pipe may be conduit containing a live cable. Do not break or cut into any service until its identity is certain and it is known that it has been made safe;
- Do not use hand-held power tools near to the marked position of an electricity cable. Fit check collars onto the tools so that initial penetration of the surface is restricted;
- Do not use a machine to excavate near to a gas pipe;
- Support services once they are exposed, to prevent them from being damaged;
- Report any suspected damage to services;
- Backfill around pipes or cables with fine material.

Backfill which is properly compacted, particularly under cast or rigid pipes, prevents settlement which could cause damage at a later date. Once new services have been laid, update the plans.

5.7 Identifying Exposed Services

Failure to correctly identify exposed services is a common cause of incidents. Difficulties arise because a wide variety of materials and colours have been used for services over the years and black plastic has often been used to cover water pipes, electricity cables and telecommunication cables.

The following general precautions are recommended to be followed until the nature of the service is confirmed, including but not limited to:

- Black plastic services should be assumed to be a live electricity cable;
- Iron and steel pipes should be treated as gas pipes;
- Continuously welded steel pipes should be treated as containing hazardous or high pressure fluid;
- Where there is any doubt about the identity of an exposed service, it should be treated as an electricity cable or gas pipe until proved otherwise.

5.8 Collapse of Excavation

The entity shall ensure that before digging any trench, pit, tunnel, or other excavations, they shall decide what temporary support or battering will be required and plan the precautions to be taken to ensure:

- No part of the excavation collapses;
- Any fall and dislodgement of material is prevented;
- No person is buried or trapped by the fall or dislodgement of any material.

Excavations must be supported as soon as possible by the provision of sufficient and suitable materials. Such supports must only be installed, altered or dismantled under the supervision of a competent person and without employees installing the supports being put at risk.

Battering the excavation sides to a safe angle of repose may make the excavation safer. In granular soils, the angle of slope should be less than the natural angle of repose of the material being excavated. In wet ground a considerably flatter slope will be required.

5.9 Choice of Support Method

The entity shall consider the appropriate support method for the ground conditions, including but not limited to:

- Sheeting, waling and strutting;
- Hydraulic struts;
- Proprietary support systems;
- Soil nailing method;
- Soldier pile support.

5.10 Cofferdams and Caissons

Cofferdams and caissons are both structures that are used when undertaking construction works in areas submerged under water. The main difference between the two is that a cofferdam is a temporary structure which is removed after completion of the work, whereas a caisson is built to remain in place as part of the completed structure.

Every cofferdam or caisson shall be:

- Of suitable design and construction and have sufficient strength and capacity for the purpose for which it is being used;
- Equipped to enable workers to gain shelter or escape, if water or materials should enter it;
- Adequately maintained.

Work must not be carried out in any cofferdam or caisson unless:

- It and any work equipment or materials which affect its safety have been inspected:
    - Before any person carries out any work at the start of every shift;
    - After any event likely to affect the strength or stability of the cofferdam or caisson or any part of it.
- The competent person who inspected it is satisfied that work can be carried out in it safely.

Work must not be carried out in any cofferdam or caisson if any inspection reveals any defect rendering the cofferdam or caisson unsafe, until that defect has been rectified.

5.11 Materials Falling into Excavations

The entity shall ensure excavated spoil and other materials are not stored, or the parking of plant and vehicles close to the sides of excavations. The extra loadings from spoil, vehicles, etc. can make the sides of excavations more likely to collapse. Loose materials may fall from spoil heaps into the excavation.

A scaffold board used as a toe board and fixed along the outside of the trench sheets will provide extra protection against loose materials falling. Safety helmets will protect those working in the excavation from small pieces of materials falling either from above, or from the sides of the excavation.

5.12 People and Vehicles Falling into Excavations

The entity shall prevent people from falling into excavations by providing guarding or barricading. Edges of excavations should be protected with substantial barriers where people are liable to fall into excavations. All excavations in public places should be suitably barricaded to prevent members of the public approaching them.

Prevent vehicles from falling into excavations by keeping them out of the area. Vehicles passing close to the edges of excavations may also overload the sides, leading to collapse. Where necessary, use baulks or barriers to keep vehicles away from excavated edges. Baulks and barriers are best painted or marked to make sure they can be seen by drivers.

Where vehicles have to tip materials into excavations, prevent them from over-running into the excavation by using stop-blocks. The sides of the excavation may need extra support to remain in a safe condition.

5.13 Undermining Nearby Structures

The entity shall ensure excavations do not undermine the footings of scaffolds or the foundations of nearby buildings or walls. Walls with very shallow foundations can be easily undermined by even small trenches, causing the wall to collapse onto those working in the trench. Before digging starts, decide if extra support for the structure is needed. Surveys of the foundations and the advice of a structural engineer may be required.

5.14 Overhead and Underground Services

The entity shall plan their work activities regarding overhead and underground services, ensuring they are appropriately supervised and carried out safely and without risk to health. Planning includes conducting a risk assessment, the selection of work equipment and preparation for emergencies. Once all significant risks have been identified a safe system of work shall be developed, documented and communicated. The precautions required to create a safe system of work will depend on the nature of the excavation and the hazards identified during the risk assessment.

Further information on Overhead and Underground Services can be found in OSHJ-CoP-09: Overhead and Underground Services.

5.15 Ground and Surface Water Inflow

Depending on the permeability of the ground, water may flow into any excavation below the natural groundwater level. The supports to the side of the excavation should be designed to control the entry of groundwater and the design should take any additional water loading into account. Particular attention should be given to areas close to lakes, rivers and the sea.

Water entering the excavation needs to be channelled to sumps from where it can be pumped out; however, the effect of pumping from sumps on the stability of the excavation should be considered. Consultants will need to consider these issues during planning.

5.16 Other Aspects of Excavation Safety

5.16.1 Access and Egress

Safe access and egress shall be provided to employees getting into and out of an excavation. Ladders shall be securely fixed, appropriately maintained and allow employees to promptly escape in the event of an emergency.

5.16.2 Lighting

The workplace must be adequately illuminated, especially at access points and openings and where excavation operations are taking place.

5.16.3 Ventilation

Ventilation of excavations shall give consideration to the following factors, including but not limited to:

- Excavations shall be kept clear of toxic, explosive or asphyxiating gases;
- Leakage of propane and butane from LPG cylinders;
- Ventilating the excavation with clean air to dissipate any gas accumulations.

Further information on ventilation can be found in OSHJ-CoP-06: Confined Spaces.

5.17 Barricading

The entity shall assess and identify the need for barricading and areas where barricading may be required, include but not limited to:

- Where there is a risk of people falling into an excavation;
- Being struck by falling objects;
- Vehicles and people entering the workplace;
- To control access to excavation areas.

5.17.1 Types of Barricading

Soft Barricading

Soft Barricading can be used to prevent entry of people and equipment as an immediate and short term control measure. This type of barricading will be used when the risk assessment indicates that the risk of using soft barricading is acceptable. Types of soft barricading, include but are not limited to:

- Scissor/expanding barricade;
- Post and chain;
- Plastic cone and plank;

- Flag type bunting;
- Plastic mesh barriers.

Hard Barricading

Hard barricading shall be used to physically prevent entry of people and equipment. This type of solid barricading shall be used to provide a physical barrier. Types of hard barricading, include but not limited to:

- Mesh or hoarding fencing panels;
- Scaffolding tube and fitting to construct temporary walkways and handrails;
- Road traffic control barricade;
- Free standing A-frame barricades.

Barricading should be erected by competent persons with suitable hazard warning signage prominently displayed and include designated access and egress points.

Further information on barricading can be found in OSHJ-GL-24: Barricading.

5.17.2 Selection of Barricading

The entity shall ensure when selecting the type of barricade, the following factors are considered as part of a risk assessment, including but not limited to:

- The risk associated with the hazard;
- The visibility of the hazard;
- The required strength of the barrier;
- The amount of clearance provided from the hazard by the barricade.

5.17.3 Erection and Use of Barricading

The entity shall ensure that the erection and use of barricading is part of the safe system of work, including but not limited to:

- The barricade shall encompass the entire potentially affected area of the workplace hazard;
- Barricading is erected to separate hazardous areas by: integration with existing structures or a standalone installation;
- Entry points in the barricading shall be positioned in such a way that they do not lead directly to the hazard;
- Barricading does not create an additional hazard;
- Barricading is erected so that all sides of the hazard are protected from unauthorised access and members of the public;
- Adequate lighting and warning signage are installed to alert people to the presence of barricading.

All barricades shall be accompanied by appropriate signage, which shall be placed on all access points.

Further information on signage can be found in OSHJ-GL-17: Safety Signs and Signals.

5.18 Inspections and Examinations of Excavations

The entity shall ensure that excavations which need to be supported, or battered back to prevent danger are inspected by a competent person, including but not limited to:

- At the start of the shift before work begins;
- After any event likely to have affected its stability;
- After any accidental fall of rock, earth or other material.

If the competent person is not satisfied that work can be carried out safely, they should advise the person for whom the inspection was carried out as soon as possible. The workplace should not be used until any defects have been corrected.

The entity shall record and retain inspection and examination records.

6 Training and Competency

The entity shall ensure employees are provided with adequate knowledge on excavation and equipment safety.

The entity shall provide employees with training in languages and in a format that employees understand, including but not limited to:

- Specific information, instruction on excavation and equipment safety and check they understand these instructions;
- How to avoid risks;
- Safe systems of work;
- Formal training on excavation and work equipment;
- Emergency procedures and response.

Periodic refresher training shall be conducted to ensure employees competency is maintained, including but not limited to:

- Where training certification has expired;
- Where identified as part of a training needs analysis;
- Where risk assessment findings identify training as a measure to control risks;
- Where there is a change in legal requirements;
- Where incident investigation findings recommend refresher training.

The entity must record and maintain accurate training records of OSH training provided to employees.

Further information on training can be found in OSHJ-GL-26: Training and Competence.

7 Emergency Preparedness and Response

The entity shall be prepared for emergencies that may occur during excavation work. Due to increased risks from excavation work, the entity needs to have an emergency plan on what to do when an emergency occurs and how to respond to that emergency.

The entity shall ensure the following factors are considered in the emergency plan, including but not limited to:

- Emergency response personnel are available, who can take charge and make decisions on behalf of the entity during an emergency and liaise with emergency services;
- Emergency response personnel are available, who are familiar with the work area ensuring the prompt rescue and evacuation of employees;
- Adequate firefighting and first aid equipment is available for the type of work activities and the work equipment present in the workplace;
- Employees are trained in emergency response, including information of first aid arrangements and where first-aiders, first aid equipment and facilities are located;
- Employees are appointed as first-aiders and available at each location and during each working shift when work is being conducted.

Further information on First Aid can be found in OSHJ-CoP-16: first aid at Work.

Further information on developing an emergency plan can be found in OSHJ-CoP-18: Emergency Preparedness and Response.

8 References

OSHJ-CoP-01: Risk Management and Control

OSHJ-CoP-06: Confined Spaces

OSHJ-CoP-09: Overhead and Underground Services

OSHJ-CoP-16: First Aid at Work

OSHJ-CoP-18: Emergency Preparedness and Response

OSHJ-GL-16: Permit to Work

OSHJ-GL-17: Safety Signs and Signals

OSHJ-GL-24: Barricading

OSHJ-GL-26: Training and Competence

9 Document Amendment Record

TITLE	Safe Excavation

DOCUMENT AMENDMENT RECORD			
Version	**Revision Date**	**Amendment Details**	**Pages Affected**
1	15 SEP 2021	New Document	N/A

APPENDIX 1. Angles of Repose

Appendix 1: Angles of Repose

Ground Conditions	Safe Temporary Slopes (degrees from the horizontal)	
	Dry Site	Wet Site
Boulders	35/45	30/40
Cobblers	35/40	30/35
Gravel	30/40	10/30
Sand	30/35	10/30
Silt	20/40	5/20
Soft Clay	20/30	10/20
Firm Clay	30/40	20/25
Stiff Clay	40/45	25/35