

## DUSUP GUIDELINES FOR TRIAL PITS AND EXCAVATIONS

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<b>Revision Code:</b>	01	<b>Content Owner:</b>	Ali Alsayegh
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## Approval

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## 1 INTRODUCTION

Dubai Supply Authority (DUSUP) provides energy supply (Natural Gas) to Emirate of Dubai to meet the needs of electricity generation and water desalination through its pipeline network. Through the production of natural gas (which is processed into gas and condensate products), the purchase of pipeline gas and LNG (and its regasification), gas storage and the operation of the pipeline network, DUSUP plays a key role in the growth and development of Dubai.

DUSUP has assigned Dubai Petroleum Establishment (DPE) the responsibility for operating DUSUP assets and authorised DPE to manage all emergency events occurring on its own operated facilities, pipelines and assets within pipeline corridors in liaison with other governmental entities.

DPE-DUSUP designs operates and maintains DUSUP's onshore pipelines and related facilities to International Standards in order to ensure an uninterrupted flow of gas and other hydrocarbons across Dubai.

There are approximately 700 kilometres of onshore hydrocarbon pipelines operating in Dubai. The gas pipelines operate at high-pressures up to 960-psig and transport highly explosive and flammable natural gas. A number of jet fuel and fuel oil pipelines share the corridors with the gas and condensate pipelines.

## 2 PURPOSE

The purpose of this guideline is to assist DUSUP/DPE staff and Contractors to gain an understanding of how to safely excavate within DUSUP Corridor to expose the DUSUP and Pipeline Owners pipelines.

## 3 REFERENCES

DUSUP NOC Standard Conditions - DP-OPSON-0056

DPE Permit to Work Procedure: DP-HSE-00023

DPE Ground Disturbance Safety: DP-HSE- -00111

## 4 ABBREVIATIONS & DEFINITIONS

### 4.1 Abbreviations:

Abbreviation	Description
ALARP	As Low As Reasonably Practicable
BM	Bench Mark
DEWA	Dubai Electricity and Water Authority
DM	Dubai Municipality
DEL	Dolphin Energy Limited
DPE	Dubai Petroleum Establishment
EMDAD	EMARAT, Air BP and Shell Joint Venture
EMARAT	Emirates General Petroleum Corporation
ENOC	Emirates National Oil Company

<b>Abbreviation</b>	<b>Description</b>
e-NOC	Electronic NOC
GCS	Gas Control Station
HSE	Health Safety & Environment
IA /AA	Issuing Authority/Area Authority
JAFZA	Jebel Ali Free Zone Authority
MS	Method Statement
MSRA	Method Statement and Risk Assessment
NOC	No Objection Certificate
Trakhees (PCFC)	Ports, Customs and Free zone Corporation (Trakhees)
tsf	Tons per Square Foot
PPE	Personal Protective Equipment
PA	Performing Authority
PTW	Permit to Work
RA	Risk Analysis
ROW	Road Right of Way
RTA	Roads and Transport Authority

#### 4.2 Definitions

<b>Term</b>	<b>Definition</b>
Accident	The unexpected and undesirable occurrence directly associated with DUSUP operations and DUSUP asset/facility, which results or may result in human casualties or damage to property.
Angle of Repose	Angle of repose of a granular material is the steepest angle of descent or dip relative to the horizontal plane to which a material can be piled without slumping.
Bettering	Sloping the exposed face of an excavation wall back either at a uniform angle, or stepping it back uniformly.
Benching	Method of preventing collapse of excavation walls by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.
Berm	A soil bund built over the pipeline as a protection cover.
Construction	The erection of any new buildings or structures, or the variations to the Infrastructure facilities or existing asset.
Control Measure	Provisions to reduce identified risks.
DPE	Dubai Petroleum Establishment responsible for the Operation of DUSUP Asset.
DUSUP Corridor	DUSUP Corridor is the land allocated by Dubai Municipality or other statutory government authority to DUSUP for the construction, operation and maintenance of gas and fuel pipelines in the emirates of Dubai.

e-NOC	The electronic NOC application that can be submitted via the online system ( <a href="https://noc.rta.ae/RTAeNOC/Webpages/common/login/login.aspx">https://noc.rta.ae/RTAeNOC/Webpages/common/login/login.aspx</a> )
Excavation	Excavation is a man-made cut, cavity, trench or depression formed by earth removal.
Hazard	A Hazard is any source of potential damage, harm or adverse effects on people, property environment or organization.
Ground Disturbance	Excavation works that involves a manmade cut, cavity, trench or depression in the ground surface.
Incident	An occurrence which affects or could affect the safety of people or the DUSUP asset.
No Objection Certificate (NOC)	A document approved by the DUSUP through e-NOC, for the technical design of proposed development or authorizing a contractor to carry out a Construction/Restricted Activity within the NOC Zones.
Permit to Work (PTW)	A written or digital approval granted by DPE that authorizes a person or persons to carry out specific work within a specified time frame within the proximity of DUSUP asset/plot boundary limit.
Pipeline Representative, Pipeline Operator or Patrol staff	The staff designated by DUSUP the duties of witnessing NOC works for compliance with NOC conditions and monitoring the safety of the pipelines.
Risk	A situation involving exposure to danger
Risk Assessment	A report prepared by the Applicant/Customer seeking DUSUP NOCs, identifying potential risks and mitigation measures involved in carrying out any Construction or Restricted Activity within the DUSUP NOC Zones.
Safety	The absence of any risk of harm or damage to the people, DUSUP asset/Infrastructure that is deemed unacceptable as per the DUSUP/DPE Safety Regulation or Standard Operating Procedure.
Shoring	Shoring is the form of prop or support, usually temporary that is used for supporting a structure or sides of excavation when in danger of collapse or cave-in.
Trench	A Trench is a narrow excavation. The depth is greater than the width, but not wider than 15 feet.
Trial Pit	Trial Pit or Trial Trench is the practice of manual digging of a test hole in the ground to ascertain the location or elevation of existing hydrocarbon pipelines/utilities.
Underground Utilities	Buried services that transport or carry/convey gas/fuel, electricity, communication, water and waste.
Zone of influence	The area over which applied external loads (e.g: vehicles, plant, excavated material) are likely to affect the volume of soil around the excavation, a structure below ground or adjacent to the external load.

## 5 WHY TRIAL PIT IS REQUIRED?

Buried pipelines installed decades ago are often not well documented. Therefore Trial Pits are required to verify and record the location and elevation of existing DUSUP pipelines or existing utilities, in order that proposed work in the proximity of existing pipelines/utilities can be designed and executed to comply with the mandatory / safe separation distance from existing pipeline or utility.

Note, as built drawings and pipeline alignment sheets shall only be used as a basis for pipeline depth and approximate locational information of each pipeline. Trial pits are a requirement to determine the exact depth and location of a pipeline, and shall be undertaken whenever works shall be conducted directly above or in some case, in the vicinity of the pipeline.

Existing trial pits records can be utilised for works instead of undertaking a new trial pit above a pipeline, which ultimately poses a potential risk to the pipeline and personnel during the excavation. Existing trial pit records may be utilised:

- Should the trial pit record be within 6 m of the work location on the pipeline.
- If the construction work for the trial pit does not involve trenchless crossings.
- At crossings near roads, the elevations of the pipelines change significantly if HDD method was undertaken during the construction of the pipeline, therefore new trial pits are recommended at these areas even if existing trial pits are located within 6 m of the work area.

## 6 TRIAL PIT NOC

DUSUP receive and process NOC through the Dubai Government e-NOC (electronic NOC) system administered by RTA. The link for e-NOC application is:

<https://noc.rta.ae/RTAeNOC/Webpages/common/login/login.aspx>

DUSUP NOC is issued for hydrocarbon pipelines that are owned and operated by DUSUP, ENOC, EMDAD and Dolphin Energy.

*Note: Excavation within DUSUP/DPE Plant premises/facilities where DUSUP NOC is not applicable, Ground Disturbance Safety DP-HSE-00111 shall be reviewed in conjunction with this report.*

### 6.1 When DUSUP TRIAL PIT NOC is Applicable?

DUSUP Trial Pit NOC is applicable for Trial Pit /Trial Trench activities within the NOC Zones classified as follows:

- 60 meter either side from the center of pipeline owners pipelines or 60 meter from DUSUP Corridor limit / pipeline owners facilities.
- 10 meter either side of the pipelines located within DEWA or EGA (DUBAL) Plot limits.
- 5 meter either side from the center of 8" Shell pipeline (Abandoned, Positively Isolated).
- Margham Field Safety Zone.
- 10m radius buffer for all abandoned wells (Positively Isolated).
- 500m buffer for LNG Terminal and associated pipeline.
- 300 meter for High Voltage Over Head Lines parallel to hydrocarbon pipelines/pipeline corridor.
- 500 meter for Subsea Pipelines.
- 500 meter for Land Use Planning adjacent to DUSUP Pipeline/Pipeline Corridor.
- ½ LFL distance from credible leak scenario i.e. above ground flanges / valves.

## 6.2 Submission Requirements

Trial Pit NOC submission shall include but not limited to following:

- AutoCAD drawing on DLTM coordinates datum showing the proposed trial pit location.
- Pdf file of drawing showing the proposed trial pit location.
- A site specific excavation method statement and excavation protection design with the shop drawing prepared as per the site hazard and control measures.
- A site specific risk assessment with necessary control measure to reduce the risk to as low as reasonably practicable (ALARP).
- Standard Trial Pit NOC conditions shall be issued for trial pits up to the maximum depth of 1.2 meters. All Trial Pit NOC requests must be reviewed as stated in this guideline document; particularly considering the work location/surroundings, trench protection and all controls mentioned in TRA.
- For Trial Pits at a depth greater than 1.2 m, the Method Statement and Risk Assessment shall be specific taking into account the step cutting, sloping and shoring process and the risk assessment shall be provided taking into account the additional risk associated with deeper excavations.
- If the Trial Pit is undertaken to confirm the depth of the pipeline, CONTRACTOR shall raise a trial pit NOC assuming the pipeline depth is greater than 1.2 m, and thus appropriate Method Statement and Risk Assessment detailing the Shoring, Step Cutting, Sloping measures to ensure the integrity of the trial pit.
- Standard Trial Pit NOC does not cover dewatering works. For including dewatering work in the NOC, detail dewatering submission with the job specific and location specific method statement, risk assessment and drawing must be submitted.
- Further details on Excavation Safety / Trench Protection can be found in Attachment 1.

## 6.3 Typical NOC Conditions:

Following are the commonly applicable NOC conditions. Additional site specific conditions may be applicable:

- Strictly comply with Dubai Municipality (DM) excavation safety requirements as per the DM Code of Construction Safety Practice.
- Approximate location of the existing pipeline must be checked using a pipeline locator and marked prior to commencement of the trial pit excavation.
- Gas test shall be performed by trained personal in excavation exceeding 1.2m (4 feet). Test to be conducted before employees enter the trench and regularly thereafter.
- Shoring, step cutting (benching) or sloping (battering) or Shielding (Trench Box) must be provided for the excavation deeper than 1.2 meters to eliminate the risk of cave-in or trench collapse.
- For step cutting or sloping, if the soil type (as per OSHA Standards) of excavation is not confirmed the soil must have a slope of 1 ½ horizontal to 1 vertical (34 degrees). Type of trench protection must be identified in TRA.
- The trench deeper than 1.2 m (4 feet) must have a safe means for workers to get in and out of the trench. (E.g. stairway, ladder, ramps). Means of egress must be fixed and secure and shall be within 7.6m (25 feet) of lateral travel. Ladders must extend a minimum of 0.9 m (3 feet) meter above the landing.



- Plastic shovels must be used while excavating within 0.50 meters of existing hydrocarbon pipeline and 2.0 meter either side of Jet Fuel Pipeline to avoid any damage to fibre optic cable..
- Spoil and debris must be placed at least 1.2 m (4 feet) away from the edge of the excavation.
- Approved barriers with deep excavation warning sign must be provided at a minimum 1.0 meter distance from the zone of influence or angle of repose line of excavation and no vehicle or storing of excavated material are permitted between the barrier and the edge of excavation.
- Method of backfill and compaction shall be clearly described in method statement and shall be approved by DUSUP in advance.
- Immediately after exposing the pipeline and before backfilling, the pipeline must be inspected by the DUSUP pipeline representative for condition of coating and any damage to the coating shall be repaired by DUSUP approved contractor before backfill. Condition of the pipeline on exposing and before backfill shall be recorded with photographs.
- Elevation and location coordinates at the crown of the pipeline must be recorded in the presence of DUSUP representative.
- A separate Construction NOC request with construction method statement including plan and cross section drawings detailing trial pit information along with a verified copy of trial pit record(s) must be submitted for DUSUP approval prior to the commencement of any construction work. Elevations and coordinates as per DM datum must be included in the drawing.
- Minimum 300mm around the existing pipeline shall be backfilled with dune sand or clean sand of low chloride content (less than 0.05 percent) mixed with sufficient water and manually compacted to minimum 90% of relative density for non-traffic areas. Minimum 95% of relative density of compaction must be achieved at the traffic area.
- Excavated material may be reused for backfill over and above 300mm sand cover, provided back material is free of large stone (i.e., less than 75 mm (3") or half the size of backfill layer whichever is less) all organic material, debris or other deleterious material. Maximum thickness of manual backfill layer shall be limited to 150mm (6"). Potable/clean Water shall be used during soil compaction. Contractor shall avoid usage of unclean/salt water or high salinity.
- Extreme care is exercised to avoid any damage to the pipeline coating during the backfilling. If any coating damage occurs, all backfill and compaction activities shall cease until the coating damage is repaired, cured and cleared by DUSUP for backfill.
- Existing pipeline berm must be restored to the original conditions.
- Location of trial pit taken must be marked at surface with suitable peg / stake labeled with Trial Pit reference and corresponding e-NOC reference for the verification at the time of construction.
- If, during a trial pit, the soil cover over the pipeline is found to be less than 1.2m, DUSUP Pipeline Operation team are required to conduct a depth check on pipeline in the area, and if requested by the DUSUP Pipeline Operation Team, the contractor shall increase the soil cover on pipeline during the backfilling of the trial pit.

## 6.4 Disclaimer Condition

Following standard disclaimer condition shall be included in all NOCs:

- Applicant shall comply with NOC conditions of DUSUP and other utility owners/services authorities such as Dubai Municipality, RTA, DEWA, ETISALAT, EITC (Du) Trakhees and UAE Armed Forces who may have services / utilities in the area that may be affected by your works.
- Each utility owners / authority conditions are managing the risk of their installed assets, if there are conflict in conditions, the most stringent condition(s) shall be followed.
- In case of other utilities or assets found during the trail pit where there are no approval from the concerned authority, the work has to be stopped until the respected authority approval is obtained.

## 7 TRIAL PIT SURVEY RECORD

DUSUP Pipeline Representative shall witness trial pit work on the existing pipeline or within 10 meters of existing pipeline and verify the trial pit survey and record it on the trial pit record form (See Attachment 2 for example).

The verified copy of trail pit record is shared with the contractor for the design of further works.

Pipeline Representative reserves the right to hold the signing of the trial pit record if the representative feels that the survey recording was not conducted to DUSUP standards or the trial pit was not backfilled as per DUSUP requirements.

For trial pits conducted for crossings above the DUSUP pipelines, if the contractor finds a protection slab, the contractor shall continue to excavate until the bottom of the protection slab is found. There are three types of slabs typically located above the DUSUP pipelines:

- a) If the slab is 250mm thick and 2x1m size, it is a pipeline protection slab with minimum 950mm soil cover between the bottom of slab and crown of pipeline.
- b) If the slab is 175mm thick, it may be pipeline protection slab installed closer to pipeline, therefore, TP must be extended to top of pipeline.
- c) If the slab is 150mm or less thickness, the slab is a utility identification slab, thus TP must be extended to top of pipeline.

The above shall be undertaken to ensure that the utility crossing above the pipeline meets the 1 m separation distance from utility to pipeline, and both the top of the slab and bottom of slab elevation shall be recorded as a minimum.

## 8 PIPELINE WITH SAFE ROAD/UTILITY CROSSING DEPTH

There may be some instances when excavating to the pipeline is not feasible due to the depth of the pipeline or conditions of the surroundings. If the alignment of pipeline is known, the trial pit verification depth for proposed road or open cut utility crossing above pipeline may be reduced as follows (after confirmation from NOC Engineer):

### 8.1 Road Crossing

If the pipeline depth underneath a proposed road is not known or is deep, contractor may excavate up to 2.5 meter below the proposed finished elevation of the road. If no pipeline is found at 2.5 m excavation, then minimum separate distance of 2 m from road top to pipeline top will be met (as per RTA requirement).

## **8.2 Utilities Crossing**

If the pipeline depth underneath a utility crossing is not known or is deep, contractor shall excavate up to 1.5 meter below the bottom of the proposed utility. If no pipeline is found at 1.5 m below the bottom of the proposed utility, then minimum separate distance of 1 m for open cut above the pipeline will be met.

## **9 EXCAVATIONS THAT REQUIRE A PERMIT TO WORK**

Excavation within the DUSUP/DPE plot limit and plant areas, or DUSUP Projects within DUSUP's pipeline corridors, are controlled by DPE Permit to Work (PTW) procedure i.e., DPE Excavation Permit Procedure - DP-HSE-00023. Should a Permit be required for the Excavation Work, NOC Engineer shall detail the requirements to the contractor.

## **10 DUSUP GUIDELINES**

Various Guidelines for DUSUP/DPE Onshore pipelines have been developed for use. Reference can be made to the following link: <https://dusup.ae/dusup-noc-guidelines/>

## Attachment 1: Excavation Safety / Trench Protection

According to the OSHA construction safety and health standards, 1926.650(b), a trench is referred to as a narrow excavation made below the surface of the ground in which the depth is greater than the width and the width does not exceed 15 feet (4.5 meters).

Safe excavation and trenching operations provides methods for protecting employees against cave-ins, and describes safe work practices for employees. A necessary first step in planning the approach to any trenching or other excavation is to understand what could go wrong. This understanding can help avoid many of the problems associated with excavation.

Contractors are encouraged to view the Trenching and Soil Classification Guideline Videos as detailed on the OSHA Website (<http://www.osha.gov/vtools/construction>).

### A.1 Hazards associated with Excavations

Common hazards associated with excavation works include the following:

- Contact with underground services;
- Contact with overhead electrical lines;
- Collapse of excavation's sides;
- Materials, including spoil, falling onto people working in the excavation;
- People and objects falling into the excavation;
- People being struck by mobile excavating equipment;
- The instability of any adjoining structure caused by the excavation;
- Presence of or possible in rush of water or other liquid;
- Undermining adjacent properties/ structures;
- Specific hazards associated with confined spaces;
- Asphyxiation from toxic gases; and
- Exposure to hazardous substances/contaminated ground.

Hence it is imperative that contractors understand the risks associated with excavations and trial pits, and are able to properly put in place mitigation measures to minimise the likelihood of trench collapse.

### A.2 Planning of Excavation Work

Contractor shall appropriate plan the work depending on site conditions, personnel experience, soil conditions and type of excavation required. The following, as a minimum shall be included in the planning of the excavation:

- Method Statement and Risk Assessment - Contractor shall raise appropriate Method Statement and Risk assessment ensuring the work scope, work plan and risk associated with the work scope appropriately assessed.
- Underground Information / Survey - Contractor shall ensure, through the use of an Information NOC, that all utilities, pipelines and other 3rd party assets are appropriately identified at the excavation location. It is also recommended that Cable Avoidance Tools / location devices are utilised prior to any excavation works to identify any utilities / pipelines not provided in the information NOC.

- Emergency Response – Contractor shall ensure that appropriate emergency response procedures are in place in case of emergency scenario including trench collapse, utility damage and confined space entry.

### **A.3 Controlling the Risk during Excavation**

Once the excavation has been appropriately planned, contractor shall continuously assess the risk through the excavation for any change in working conditions. Contractor shall always consider, prior and during excavation, the following:

- The location and nature of aboveground and/or underground services;
- Predicted nature of the ground being excavated;
- Expected presence or absence of water in the ground;
- Potential for water to run into the excavation from the surface;
- Stability of underground structures;
- Stages at which timbering or sheet piling shall be placed in the excavation as work proceeds;
- Presence of loose ‘pockets’ in what is otherwise firm, stable ground;
- Nature of any adjacent works and the potential impacts;
- Nearness of any buildings or roads and the weight of traffic;
- Whether any other important work is to be carried out adjacent to the proposed excavation;
- Whether any materials are likely to be stacked nearby;
- Method of excavation and stages of the excavation which are to be dug by machine or by hand tool if within 5 m from the pipeline;
- Amount of room which will be needed for raising and lowering material in the course of work;
- Whether the sides of the proposed excavation can be splayed to allow more freedom and make wedging easier
- The period that the excavation will be open
- The maximum allowable trench length and the weather that may be expected;
- How the trenches or sheet piling can be removed safely as the backfilling proceeds;
- Access to and egress from the excavation;
- Emergency evacuation from the excavation;
- Continuous gas testing programme;
- Sources of spoil vibrations and Arrangements for temporary site shelters at long-duration
- Excavations in open areas or near roads

The above are the minimum considerations to be taken account by the contractor during excavations

### **A.4 Inspection and Supervision**

All excavation work requires careful supervision, especially when they are first opened and sides are unsupported. Even when support work has been installed, constant vigilance is essential.

Contractors and Pipeline Representative shall always inspect the state of the excavation, in particular during the following:

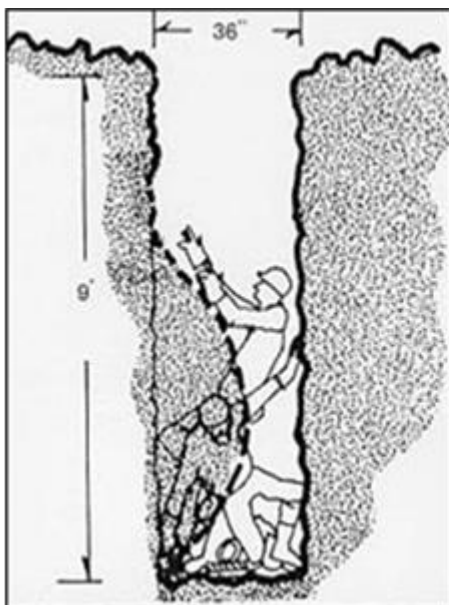
- At the start of each shift before work begins.
- After any event likely to have affected the strength or stability of the excavation.
- After any accidental fall of rock, earth or other material.
- After every rainstorm.
- After changes in working environmental condition e.g. after a windstorm.
- When fissures, tension cracks, sloughing, undercutting, water seepage, bulging are noted
- When there is a change in the size, location, or placement of the excavation spoil; and
- When there is any indication of change or movement in adjacent structures (buildings, road structure, bridge structures).

It shall be ensured that:

- Work be immediately stopped if the inspection shows the excavation to be unsafe; and
- Examination of the excavation is carried out by a competent person after substantial collapse or damage.

### A.5 Cave-ins and Protective Support Systems

Soil failure is defined as the collapse of part or all of an excavation wall. The most common soil failure is typically described as an unexpected settlement, or cave-in, of an excavation.



**Figure 1 Excavation Cave In**

Excavation workers are exposed to many hazards, but the main hazard is danger of cave-ins. OSHA requires that in all excavations employees exposed to potential cave-ins must be protected by:

#### A5.1 Sloping

One method of ensuring the safety and health of workers in an excavation is to slope the sides to an angle not steeper than one and 1½ (one-half) horizontal to 1(one) vertical (34 degrees measured from the horizontal). These slopes must be excavated to form configurations that are in

accordance with those for Type C soil. A slope of this gradation or less is considered safe for any type of soil.

Soil Type	Height/Depth ratio	Slope Angle
Stable Rock	Vertical	90 deg.
Type A	¾ : 1	53 deg.
Type B	1 : 1	45 deg.
Type C	1½ : 1	34 deg.

Figure 2 Sloping Angles per Soil Type

Description of soil types is detailed in Section A.6.

**A5.2 Benching or Step-Cutting**

Benching or Step-Cutting follows a similar methodology as sloping, but utilises steps instead of slopes to reducing the likelihood of cave in. The steps heights and depths follow the same height to depth ratio as detailed in Figure 3.

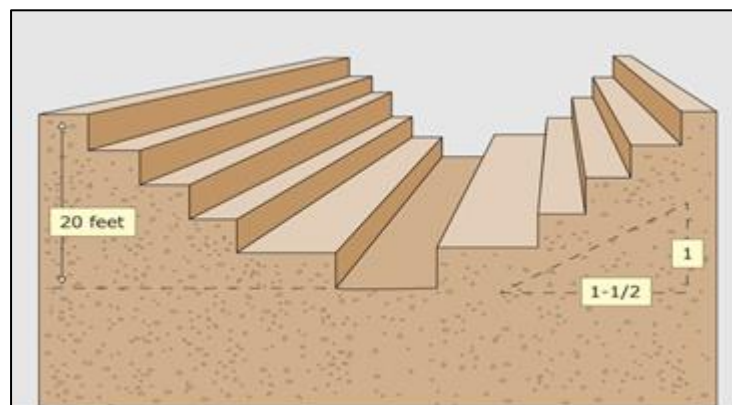


Figure 3 Step Cut - Type C Soil

**A5.3 Shoring**

The sides of the excavation can be supported by shoring – a system that supports the side or walls via aluminium, steel or wood panels that are supported by screws, hydraulic or pneumatic jacks.



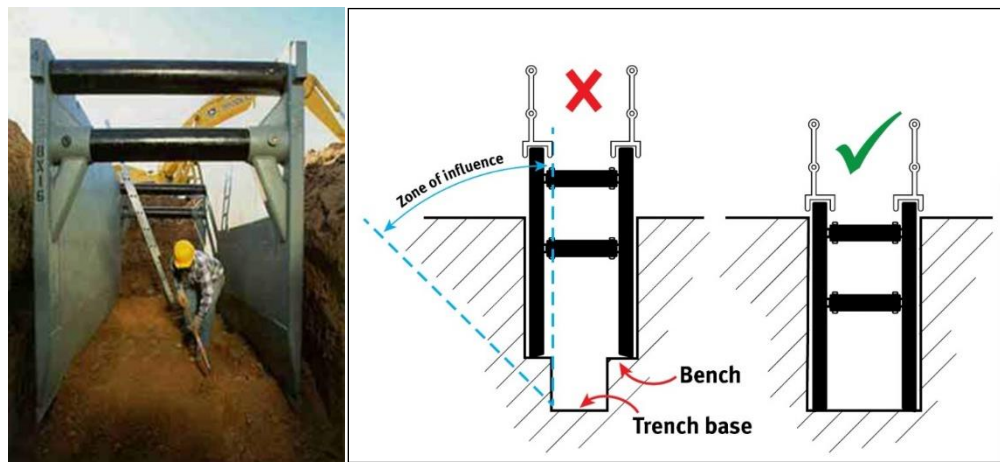
**Figure 4 Shoring**

These are particularly useful for areas near roads where sloping and step cutting may not be feasible.

**A5.4 Shielding (Trench box).**

The sides of the excavation can also be supported also by shielding (i.e. trench box). The trench box acts as a shield between the side of the excavation and the work area. The main difference between shielding and shoring, is that shoring is designed to prevent collapse, whilst shielding is only designed to protect workers should collapse occur (as the trench box is fixed).

The correct trench box size should be utilised for the size of work area required to be shielded.







**Figure 5 Trench Box**

**A.6 Classification of Soil**

OSHA classify the soil types as follows:

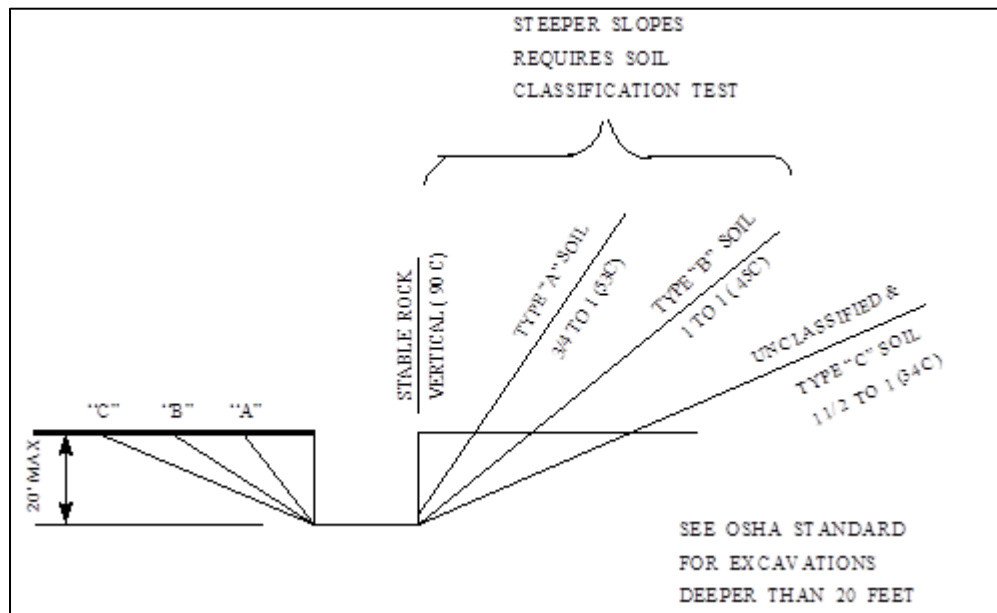


**Table 1 Soil Type Classification**

Soil Type	Description	Soil Type Picture	Height/ Depth Ratio	Slope Angle
Stable Rock	Solid Rock- natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.		Vertical	90°
Type A Cohesive Soils, Unconfined compressive strength greater than 1.5 tons per square foot(tsf)	Most stable: Clay, Silty clay, sandy clay. (Not fissured, Not subjected to vibration of any type, Never been previously disturbed, No seeping water).		3/4 :1	53°
Type B Weak Cohesive soils, Unconfined compressive strength less than 1.5tsf and greater than 0.5tsf	Angular gravel; silt; silt loam; soils that meet the unconfined compressive strength or cementation requirements of Type A soils but are fissured or subject to vibration; dry unstable rock etc.		1:1	45°
Type C Granular Soils, Unconfined compressive strength of 0.5 tsf. or less	Least stable: gravel, loamy sand, soft clay, Submerged soil or dense, heavy unstable rock, Soil from which water is freely seeping. If there is ever a doubt about the soil type, it must be treated as type C.		1 1/2 :1	34°

*Note: Soil Penetrometer may be used for the assessment approximate unconfined compressive strength of soil. However it does not replace the laboratory tests.*

The sloping angles per soil type are further depicted in the following figure.




**Figure 6 Minimum Acceptable Excavation Design Profiles and Angles**

### A.7 Reinstating an Excavation

Excavation sites may only be considered reinstated if the following activities have been completed:

- Changes are recorded to underground services, if any, on drawings submitted for updating.
- Where compacting of the backfill is needed, include the details of the compaction techniques in the approved NOC.
- If applicable, carry out compaction tests to confirm the backfill is satisfactory.
- Underground services are adequately protected during backfilling.
- Carry out reinstatement in line with the reinstatement plan included in the excavation's method statement, procedure or excavation permit.
- Do not remove access controls, warning signs, or barriers until machinery has been removed and area returned to safe condition.
- With the approval of the Pipeline Representative and trial pit record (Attachment 2) signature. Pipeline Representative reserves the right to hold the signing of the trial pit record if the representative feels that the survey recording was not conducted to DUSUP standards or the trial pit was not backfilled as per DUSUP requirements.

**Attachment 2: Excavation Safety / Trench Protection**



**Pipeline Department  
Survey - Trial Pit**

Date : 03.08.2021 Pipeline : 48RM-2 KP# 02+187  
 Proj Ref : N/A Location : AL YALAYES STREET  
 NOC Ref : 15042021-2022 Contractor : DGT Contracting

DMBM Ref: <u>SS 20953</u>		Coordinates: E <u>478284.903</u> N <u>2769743.370</u> Elev: <u>25.895</u>			
Backsight (BS)	Intermediate sight (IS)	Foresight (FS)	Height of Instrument (HI)	Elevation / Reduced Level (RL)	Remarks
				<u>4.340</u>	<u>Ground Level</u>
				<u>5.164</u>	<u>Berm Level</u>
				<u>-0.861</u>	<u>48RM 2 Pipe TOP Level</u>
Pipeline Coordinates		E <u>476884.189</u> N <u>2768139.828</u>		* Elevations are as per DM Datum Survey Instrument : <u>GPS HIPER V TOPCOM</u>	

Contractor Surveyor : Mobin K. G DUSUP Pipeline Rep. : Jeena  
 Tel / Mob : 056 922 2517 Tel / Mob : 050-5504784  
 Signature : [Signature] Signature : [Signature]

**Note:**  
 If a temporary bench mark (TBM) is established (as per DM datum), the location of TBM must be accurately recorded and must be protected until the completion of works.

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