HINDUSTAN ZINC
Zinc & Silver of India

Sustainability Framework

SAFETY STANDARD

Standard "Excavation"

Hindustan Zinc Limited

Document Control Details

	Issued by	Approved by
Name	Mr. Kamakhya Singh Chairman – Excavation Risk	Mr C Chandru Chairman - SRP Sub Committee
Sign.		
Next Revision Date – 30.07.2027		

Revision	Date	Reason For Issue	Compiled by	Approved by
00	05.11.17	For Compliance	Kamakhya Singh	Risk Chairman
01	20.05.2020	1. Confined space applicability as per clause 6.1-point 8 2.All major excavations for Depth, more than 3.5 meters, shall be done after engineering study. 3. From supporting system cribbing has been removed as we are not using the same	Kamakhya Singh	Risk Chairman
02	31.07.2025	Clause 6.1.1 Shoring sloping required for excavation more than 1.5 m in Type B&C.	Kamakhya Singh	Risk Chairman

		Clause 6.1.2 Stable rock and type A shoring required as per risk assessment. Clause 6.1.8 Excavation more than 1.5 m required confined space. Table no-1 sloping revised		

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Abbreviations

- HZL – Hindustan Zinc Limited
- HSE – Health, Safety and Environment
- IMS – Integrated Management System
- CSC – Corporate Safety Council
- ZIC – Zone Implementation Committee
- ZSC – Zone Safety Committee
- SRPSC – Standards, Rules & Procedure Subcommittee
- PPE - Personal Protective Equipment
- OHS - Occupational Health & Safety
- HR - Human Resources
- FAI - First Aid Injury
- MTI - Medical Treatment Injury
- RWI - Restricted Workday Injury
- LTI - Lost Time Injury
- DINS - Distribution Incidents

Table of Contents

1. Introduction

This standard is developed to cover the safe practices required for excavation in general and especially for shoring and sloping in excavation and trenching jobs. The standard provides guidelines and procedures to protect personnel, property and equipment from hazards associated with excavation related activities.

2. Scope and field of application

2.1 Scope

The standard outlines a systematic approach to identifying, eliminating, and controlling excavation hazards and incorporates the individual sections of this standard into a comprehensive program.

Each site should prepare specific procedures and guidelines consistent with this corporate standard. Each location shall also be aware of and follow any applicable regulatory requirements.

Sites should be aware that local regulations might impose conditions not reflected in this standard. Additional information on regulation comes from several sources, including Statutory/Regulatory Documents, and relevant national standards.

While the intent of the standard is to bring in homogeneity across all Businesses/locations/project sites/corporate office or any other locations belonging to HZL operations. The implementation of the standard is minimum mandatory requirement. However, it should be noted that the words “Shall” and “Must”” are mandatory requirements in this standard and are noted in *italics*. “Should” and “May” - are non-mandatory in this standard and understood as strongly recommended. Any questions regarding the interpretation of the standards in respect of mandatory versus non mandatory should be referred to the Corporate Safety/ standard drafting committee for clarification.

2.2 Field of Application

Deep shaft excavations, tunnel excavation, pile boring and excavation by blasting are excluded from the scope of this standard.

3. References

- Site HSE audit protocol.
- IS 3764:2002 - Code of Excavation safety.
- National Building code - Chapter 7 :2016 (Construction safety and practices).
- HZL Vehicle & Driving Standard.
- OSHA 1962 Subpart P Sloping and Benching

- VSS11 and GN 25

The Corporate Safety Standards on:

- Work at Height.
- Confined Space Entry.
- Electrical Safety.
- Contractor Safety Management.
- Permit to Work.
- Scaffold Safety.
- LOTO.
- HIRA guidance note GN7.

Other references

Factories Act, 1948 & Factories Rules (as applicable to the region/state where the sites are located),

The building & other Construction Workers (Regulation of Employment & Conditions of Service) Central Act and Rules thereunder, 1998.

4. Responsibilities

All Line Management and their teams in all Business Locations and Sites, dealing in excavation, are responsible for adhering to the standards during excavation related activities.

5. Definitions

These definitions are provided to describe the intent of this standard. The terms may be defined differently in other contexts.

Trench - Generally long, narrow, and deeper than its width, but the width of a trench is not greater than 4.5 meter at the bottom. A relatively small volume of earth is involved. Used for installation or maintenance of underground pipelines, conduit, cables, or footings for buildings without basement. The choice of shoring or sloping will be based on site specific conditions/assessments/geotechnical soil study /engineering study.

Excavation- Any man-made cut, cavity, trench or depression in earth surface formed by earth removal. Relatively large volume of earth is involved. Generally, they have relatively equal dimensions of width and length. Depth will vary but usually it is less than the smaller

dimension. Used for basements, installation or maintenance of underground tanks and pipelines, piling, culverts, and larger spread footings.

Shoring- It is a temporary structure that supports the sides of an excavation and protects against cave –in.

Sloping - A technique that employs a specific angle of incline on the sides of the excavation. The angle varies based on the assessment of impacting side factors.

Angle of repose - The greatest angle above the horizontal plane at which the material lies without sliding.

Ramp – An inclined walking surface specifically provided to gain access from one point to another and is constructed from earth or from structural members such as steel or wood.

Cave-in – Separation of mass of soil or rock material from the side of an excavation or loss of soil from under a trench shield or supporting system and its sudden movement into the excavation in quantity that it could entrap, engulf, bury, injure or immobilize a person(s).

Benching – Method of protection to prevent cave-ins by excavating the sides of an excavation to form one or series of steps usually with vertical or near vertical surfaces between levels.

Competent Person(s)
Those who, through extensive knowledge, training, skill and experience have successfully demonstrated their ability to carry out sloping and shoring of an excavation and are authorized by management.

Standard Ladder
It refers to the sound metallic ladder having width not less than 450mm and rungs with uniform spacing of 300mm with secured footing. It should be placed at an angel of 75^0 (1/4 Width: Height) from horizontal. Ladder rails shall extend at least 1m above the top landing and shall be secured.

6. Standard/Guidelines – Excavation

The standard ensures that necessary precautions are taken to safeguard the underground services, human life and property while carrying out excavation work.

Excavation includes digging, road cutting, removing soil, excavation for electrical cables, communication cables, utility lines, fire hydrant lines, digging for foundations either using mechanical equipment or manually.

6.1 General Excavation:

1. All the Excavations, more than 1.5 meter deep in type B&C soil shall require shoring or sloping designed by competent person.

2. For soil types of Stable rock& Type-A, shoring shall be installed as per the risk assessment and based on the site condition.
3. Excavated material must be kept at least 1 meter away from the edge of the excavation.
4. Excavated material must not be permitted to accumulate in the work area or aisles. It should be shifted away to designated place.
5. Excavation bracing and shoring must be checked by a competent person, prior to starting the job, subsequently on daily basis and after every rain and storm.
6. Power supply to all electrical equipment/lights should be through ELCB (Earth Leakage Circuit Breakers, tripping at 30mA current leakage to earth).
7. No hot work shall be done in excavation without a valid hot work permit.
8. Any excavation which is more than 1.5 meter in depth apart from stable rock and as per risk assessment has potential of engulfment should comply the confined space applicability and should follow the Confined space standard.

6.2 Trench Excavation:

1. Points in 6.1 are applicable and in addition to that, the following points are to be complied with,

2.If the trench is 4 feet or more deep it should be provided with standard ladder to facilitate safe entry and exit.

3.The Sides of trenches, in soil including embankments, shall be shored or otherwise supported when the trench is more than1.5 meter in depth. In lieu of shoring, the sides of the trench above the1.5-meter level may be sloped to preclude collapse but shall not be steeper than 0.3-meter rise to each 0.15 meter horizontal.

6.3 Guidelines and Procedures

6.3.1 Excavation clearance

Excavation clearance shall be taken for all excavations. However, when excavation work is to be undertaken outside the Site facilities, irrespective of the depth of excavation, all statutory clearances shall be obtained prior to commencing the work.

The clearance shall be obtained as follows:

6.3.1 (a) For New Projects, Minor Projects, Maintenance jobs (Green field or within existing plant)

The Project Manager/Site In-Charge shall be responsible for the co-ordination with all the departments and obtaining excavation clearance. The agency undertaking the excavations shall ensure:

a) A detailed excavation plan, engineering study if required, layout, method of excavation, nature of soil characteristics, types of machinery and other resources.

b) Identify hazards associated with the activity and prepare SWP/JSA. Review SWP/JSA on daily basis considering site conditions and explain Safety measures/emergency plan during Toolbox Talks before commencing the job.

c)For excavation & trenching jobs concerned in charge or his authorized representative is responsible for co-ordination with all the departments and obtain the excavation clearance.

6.3.2 Work Permit

Ensure relevant Work permits are obtained as per PTW standard along with HIRA/JSA.

6.3.3 Safety Aspects

The following important safety aspects shall be implemented during execution of excavation activity at project site:

6.3.4(a) Safe access

Safe access must be provided for excavations by means of ladders, stairs or ramps.

Provision of safe means of access & egress to workers e.g. clear passage for entry and exit, ladder, staircase, slope, steps etc. shall be ensured.

If the excavation is1.2 meter or deeper, it should be provided with standard ladder to facilitate safe entry and exit.

Trenches1.2 meter or more in depth must have ladders spaced so that employee's lateral travel to a ladder does not exceed 8 meter. The height of the ladder is to be extended up to 1 meter from the top of the ground surface. The ladder must be secured.

Ensure proper passage over the excavation for by passers to move from one bank side to another with minimum width of 600 mm gratings placed on horizontal members with guard rail.

Approach to excavation for vehicular movement by means of ramp should be on stable ground with gradient not more than 1:10.

Ensure that excavated area is not blocking the access to site for men and material, or otherwise necessary signs shall be displayed at appropriate location alternate route for traffic should be provided with proper signage in case of road blockage.

Separate access for man and equipment shall be provided wherever feasible.

6.3.4 (b) Caution and Barricades

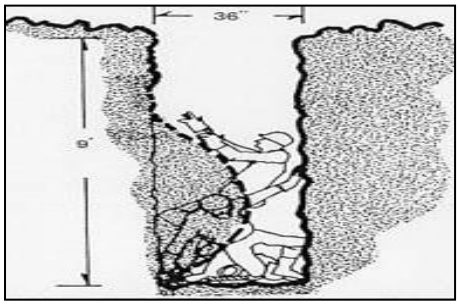
1. Excavations should be barricaded to prevent people falling into them.
2. Provide barricading of the area and display of warning signboard in Hindi / English / regional language at conspicuous locations.
3. Warning signs including light signal to be provided.
4. No trench, ditch or other excavation shall be left overnight without barricades and warning lights such as florescent warning tapes, flashing red lights shall be provided to warn persons in night.
5. Adequate illumination (25 Lux) should be provided at night and in day as per site condition so that the area will become visible.
6. If barricades or portions of barricades are removed for work, they shall be replaced as soon as practicable. A person shall be deployed to warn people till barricades are replaced.
7. The warning/indicative barricades (for <1m depth) must be1.8 meter away from the edge of the excavation (caution tape & sign board). In operations area the plastic tape must be at two levels i.e. 21” and 42” height from the ground.

8. The barricades installed closer than 1.8 meters from the edge of the excavation, must be hard barricade (for depth >1m). Hard barricade shall have horizontal members at 21" and 42" respectively from the ground with adequate vertical supports. For barricading relevant Indian Standard code shall be referred.

Barricading around Excavation

6.3.4 (c) Precautions against cave in, seepage etc.

1. If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above and near an excavation, the side of the excavation shall be sheet-piled, shored, and braced as necessary to resist the extra pressure due to such superimposed loads.
2. When mobile equipment is utilized or allowed adjacent to excavations, substantial stop logs, or barricades shall be installed. Mechanical Equipment should be away from the excavation (At least equal to the depth of excavation)
3. Care shall be taken during monsoon or during seepage of water from nearby areas. If possible, the area gradient should be outward from the excavation.
4. If there is evidence of cave-ins or slides, all work in the excavation must cease until the necessary precautions have been taken to safeguard employees till further clearance is obtained.



5. Where vehicles or equipment operate near excavations, the sides must be shored or braced as necessary to withstand the force exerted by the superimposed load. Also stop-logs or other substantial barricades must be installed to protect the edge of such excavations.

6. Dewatering from the pit shall be done at remote locations to avoid back flow to the pit resulting in soil collapse.
7. All major excavations for Depth more than 3.5 meters shall be done after engineering study and ensure that validated excavation schemes shall be installed.
8. Ensure that there are no scaffolds or temporary structures adjacent to where trench or excavation is to be made unless adequate measures have been taken based on a formal risk assessment.

6.3.5 Preparation (to be done in consultation with a competent person)

1. Study the soil characteristics with reference to the angle of repose for soil required etc.
2. It should be ensured that there is no exposed live wire in working areas which are accessible to workers.
3. Ensure that there are no vibrations from an external/internal source which may impact the excavation.
4. Ensure that consideration has been given to proximity of adjacent structures while finalizing the method of excavation.
5. All efforts will be made to locate underground utilities that may reasonably be expected to be encountered during excavation work. A cable detector may be used to detect the underground cable for clearance. In the situation where a cable or utility is found to exist, the engineer will judiciously after obtaining the excavation clearance, excavating a trial trench manually. The depth of trial trench shall not exceed 1.5 meters in general to ascertain the presence of any cable/gas pipeline/other utility. In case, no cable or other utility service lines detected in the trial trench, mechanical excavation up to 1.2-meter depth shall be undertaken.

   The whole process is repeated for the next 1.2 meters.

6.3.6 Supervision, workforce and Inspection

1. It should be ensured that all excavations are supervised by competent person.
2. Give Toolbox talks regarding safety measures to be observed by the workers involved before starting the job.
3. Confirm methodology to be adopted, explain Risk Assessment (HIRA/JSA) and plan of action in case of emergency. Review SWP/JSA daily, considering the site conditions and explaining the safety measures.
4. Confirm that PPEs provided are as per HIRA/JSA.
5. In the excavation, if there is a possibility of accumulation of water and if the depth of excavation is more than1.8 meter than double lifeline full body harness must be used. The harness should be secured to a suitable lifeline.

6. Minimum people shall be kept inside pit. All idle workers should be removed from there.
7. Each excavation shall be inspected daily by competent persons, after heavy rains & Storms, or more often if conditions change rapidly.

6.3.7 Precautions during work

i. If, during excavation, unexpected utilities are discovered, the Contractor should stop excavation and immediately notify the site in charge. Work shall be resumed only after obtaining further clearance in consultation with the competent person.

ii. **Hand tool excavation**: Whenever the presence of underground pipes, cables, vessels, or structures is known, or suspected, they shall be exposed by hand tool digging before mechanical excavators are used. Hand tool excavation is required within 3 meters of the object. Tools should be provided with insulated handles.

iii. **Machine excavation**: When the location of all utilities or structures has been established by route surface markers or hand tool excavation, machine excavation may commence under close surveillance of the contractor's person responsible. No person shall enter within the swing area of excavator machines.

iv. Movement of vehicles and heavy cranes shall be 1 meter away or 1.5 times the depth of excavation, whichever is greater depending upon soil strata.

v. Loose excavated material must be placed outside barricaded area. Precautions must be taken to prevent loose excavated material falling into the excavated area.

vi. The disposal area should be defined, made safe for receiving the loose excavated material and manner of disposal is to be defined.

vii. All electrical equipment and electrical connection used for excavation shall be tested and validated by the site electrical department. All Excavation equipment shall be validated by the Mechanical/HEMM Dept. periodically.

viii. In the case of excavation more than 4.5 meters of depth, ensure adequate means of communication and proper ventilation are provided.

ix. Power supply to all electrical equipment/lights should be through ELCB (Tripping at 30mA current leakage to earth with fault current not more than 200ms).

6.3.7 Dewatering

1. In case ground water is entering the excavated area, ensure continuous dewatering.
2. People shall not work in excavations that contain /accumulating water unless precautions have been taken to protect people from hazards posed by water accumulation. The precautions taken shall include support or sealed systems to protect from cave-ins, water

removal to control the level of accumulating water and use of safety harness and lifelines.

3. Dewatering from the pit shall be done at remote location to avoid backflow to the pit, resulting in soil collapse. If water is controlled or prevented from accumulating using water removal equipment, the water removal equipment & operation shall be monitored by a person trained in the use of the equipment. Ensure that the drained water does not create additional hazards
4. If excavation work interrupts the natural drainage of surface water, diversion ditches, dikes, or other suitable means will be used to prevent surface water from entering the excavation. Precautions shall also be taken to provide adequate drainage of the area adjacent to the excavation.

6.3.9 Shoring

1. Bracing or shoring of trenches shall be carried along with the excavations.
2. Trenches1.5 meter or deeper must be shored or sloped back to the angle of repose. Any excavation in unstable ground will require shoring or sloping.

Shoring Methodology

Any one of two methodologies shall be used for shoring purposes. However, irrespective of methodology material used should be in good condition.

1. Timber Shoring:

Wooden planks used for shoring must be in sound, free of knots, cracks and adequate dimensions of Grade 2. As per Annexure 3

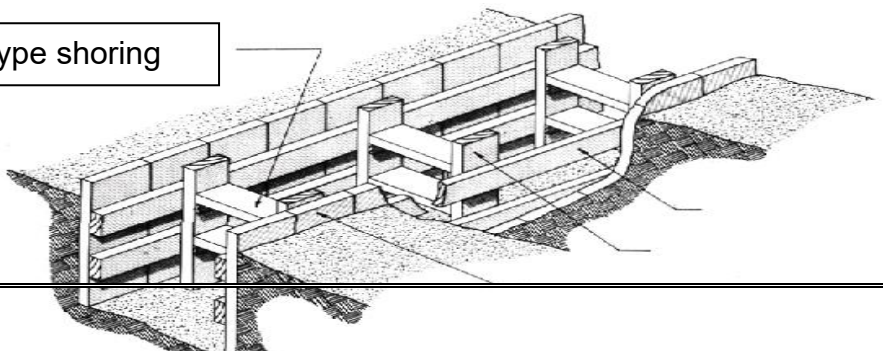
2.Sheet Shoring:

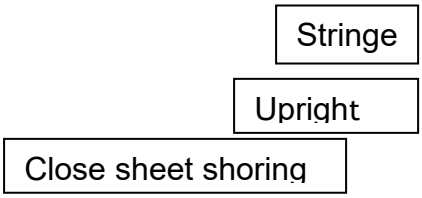
Corrugated sheets used for shoring shall be firmly supported by steel/scaffold pipes with the spacing of 4 feet in Horizontal and vertical direction with cross bracings and shall be suitably clamped, protruded scaffold pipes to be kept.

3. **Supporting systems**, i.e., piling, shoring, etc., should be designed to meet accepted engineering requirements. When tie rods are used to restrain the top of sheeting or other retaining systems, the rods shall be securely anchored well back of the angle of repose.

4. For shoring extending below the water table proper means of water drainage with the means of weep holes or other means shall be ensured. When tight sheeting is used full loading due to ground water table shall be assumed unless prevented by weep holes or drains or other means. In that case additional stingers, ties, additional bracing shall be provided.

Rib Type shoring





6.3.10 Sloping

1. All slopes shall be excavated considering angle of repose except for areas where solid rocks allow for line drilling or pre-splitting. Refer following table for angle of repose.

2. The angle of repose shall be flattened where the excavation has water conditions, silt materials, loose boulders and areas where erosion, deep frost action appear.

3. Except in hard rock excavation below the level of base of footing of any foundation or retaining wall shall not be permitted unless the wall is under pinned, and all other precaution taken to ensure the stability of adjacent walls for the protection of persons involved in excavation work or in vicinity thereof.

4. Clays, slit, loams or non-homogeneous soil require shoring and bracing. The presence of ground water requires special treatment.

5. Cross braces and trench jacks shall be placed in a true horizontal position be spaced vertically and be secured to prevent sliding, falling or kick outs.

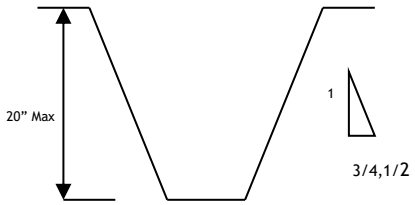
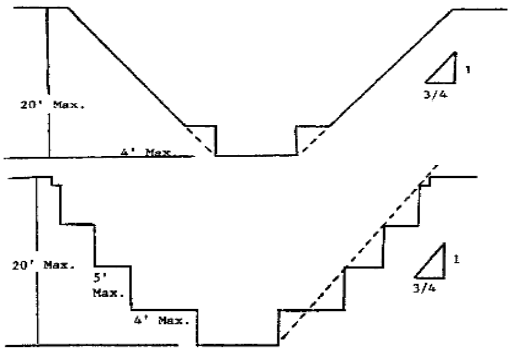
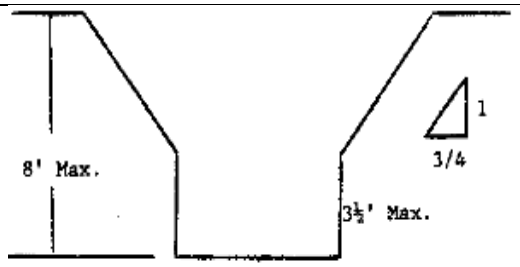
For sloping of sides/angle of repose, please refer to Table no-1 below

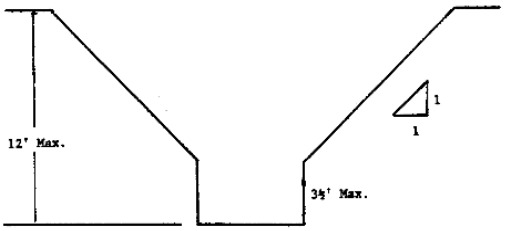
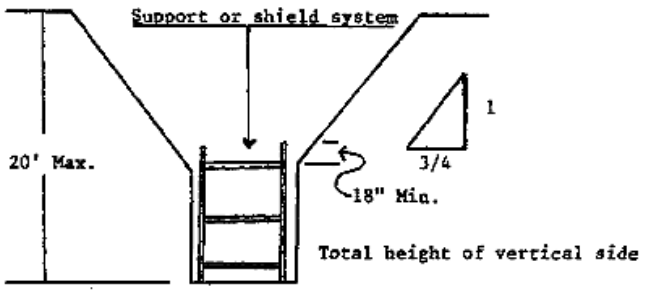
Table no -1

Soil or Rock Type	**Type of strata**	**Soil bearing capacity in T/m^2**	**Maximum Slope (H:V)**	**Max slope** Degree
Stable Rock	Solid rock, Shale or cemented sand & gravels	45 to 90	Vertical	90
Type A	Soft and hard murrum, compacted angular gravels, very stiff dense	20 to 45	0.5:1 0.75:1	Excavation < 3.67 meter-63 Excavation> 3.67 meter-53

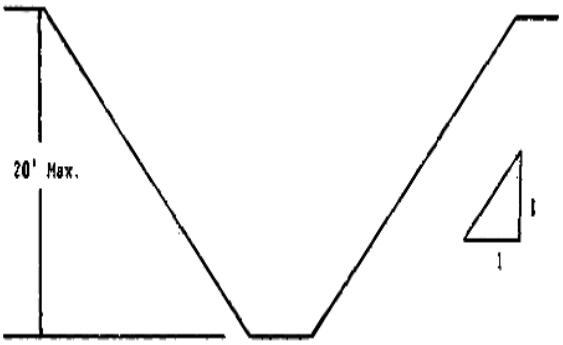
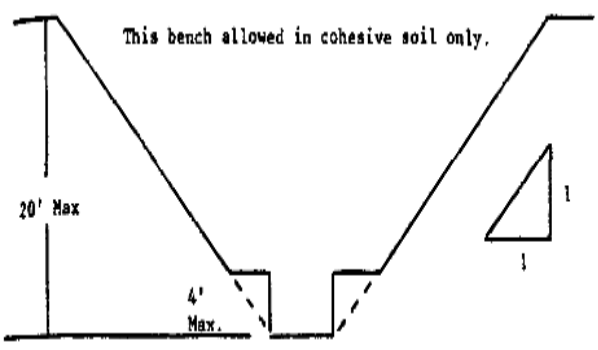
Type B	Clay and cohesive soil avg soil, previously excavated soil	15 to 20	1:1	45
Type C	Compacted sharp Sandy soil, broken rock, gravel and Black cotton soil, soft to very soft soil	0 to 15	1.5:1	34

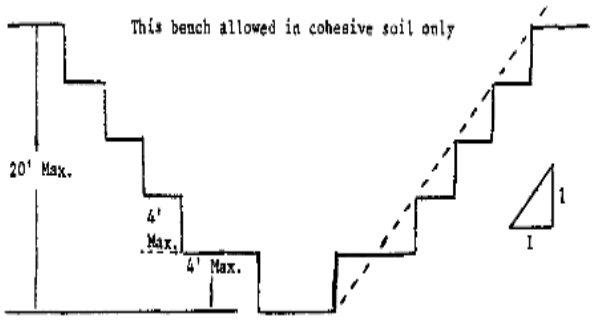
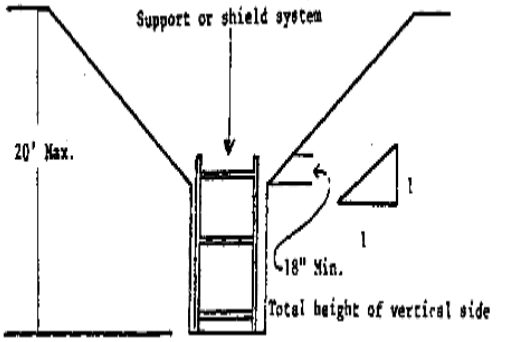
Excavations made in type A Soil

All simple slope excavations 6 meter or less in depth will have a maximum allowable slope of 3/4 :1 and in exception which are open 24 Hr or less shall have ½:1	
All benched excavations 6 meter or less in depth will have a maximum allowable slope of ½ to 1 and maximum bench dimensions as indicated.	
All excavations 2.5 meter or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3.5 Feet.	

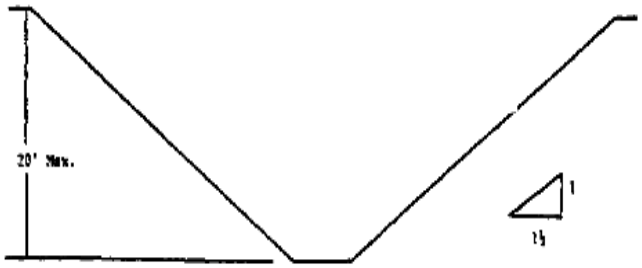
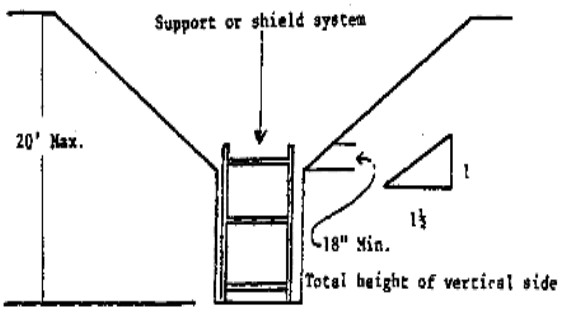
All excavations more than 2.5 meter but not more than 4.5 meter in depth with unsupported vertically sided lower portions will have a maximum allowable slope of 1:1 and a maximum vertical side of 3.5 feet.	
All excavations 6 meter or less in depth which have vertically sided lower portions that are supported or shielded will have a maximum allowable slope of 3/4:1. The support or shield system shall extend at least 18 inches (0.5 meter) above the top of the vertical side.	

Excavations Made in Type B Soil

All simple slope excavations 6 meter or less in depth will have a maximum allowable slope of 1:1.	
All benched excavations 6 meter or less in depth will have a maximum allowable slope of 1:1 and maximum bench dimensions as indicated.	

	
All excavations 6 meter or less in depth which have vertically sided lower portions will be shielded or supported to a height at least 18 inches (0.5 meter) above the top of the vertical side. All such excavations will have a maximum allowable slope of 1:1.	

Excavations Made in Type C Soil

All simple slope excavations 6 meter or less in depth will have a maximum allowable slope of 1.5:1.	
All excavations 6 meter or less in depth which have vertically sided lower portions will be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations will have a maximum allowable slope of 1.5:1.	

Refer Annexure 4 for Approximate Angle of Repose for Sloping of Sides of Excavation

6.4 Emergency Rescue

The supervisor shall make the persons aware about the location of the First Aid box and site assembly point. The site-specific rescue plan shall be readily available and discussed before the start of work.

Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

6.5 Standard Compliance Audit

A Standards compliance weekly audit checklist is attached in Annexure-5.

Audit shall be carried out by an audit team inclusive of site-in-charge, Contractor-in-charge and Contractor's safety person every week till the excavation work is in progress.

Audit outcome shall be taken in account while calculating contractor's safety performance.

7.0 Management systems

7.1 Support resources

Site Safety and Corporate safety, SRP and Site Apex committee, Sub Committee at Site/units level are available to assist in the implementation of this standard.

7.2 Management records

The site permits audit checklists shall be retained for 3 years.

7.3 Audits

Apex committee shall include the provisions of this standard in their second party safety audits protocol. Site/units shall have a first-party audit program conducted that assesses compliance of Site/unit procedures and practices with the requirements in this standard. First-party audits shall also address local laws, regulations, and situations unique to the Site/unit relative to excavation. A competent person approved by APEX committee shall be a part of the first party audit team.

7.4 Standard renewal process

This standard shall be reviewed and revised as necessary, at a minimum not later than two years from the date of the last revision.

7.5 Deviation process

The Business/Unit Head must authorize deviations from this standard after consultation with the Corporate EHS Group. Deviations must be documented, and documentation must include the relevant facts supporting the deviation decision. Deviation authorization must be renewed periodically and no less frequently than every two years.

7.6 Training and communications

Each business and site should provide training as appropriate.
Training recipients: All key personnel in the civil department and key personnel from contractors, who are involved in managing civil work.

An awareness session for the rest of the line management and employees should also be planned.

Contractor induction training should include important points from this standard for contractors working at any site where excavation work is in progress.

7.7 Contact

The contact for this document is the Corporate Safety Manager and Corporate SRP Champion. Clarification/Interpretation regarding this standard shall be referred to the Chairman, Site Rules and Procedures Subcommittee.

ANNEXURES

Annexure 1 – Typical Signs

ANNEXURE-I.docx

Annexure 2 - "RACI" chart – Roles & Responsibilities to implement this Standard.

ANNEXURE-II RACI.docx

Annexure 3 – Trench shoring – Minimum Requirements

ANNEXURE-III.docx

Annexure 4- Approximate Angle of Repose for Sloping of Sides of Excavation

ANNEXURE-IV.docx

Annexure 5 - Compliance audit Check List.

ANNEXURE-V.xlsx

Annexure 6 - Potential Hazards

ANNEXURE-VI.docx