

Excavation

Excavation work, including trenching, is a high-risk activity in construction projects. The primary hazard is cave-ins, which can lead to fatalities due to suffocation or crushing. It is critical to distinguish between excavations (any hole left in the ground after material removal) and trenches (excavations where the depth exceeds the width). Proper planning, soil classification, and support systems are essential to ensure worker safety.

Regulatory and Safety Standards

In Saudi Arabia, excavation work must adhere to national HSE regulations and, where applicable, the specific HSE standards set by NCC T&D clients. Key requirements include:

- Proper soil classification and testing.
- Use of engineered support systems for trenches deeper than 1.2 metres.
- Regular inspections and supervision by a competent person.

Soil Classification

The stability of excavation walls depends on the type of soil. Saudi Arabian regulations classify soil into four types, similar to international standards:

Type 1 Soil

Characteristics:

- Hard, very dense, and difficult to penetrate.
- Low natural moisture content and high internal strength.
- No signs of water seepage.
- Can only be excavated using mechanical equipment.

Type 2 Soil

Characteristics:

- Very stiff and dense, moderately difficult to penetrate.
- Low to medium natural moisture content and medium internal strength.
- Appears damp after excavation.

Type 3 Soil

Characteristics:

- Previously excavated soil or soil that is stiff to firm.
- Exhibits signs of surface cracking, water seepage, or low internal strength.
- Dry soil may flow easily into a conical pile.

Type 4 Soil

Characteristics:

- Soft to very soft, very loose, and sensitive to disturbance.
- Wet or muddy, with almost no internal strength.
- Exerts significant fluid pressure on support systems.

Determining Soil Type

- Conduct visual and physical examinations of the soil at the excavation walls and within a horizontal distance equal to the depth of the excavation.
- Classify the soil as the highest numerical type (most protective) if multiple soil types are present.

General Safety Requirements for Excavations (but not limited to the following).

Pre-Excavation Planning:

- Identify and mark all underground utilities (e.g., oil & gas pipeline, electrical, telephone, water) before excavation begins.
- Shut down or disconnect utilities that pose a danger during excavation.
- Obtained permit to the relevant third party and/or owner of the possible buried facilities. If possible and available, collect all the relevant official design/drawings of the locations.

Worker Safety:

- Ensure no worker enters an excavation that does not comply with safety regulations.
- Assign a competent person to supervise excavation activities.

Stability of Nearby Structures:

- If excavation could affect the stability of nearby buildings or structures, consult a qualified civil and/or structural engineer to prepare the appropriate precautionary procedures.

Water Accumulation:

- Keep excavations reasonably free of water to prevent instability.

Clear Workspace:

- Whenever feasible and practical, maintain a clear workspace of at least 450 millimeters between the excavation wall and any formwork or structure.

Barriers and Signage:

- In Saudi Arabia, the Saudi Building Code (SBC) and other international standards do not explicitly specify a fixed depth for requiring barriers but emphasize fall protection for any hazardous excavation. However, OSHA standards require guardrails or barriers for excavations that are 1.8 meters (6 feet) or deeper to prevent falls.
- The 1.2-meter rule is outdated and no longer considered a valid threshold for determining when barriers or supports are needed, as even shallow excavations can pose risks.
- For depths greater than 2.4 meters, it is common practice to implement more robust fall protection systems, but this is not a universal standard and may vary by project or client requirements.
- In summary, while 1.8 meters is the more widely accepted threshold for requiring barriers under OSHA guidelines, it is essential to assess site-specific risks and comply with local regulations like the SBC, which may have additional requirements.

Support Systems for Excavations

Support systems are required to prevent cave-ins and ensure worker safety. The type of support system depends on the soil type and excavation depth.

Types of Support Systems

Timbering and Shoring:

- Use high-quality, durable and good wood for sheathing, horizontal supports (wales), and cross braces (struts).
- Install sheathing vertically against the excavation walls and secure it with wales and struts.

Prefabricated Support Systems:

- Designed by an engineer and installed according to specifications.
- Suitable for excavations up to 3.6 metres deep in Type 1, 2, or 3 soil.

Hydraulic Support Systems:

- Designed to resist hydrostatic and earth pressures in Type 3 soil.
- Must extend to the bottom of the excavation and touch the excavation walls.

Engineered Support Systems:

- Required for trenches deeper than 6 metres or wider than 3.6 metres.
- Designed by an engineer and installed under their supervision.

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Installation of Support Systems

- Install support systems progressively in Type 1, 2, or 3 soil.
- For Type 4 soil, install support systems in advance of excavation where practical.
- Ensure support systems extend at least 0.3 metres above the excavation and are removed only immediately before backfilling.

Sloping and Benching

Sloping or benching excavation walls can eliminate the need for support systems in certain conditions:

- Type 1 or 2 Soil: Slope walls at a gradient of 1:1 (horizontal to vertical).
- Type 3 Soil: Slope walls at a gradient of 1:1.
- Type 4 Soil: Slope walls at a gradient of 3:1.

Excavation Safety Measures

Daily Inspections:

- Inspect excavation walls, support systems, and equipment daily.
- Document inspections and maintain records on-site.

Access and Egress:

- Provide ladders or other safe means of access and egress for workers.
- Ensure ladders are protected by the support system.

Housekeeping:

- Keep the area within 1 metre of the excavation edge clear of equipment, soil, and debris.
- Lower waste materials using chutes or other safe methods.

Emergency Procedures:

- Develop and implement emergency rescue procedures for excavation collapses.
- Train workers on rescue techniques and provide necessary equipment (e.g., shovels, air bags).

Additional Considerations for NCC T&D Projects

Given the high-risk nature of NCC T&D's operations, the following measures are recommended:

- Conduct pre-excavation surveys to identify soil conditions and underground utilities.
- Use real-time monitoring to detect soil movement or instability.
- Ensure all workers are trained in excavation safety and emergency response.
- Coordinate with local authorities and utility providers to ensure safe excavation practices.

For more information, refer to NCC T&D's relevant IMS procedures or consult our HSE Department for expert guidance and training resources aligned with Saudi Arabian regulatory requirements.

