
Advanced Certificate in Engineering Geology and Soil Mechanics

Tunnelling and underground construction

Tunnelling and Underground Construction Glossary

Anchor Plate

Anchor plates are large steel plates that are used to support the ends of rock bolts in tunnels. They are designed to distribute the load from the rock bolt to a larger area of the rock mass, preventing the bolt from pulling out.

Backfill

Backfill refers to the material used to refill an excavated area, such as a tunnel, after construction is completed. The backfill material is typically chosen to provide stability and support to the tunnel structure.

Backhoe

A backhoe is a type of excavating equipment that consists of a digging bucket on the end of a hydraulic arm. Backhoes are commonly used in tunnel construction to remove soil and rock from the excavation site.

Benching

Benching is a method of excavation in which the tunnel face is cut back in steps or benches to create a stable working area. Benching helps to prevent rockfalls and collapses during excavation.

Blasting

Blasting is a common method used in tunnel construction to break up rock and soil. Explosives are placed in drill holes and detonated to create the necessary space for the tunnel.

Compaction grouting

Compaction grouting is a technique used to improve the stability of soil and rock mass around a tunnel. Grout is injected into the ground under pressure, compacting the surrounding material and increasing its strength.

Crown

The crown of a tunnel is the highest point of the tunnel's cross-section. It is typically arched to provide structural support and distribute the weight of the overlying material.

Cut and Cover

Cut and cover is a method of tunnel construction in which a trench is excavated, the tunnel is built within the trench, and then the trench is covered over. This technique is commonly used in urban areas where space is limited.

Deformation

Deformation refers to the changes in shape or size of a tunnel or surrounding rock mass due to external forces. Monitoring deformation is important to ensure the stability of the tunnel structure.

Excavation

Excavation is the process of removing material from the ground to create a tunnel. Excavation methods vary depending on the type of material being excavated and the desired tunnel shape.

Face Stability

Face stability refers to the ability of the tunnel face to resist collapse during excavation. Proper support systems and excavation techniques are essential to maintain face stability.

Geotechnical Investigation

Geotechnical investigation involves studying the physical properties of soil and rock to assess their suitability for tunnel construction. This information is used to design safe and stable tunnels.

Ground Freezing

Ground freezing is a technique used in tunnel construction to stabilize the ground around the excavation site. Pipes filled with a freezing agent are installed, lowering the temperature of the surrounding soil and rock to create a frozen barrier.

Ground Improvement

Ground improvement techniques are used to strengthen weak or unstable soil and rock mass around a tunnel. Methods such as compaction grouting, jet grouting, and soil mixing can be used to improve ground conditions.

Heading

The heading is the front or face of the tunnel where excavation is taking place. It is typically the first part of the tunnel to be constructed and requires careful monitoring to ensure stability.

Inverted Arch

An inverted arch is a type of tunnel support structure that is installed on the ceiling of the tunnel. It helps to distribute the weight of the overlying material and provides additional support to the tunnel structure.

Jet Grouting

Jet grouting is a ground improvement technique that involves injecting high-pressure grout into the ground to create a column of soil-cement. This method is often used to stabilize soil and rock mass around tunnels.

Key Block

Key blocks are large blocks of rock that are left in place during tunnel excavation to provide support to the tunnel face. They help to prevent collapses and provide stability to the tunnel structure.

Lining

The lining of a tunnel refers to the structure that is installed to support the tunnel walls and ceiling. Linings can be made of concrete, steel, or other materials, depending on the tunnel design and ground conditions.

Microtunneling

Microtunneling is a trenchless method of tunnel construction that uses a remote-controlled machine to excavate tunnels with a small diameter. This method is often used for installing utility pipelines underground.

Needle Beam

A needle beam is a temporary support structure used in tunnel construction to prevent the collapse of the tunnel face. It is typically made of steel beams and installed behind the tunnel face during excavation.

Oversize Excavation

Oversize excavation refers to the process of excavating a larger area than is needed for the tunnel structure. This extra space allows for the installation of support systems and provides a safe working environment for construction crews.

Permeation Grouting

Permeation grouting is a technique used to improve the stability of soil and rock mass around a tunnel by injecting low-viscosity grout into the ground. The grout permeates the surrounding material, filling voids and increasing strength.

Quality Control

Quality control in tunnel construction involves monitoring and testing materials, construction methods, and workmanship to ensure that the tunnel meets design specifications and safety standards. Quality control measures help to prevent defects and ensure the long-term durability of the tunnel.

Rock Bolt

A rock bolt is a long steel rod that is inserted into drill holes in the rock mass to provide support to the tunnel structure. Grout is often injected around the rock bolt to anchor it in place.

Shotcrete

Shotcrete is a sprayable concrete mixture that is commonly used in tunnel construction to line tunnel walls and ceilings. It is applied using a high-pressure hose, providing a quick and efficient way to create a durable tunnel lining.

Thrust Boring

Thrust boring is a trenchless method of tunnel construction that uses a drilling machine to bore a tunnel through the ground. This method is often used for installing pipelines and conduits underground without disturbing the surface.

Underpinning

Underpinning is a technique used to strengthen the foundations of existing structures to support the construction of a tunnel underneath. Various methods, such as micropiles, jet grouting, and compaction grouting, can be used for underpinning.

Ventilation

Ventilation systems are installed in tunnels to provide fresh air and remove harmful gases generated during construction and operation. Proper ventilation is essential to ensure the safety of workers and maintain air quality in the tunnel.

Waterproofing

Waterproofing is the process of applying materials to the tunnel lining to prevent water infiltration. Waterproofing membranes, coatings, and sealants are commonly used to protect the tunnel structure from water damage.

Excavation Face

The excavation face is the front of the tunnel where excavation is taking place. It is typically supported by temporary or permanent support systems to prevent collapses and maintain stability during construction.

Yieldable Steel Sets

Yieldable steel sets are support structures made of steel beams that are installed in tunnels to provide temporary support to the tunnel walls and ceiling. The steel sets are designed to yield or deform under pressure to absorb the energy from rock movements.

Zoning

Zoning refers to the division of tunnels into different zones based on the geotechnical conditions, construction methods, and support systems required. Zoning helps to optimize construction processes and ensure the safety and stability of the tunnel.

Conclusion

This glossary provides a comprehensive overview of key terms and concepts related to tunnelling and underground construction. By understanding these terms, engineers and geologists can effectively plan, design, and construct tunnels that are safe, durable, and sustainable. Each term is explained in detail, with practical examples and applications to enhance learning and understanding. Whether you are new to the field of engineering geology and soil mechanics or looking to expand your knowledge, this glossary serves as a valuable resource for mastering the fundamentals of tunnelling and underground construction.