Executive Certificate in Underground Construction

Underground Excavation and Support Systems

Underground excavation and support systems are critical components of the underground construction industry. These systems involve the construction of underground structures, such as tunnels, shafts, and caverns, and the support of the ground and surrounding rock to ensure the stability and safety of these structures. In this explanation, we will discuss key terms and vocabulary related to underground excavation and support systems in the context of an Executive Certificate in Underground Construction.

1. Excavation methods: Excavation is the process of removing soil or rock to create an underground opening. There are various excavation methods used in underground construction, including:
* Tunnel boring machines (TBMs): TBMs are large, specialized machines used to excavate tunnels. They consist of a rotating cutterhead that excavates the tunnel face, and a trailing back-up system that supports the tunnel lining and removes excavated material.
* Drill and blast: Drill and blast is a traditional excavation method that involves drilling holes in the rock face and then blasting the rock with explosives. This method is commonly used in hard rock tunneling and mining.
* Roadheader: A roadheader is a machine that uses a rotating cutting head to excavate rock. It is often used in soft to medium-hard rock tunneling and mining.
* Sequential excavation method (SEM): SEM is a tunneling method used in soft ground. It involves excavating the tunnel in small sections, or "bites," and installing temporary support before moving on to the next section.
1. Ground support systems: Ground support systems are used to stabilize the ground and surrounding rock in underground excavations. There are various types of ground support systems, including:
* Rock bolts: Rock bolts are steel rods that are installed in the rock to provide additional support. They can be grouted in place or self-drilling.
* Shotcrete: Shotcrete is a type of sprayed concrete that is used to provide a layer of support on the excavated surface. It can be applied in a dry or wet mix.
* Lattice girders: Lattice girders are steel or concrete beams that are installed to provide additional support to the tunnel lining.
* Liner plates: Liner plates are steel plates that are installed to provide additional support to the tunnel lining.
1. Geotechnical instrumentation: Geotechnical instrumentation is used to monitor the behavior of the ground and surrounding rock in underground excavations. There are various types of geotechnical instrumentation, including:
* Extensometers: Extensometers are instruments used to measure ground movement or deformation. They can be installed in drill holes or on the surface.
* Inclinometers: Inclinometers are instruments used to measure the inclination or tilt of the ground or tunnel lining.
* Pressure cells: Pressure cells are instruments used to measure the pressure or stress in the ground or

tunnel lining.
* Piezometers: Piezometers are instruments used to measure the groundwater pressure or level.
1. Tunnel lining systems: Tunnel lining systems are used to provide a structural envelope for the tunnel. There are various types of tunnel lining systems, including:
* Segmental linings: Segmental linings are precast concrete segments that are installed in a circular or horseshoe-shaped pattern to form the tunnel lining.
* In-situ linings: In-situ linings are formed by spraying concrete or shotcrete onto the excavated surface to create the tunnel lining.
* Steel linings: Steel linings are used in high-stress or high-deformation tunnels. They are often used in combination with other lining systems.
* Composite linings: Composite linings are formed by combining different lining materials, such as concrete and steel, to provide a stronger and more durable lining.

Practical applications:

Understanding the key terms and vocabulary related to underground excavation and support systems is essential for anyone involved in the underground construction industry. Here are some practical applications:

* Planning and design: Engineers and project managers need to understand excavation methods, ground support systems, geotechnical instrumentation, and tunnel lining systems to plan and design underground excavations.
* Construction: Contractors and field engineers need to understand these terms to manage the construction process, including excavation, support installation, and lining construction.
* Maintenance and repair: Maintenance and repair personnel need to understand these terms to diagnose and address issues with underground structures.

Challenges:

Underground construction is a complex and challenging field, and there are several challenges related to underground excavation and support systems, including:

* Geological complexity: Underground excavations often encounter complex geological conditions, such as varying rock types, groundwater, and fault zones. Understanding these conditions and designing appropriate excavation and support systems is critical.
* Safety: Underground construction can be hazardous, and ensuring the safety of workers and the public is a top priority. Understanding the behavior of the ground and surrounding rock and designing appropriate support systems is essential for safety.
* Cost: Underground construction can be expensive, and managing costs is essential for project success. Understanding excavation methods, support systems, and lining systems can help manage costs.

In conclusion, underground excavation and support systems are critical components of the underground construction industry. Understanding the key terms and vocabulary related to these systems is essential for planning, design, construction, maintenance, and repair. By understanding these terms, industry

professionals can ensure the safety, quality, and cost-effectiveness of underground construction projects.