Video 7: Deep Underground Concept — Part 4: Big Underground Structures

The shaft's length of 100 m was not arbitrarily chosen. The drilling of a borehole of this length is not time-consuming and is relatively inexpensive. After the shaft is finished, its bottom at level -100 m is employed as a working platform for the next stage and is constructed similarly to the bottom in the first stage.

This figure shows various phases of such construction. Several groups of boreholes are drilled close to each other, and the widening of each hole is performed. A new set of vertical and horizontal boreholes of 100 m are drilled, and the procedure is repeated. Each level serves as a platform for excavation of the next level and transport of material, which enables modular construction. Groups of shafts can be connected by horizontal tunnels, constructed in the same way, at a slower pace, but this shouldn’t delay the construction of shafts on the next level.

According to our proposal, 100 days is required for a shaft with a depth of 100 m, which is equivalent to 1.5 cm daily advance of borehole widening. At this speed, and taking into account time required to drill boreholes, the structure can achieve a depth of 300 m a year or 3000 m in 10 years.

The result of this construction is a system of vertical shafts and horizontal tunnels, which does not substantially differ from deep mine systems. This kind of system only enables access and connection but are not particularly useful. We need bigger underground structures.

Large and stable underground structures can be constructed in favourable geological conditions in two ways.

In the first method, an underground structure of a circular or elliptic shape is constructed, as are the tunnels in these pictures, constructed in a traditional way. When using the Deep Underground concept, excavation phases should look like those in the next picture.

This picture shows the phases of the construction of an elliptical cavern. The first step is vertical drilling, and the second step involves widening of the drill holes into shafts. In the third step, a number of horizontal drill holes are created at different levels between the shafts. Half of the holes are drilled from one side, and rest of the holes are drilled from the other side and widened in length of underground cavern.

Cross-section profiles show the boundary of the desired cavern to be excavated and the boreholes. The next step is to widen some boreholes. The result is a honeycomb-like structure. The final step is exploding the remains and the construction of the final shape of the cavern.

If we remove the remains of the overlay section, the result is a well-elliptic shaped underground structure. As the remains of the rock are used to straighten the floor, heavy rock blocks do not have to be transported to the surface.

In the second method, several underground objects are constructed in close proximity and connected, with support pillars between two objects. This approach is very similar to building construction often seen in cities. There is a pillar or several pillars which support an arc.

The picture showcases the stages of constructing an underground structure using pillars. Horizontal boreholes are drilled in the initial stage, and tunnels are widened. The material between tunnels is removed, leaving only pillars. The final result is a spacious and functional underground structure.

Both methods ensure long-term stability, allowing for the construction of various stable underground structures.

The next videos will elaborate on how these structures can be utilized effectively.