Underground Mining of Metalliferous Deposits
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Lecture 43
Cut & Fill Stoping – II [Post Pillar Method]

POST PILLAR METHOD - APPLICABILITY

Post Pillar Cut-and-Fill stoping is adopted in such cases where:

- Ore body is wider (all other conditions being similar to Cut and Fill) – up to 60m in India
- Condition of hanging wall, stope back or induced stresses are such that ordinary methods of rock bolting and fill would not give sufficient support to the stope back.

Simply speaking, Post Pillar method is Cut & Fill with Pillars within the stope.

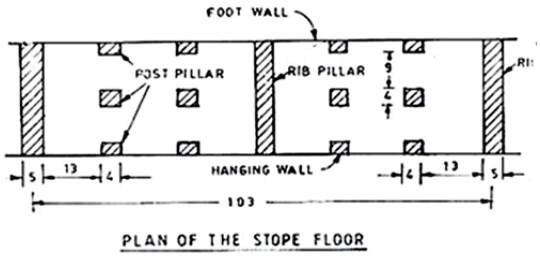

Figure 1. Section View

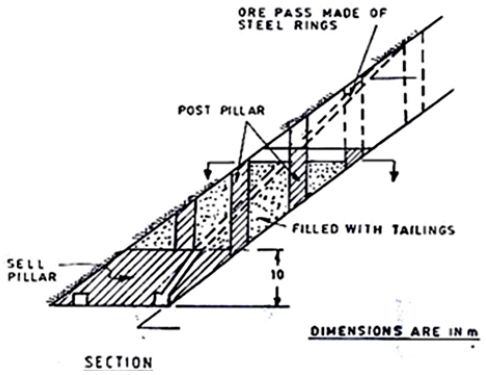

Figure 2. Plan of stope floor

Preparation

Sill level development

Sill level development starts from centre raise on both sides

Driven about (7m- 10m) above the lower drive and full width of the ore body is exposed for a maximum vertical height of 4.8m.

Pneumatic loaders with tilting buckets are very useful at this stage.

Roof above Sill is supported with rock bolts (1.5m × 1.5m)

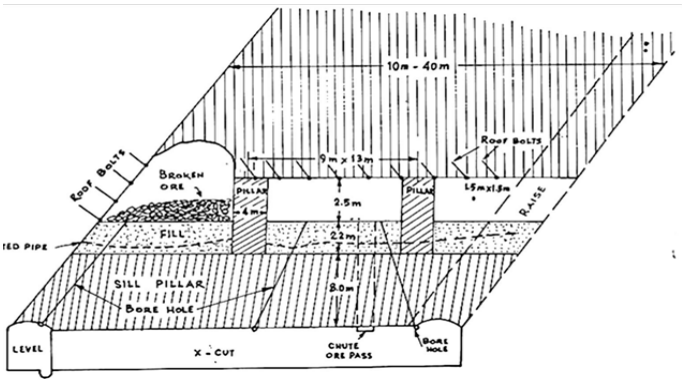

Figure 3. Cut and Fill with Pillars

Detailed method of working:

Two panels (~60m each) are prepared for different but synchronous operations:

- one for production and
- other being available for filling and consolidation.

The sill drive is heightened up to 4.8 m and pillars of 4m × 4m are left in a regular pattern. Pillars are left in regular pattern: say, 13m along strike and 9m

along dip. The pattern and size of pillar are to be decided by geotechnical analysis.

Cycle of operation:

Drilling:

The ore slice can be drilled in two different ways

- with horizontal stope holes,
- or with upward holes for which certain headroom is required between the back and the fill surface (usually 2-2.4m).

For drilling light rock drills (**Jack hammers**) are often used though **mechanized Jumbo drills** are also used. An advantage of upward drilling method is that large sections of the roof can be drilled without interruptions and large round can be blasted. 32mm ø 1.8m long holes. An advantage of upward drilling method is that large sections of the roof can be drilled without interruptions and large number of holes can be blasted at a time.

Blasting:

Blasting round consists of horizontal or inclined/vertical holes and charging the cartridge or slurries.

For even distribution of explosives inside the hole, ANFO charging with compressed air operated ANFO Loader is highly recommended.

ANTI-STATIC Protection. Stope must be well ventilated (Auxiliary fans)

ANFO (or **AN/FO**, for **ammonium nitrate/fuel oil**) is a widely used as industrial explosive. It consists of 94% porous prilled ammonium nitrate (NH_4NO_3) (AN), which acts as the oxidizing agent and absorbent for the fuel, and 6% number 2 fuel oil (FO) [Diesel].

Loading:

In highly mechanized stopes with hydra boom jumbos for drilling, the loading and transport are often done with **LHDs.** The average distance of travel is generally 60m but has also been as high as 240m. This has made it possible to space the ore passes far apart and save their cost. 0.76/1.5 cum electric LHDs transfer the broken ore into the ore passes from where it is hauled by mine cars with battery locomotive to the grizzly. More than 75% of world's underground mines use LHD for handling the muck of their excavations.

Support

1. Temporary supports with props are sometimes necessary at the face before permanent supports are installed.
2. Hangwall, Roof or back needs to be artificially supported with Rock Bolts.
3. Cemented/grouted Rock bolts are extensively used (1.5m × 1.5m)
4. Raisin capsules are used where first setting is required

Filling preparation

1. Ore passes are extended (Steel or Concrete)
2. Barricades are constructed where leakage possibilities are there
3. Machines are shifted to other panel for production
4. Pipelines are laid for supply and discharge of tailings/sand etc.
5. Perforated GI pipe network is extended all over the stope floor for fast and effective drainage of water from slurry fill materials.
6. Maximum height of the excavation is limited to 4.8m above the backfill.

7. Special drainage technique is required since the slurry (Tailing and water mixture)contains 30-40% water.
8. To provide proper drainage of the fill while it sets percolation drains (perforated pipes) are installed along the stope sill and decantation towers are maintained through the fill; Run-off-water must be disposed off in the drainage system on the haulage level below the stope.

Synchronous operation

- When filling is in progress in South panel, production must start from North panel (for example)
- In fact, drilling/blasting must progress for few rounds and stock of ore must build up in North panel for uninterrupted supply of ore from the stope
- Once the filling in S-Panel is completed, we need to allow the tailing to settle and dry
- And then the next CUT can start in South Panel. Now North Panel should be taken up for filling.
- This Cut and Fill cycle continues till we reach the crown pillar.
- Once both North and South panels are finished, the entire stope is filled and closed.

Advantages

- Moderate productivity (OMS)
- High rate of production
- Permits good selectivity, sorting possible
- Low development cost
- Adaptable to mechanization
- Recovery is high, low dilution
- Waste recycled as fill material

- Good safety record

Disadvantages

- Fairly high mining cost (Filling/Support wastage)
- Filling complicates cycle of operation causing occasional discontinuous production
- Ventilation is often poor
- Difficult to transport heavy equipment in inclined service raises
- Compressibility of fill causes some ground settlement issue
- Loss of ore in Pillars