Underground Mining of Metalliferous Deposits
Professor Bibhuti Bhusan Mandal
Department of Mining Engineering
Indian Institute of Technology, Kharagpur
Lecture 41
Cut and Fill Stoping – I

ARTIFICIALLY SUPPORTED STOPES

1. Shrinkage stoping
   - With pillar (post pillar)
   - Without pillars
   - With subsequent back filling
2. Cut-and-fill stoping
   - Horizontal cut-and-fill stoping
   - Post pillar cut-and fill stoping
3. Vertical Crater Retreat – with back filling
4. Square set stoping

CUT & FILL METHOD

Supported class of methods consists of those methods which require *substantial amount of artificial support* to maintain stability in exploitation openings and systematic ground control. One of the **supported class** in common use today is Cut and Fill method.

In this method the ore is excavated in horizontal slices starting from the bottom of the stope and advancing upwards. The broken ore is loaded and completely removed from the stope. When ore slice of the ore has been excavated the corresponding volume is filled with waste material. The filling is conducted integrally with the mining cycle and not after the completion of the entire mining operation.
The filling material can consist of waste rock from preparation, distributed mechanically and evenly over the stoped out area. In modern cut and fill method however the hydraulic filling method is normal practice. The filling material here consists of fine grained tailing from ore dressing plant (mill tailing) or sand mixed with water transported into the mine and distributed through pipe lines. When the water is drained off a competent fill with a smooth surface is formed.

APPLICABILITY

- This method can be used with steeply dipping ore bodies with reasonably firm ore.

Ore strength:	Moderate to strong, maybe less competent than with un-supported method.
Rock Strength:	Weak
Deposit Shape:	Tabular, can be irregular
Dip:	Moderate to fairly steep can accommodate flatter deposit if ore passes are steeper than angle of repose (> 40°)

Deposit Size: Narrow to moderate width [4-7 m in many cases]
Ore grade: Fairly high
Depth: Moderate to deep

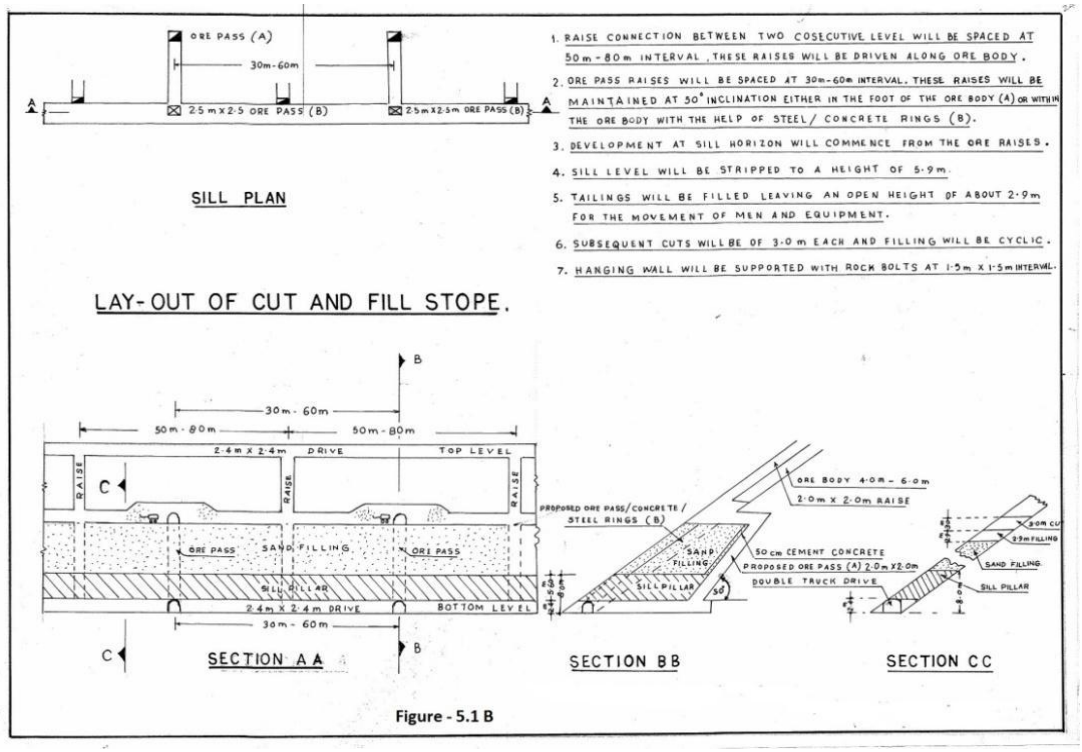

Figure 1. Layout of Cut and Fill stope

Preparation

Systematic development

I. Lateral development i.e. drives (2.4m×2.4m)
II. Connecting raises (2.2m×1.5m)

Notes: Sill drive for Sill Level can be started during raising at advanced stages

- Haulage drift along the stope
- Undercut of the stope usually 5 – 10m above the haulage drift

- Short raises for man-ways and ore passes from haulage drift to undercut

- Raise from undercut to level above for fill transport and ventilation.

The centre raise divides the stope in two panels For example, if the strike direction is roughly in N-S direction, we may call them North Panel & South Panel Width of the panels varies from 50-80m depending on the level of mechanization. Usually one Electric

Load-Haul-Dump (LHD) is deployed in each panel. Vertical spacing between two consecutive levels is around 100 ft. (~37.5m)

All three raises need to be equipped with Wooden Ladder ways with ribbed tor steel rungs.

Essential services like Compressed air pipe, water supply pipelines are laid through the raises. These service lines are extended or shortened as may be required during stoping.

Electric supply for LHD operation and lighting are provided from the service levels.

Roofs and sides (wherever required) need to be supported with rock-bolts and Timber props because these access paths are required throughout the life of the stope or even later.

Pipelines for Sand-stowing or Tailing filling (Backfilling) are laid from the top level. Usually HDPE (High density Polyethylene) pipes are used for our convenience.

Steel chutes are fixed at the bottom of the centre raise and the ore passes for loading of ores on to the mine cars.

Telephone communication wired/wireless is extremely important for effective supervision/maintenance/safety and accident management

Sill level development

- Sill level development starts from centre raise on both sides
- Driven about 5m above the ore 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)

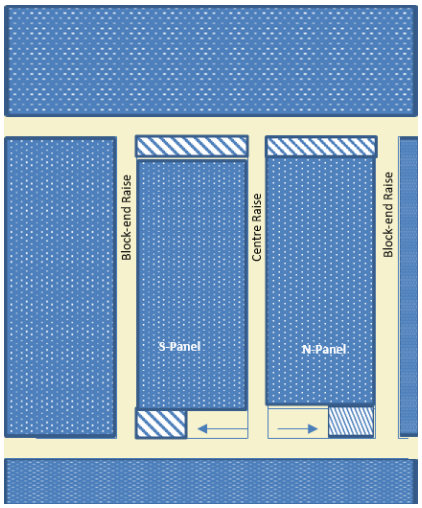

Figure 2. Longitudinal section projected on vertical plane