

# STRIPPING RATIO-SLOPE STABILITY & HAUL ROAD DESIGN

VEDA KUMAR

# What is stripping ratio

- ▣ SR is the decision maker between OC or UG options
- ▣ This has more economic importance than technical importance.
- ▣ This is the quantity of waste to be handled per mining unit quantity of mineral
- ▣ This is in other words  $Q$  of waste/ $Q$  of mineral

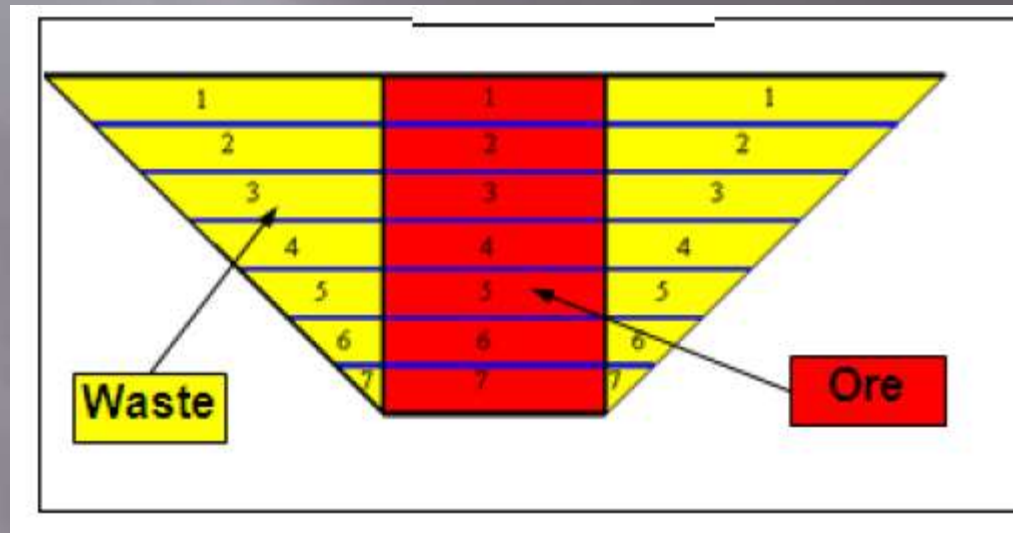
# What is waste

- ▣ Is it OB?
- ▣ Is it inter-bedded waste?
- ▣ Is it intercalated waste?

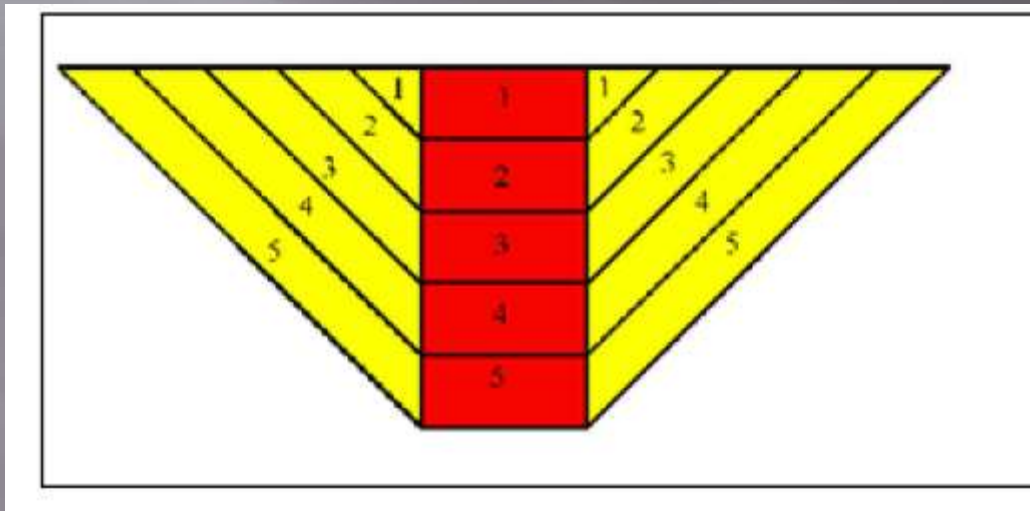
Please discuss

# Which waste to be considered?

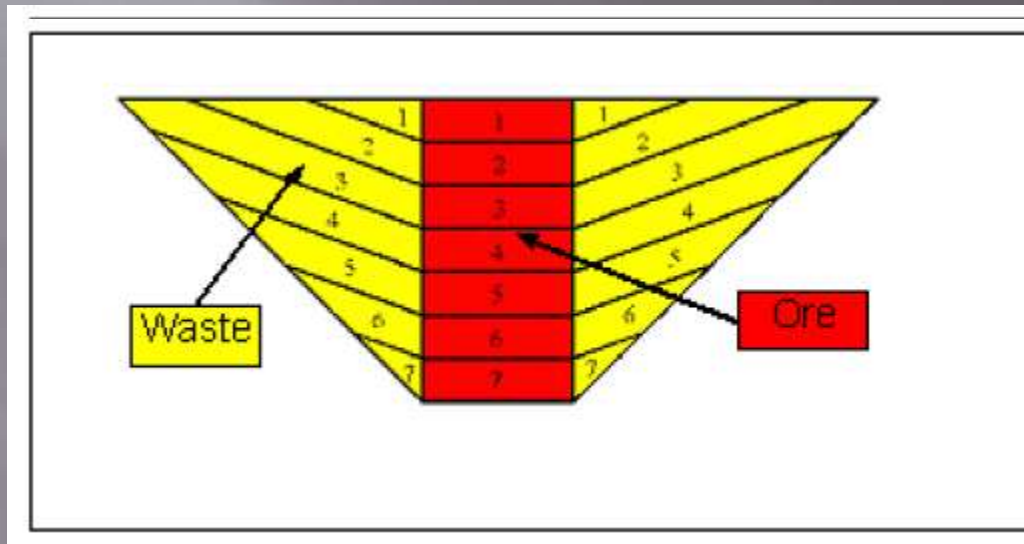
- ▣ Only OB and inter-bedded wastes are taken in to consideration
- ▣ The intercalated waste is considered only during quality planning
- ▣ For start-up during gestation only OB is taken
- ▣ For overall planning, total waste is considered



Reducing stripping ratio



Increasing stripping  
ratio



Constant stripping ratio

# Factors effecting stripping ratio

- ▣ Sudden change in geology
- ▣ Mineral policy
- ▣ Market fluctuations
- ▣ Change in thickness of the waste or ore



# Design of high wall slopes & stability

- ▣ What is design of high-wall slope?
  - High wall is the pit final wall that remains after completion of excavation
  - There are two types of slopes namely operating slope and final pit slope,
  - Operating slope always varies and final slope is a design criteria
  - Law needs high wall slope to be as near to the angle of repose as possible

# Economics of high wall angle

- ▣ Steeper high wall gives more production but less safety
- ▣ Gentle high wall gives less production and higher safety,
- ▣ A balance has to be struck between these two
- ▣ High wall design is a planning process that is done initially

# How is high wall design done?

- ▣ The pit outline is taken first
- ▣ Material properties are taken then,
- ▣ Buffer zone or other safety margins are left
- ▣ Slope line is drawn down
- ▣ Reserves are calculated accordingly,
- ▣ Now slope is varied again geometrically
- ▣ Quantity regressions are drawn
- ▣ Finally compromise is arrived between safety and production

# Factors that affect slope angle?

- ▣ Material property i.e. matrix (both size and shape)
- ▣ Properties of contact zones,
- ▣ Hydro-geology of the area
- ▣ Existence of geological disturbances,
  - Faults, folds and joints mainly.

# Types of slope failure



Plane failure



Wedge failure



Circular failure



Toppling failure

# How do different failures occur?

- ▣ Plane failure takes place due to geological disturbances.
- ▣ Wedge failure takes place due to intersection of weak planes. Generally less common
- ▣ Circular failure is very common in dumps.
- ▣ Toppling failure takes place in hard toe and soft crest conditions.

# Factors effecting slope stability

- ▣ Final pit slope angle,
- ▣ Irregular drainage pattern leading into cracks
- ▣ Back break extensions due to blasting
- ▣ Failure due to vibration
- ▣ Overhang formation/ undercut formation
- ▣ Forming benches parallel to the weak plane
- ▣ Terminating just before contact zone

# What we can do?

- ▣ Check the sufficiency of waste dump,
- ▣ Check the depth or height of final excavation.
- ▣ Check the final pit slope angle/ or ask
- ▣ If it is more than 60 to 75 degrees (exception colour granite) ask them to re-adjust,
- ▣ Check as geologists, the general dip and discourage the formation of benches parallel to the strike.
- ▣ Best attack is perpendicular to strike
- ▣ If parallel to strike is inevitable, attack in the direction of dip



Any questions?

Thank you