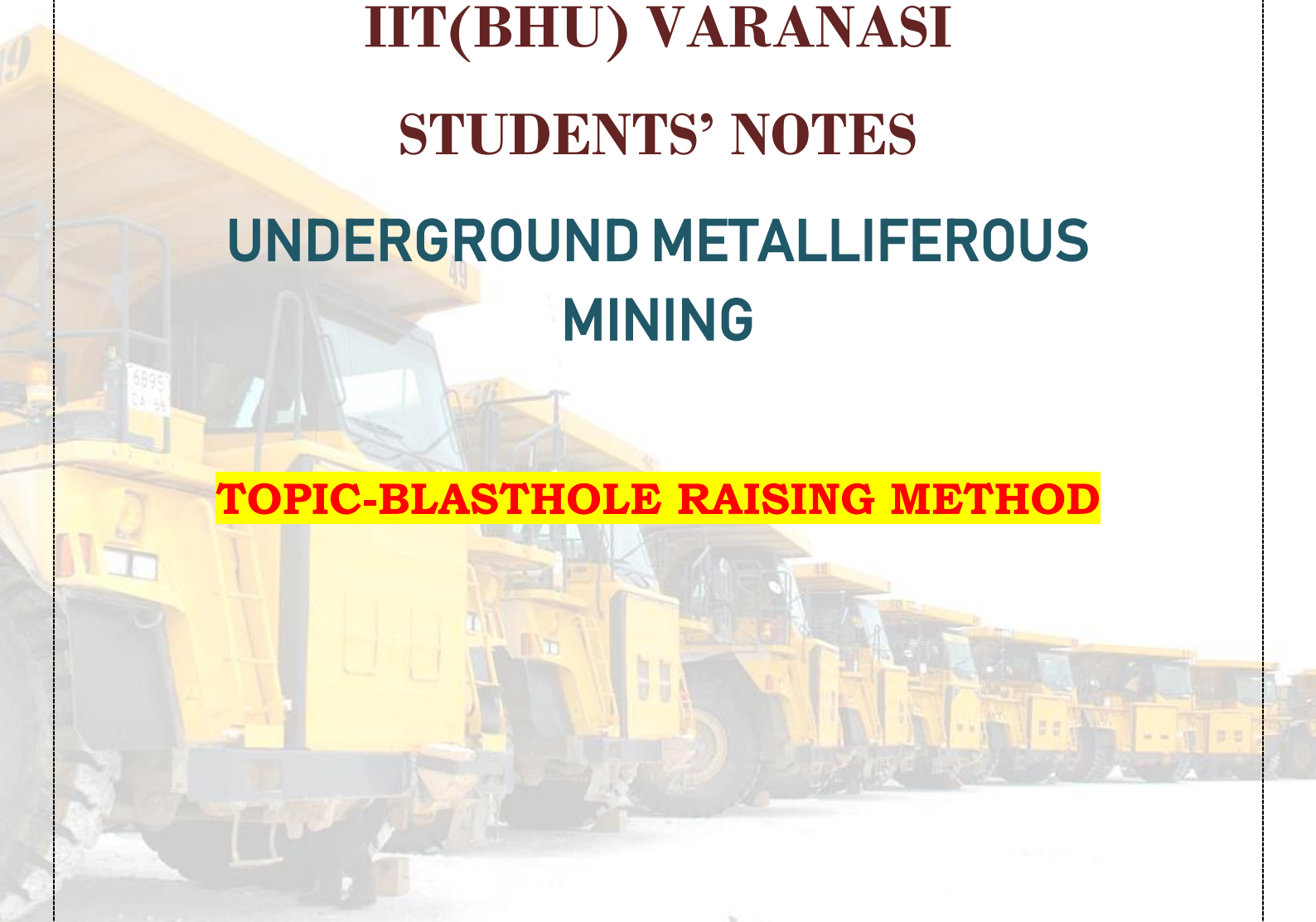
IIT(BHU) VARANASI

STUDENTS' NOTES

UNDERGROUND METALLIFEROUS MINING

TOPIC-BLASTHOLE RAISING METHOD

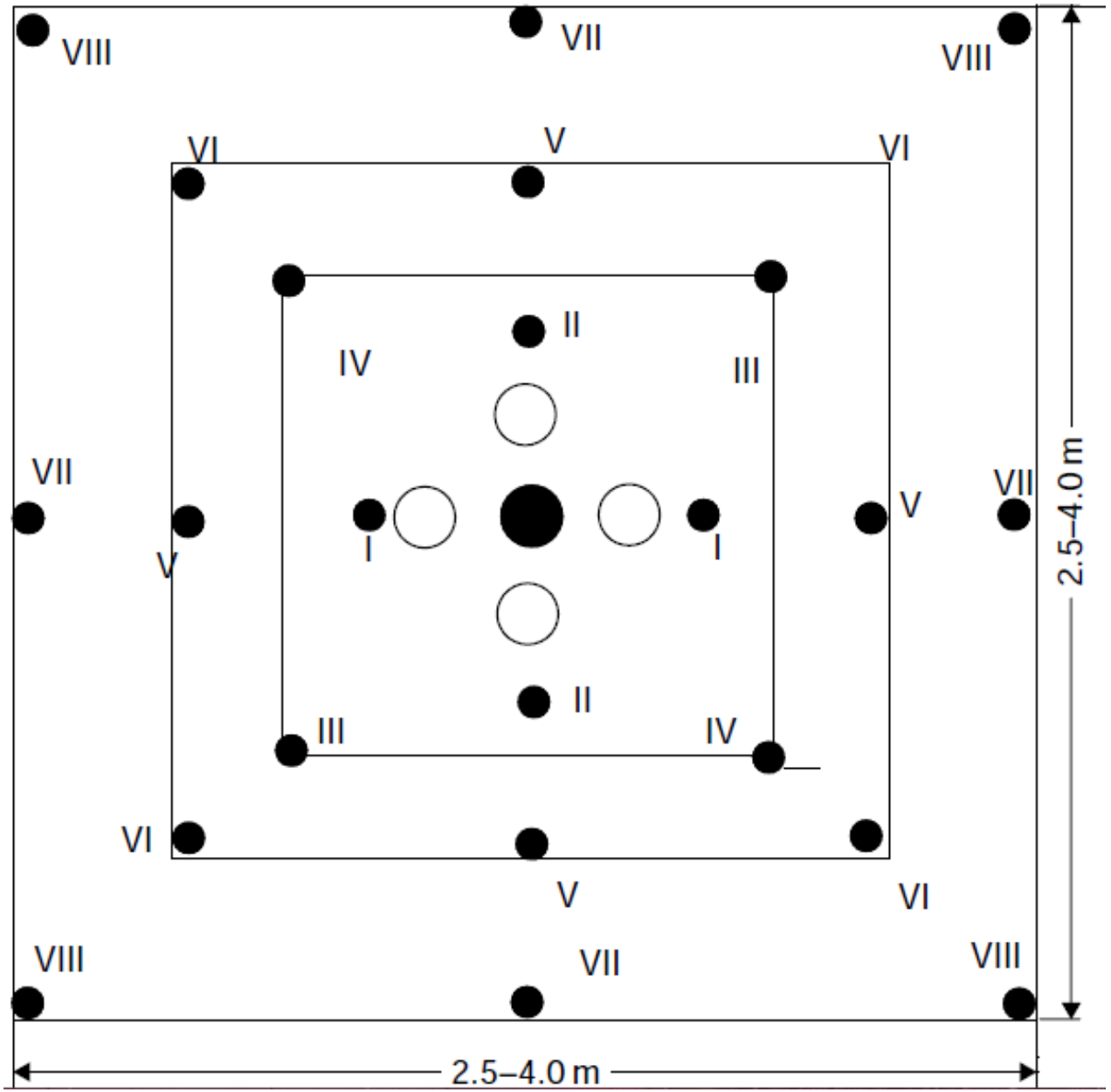


BLASTHOLE RAISING METHOD

LONG-HOLE RAISING

- Long-parallel holes
- Cylindrical or burn cut pattern
- Hole length and inclination
- Both level should accessible
- Drilled from top level to bottom

- *Marking the raise*
- *Equipment installation*
- *Drilling*
- *Raise correlation*



- *Blowing and plugging the holes*
- *Charging and blasting*
- length of round that is usually, 2.5 to 3 m
- stemming material
- explosive ANFO with suitable primer/booster
- delay detonators

Limitations

- This technique can be applied only if raise site can be accessed from both the levels.
- Raises upto 40 m lengths and 45° inclinations can be driven.
- Accurate drilling and proper blasting is the key to the success of this method.
- Disturbed ground with joints, fissures etc. may result frequent jamming of drill rods and bits.

Advantages

- *Safety*
- *Productivity*
- *Better working conditions*
- *Better raise configuration*
- *Flexibility and simplicity*
- *Economical*

BLASTHOLE RAISING METHOD

DROP RAISING

- It is advance version of long hole raising tech.
- vertical crater retreat (VCR)
- crater theory are spherical or its geometric equivalent
- stressed zone of elliptical shape

VCR concept

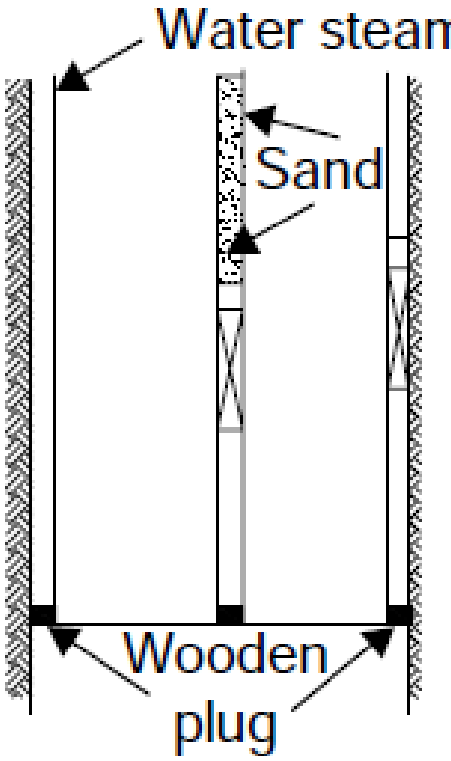
- *The term 'crater' in blasting terminology is applied for creation of a surface* cavity in a rock mass as result of detonating an explosive charge into it.
- It gained importance in surface blasting operations, and in the recent past, in underground blasting operations too.

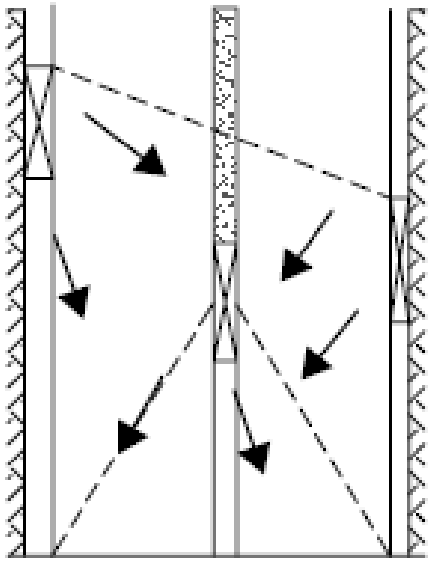
- Spherical charge is defined as the one which is having a length to diameter (L: D) ratio to 1:4 or less, and up to, but not exceeding a L:D 6:1.
- Thus, for holes of 165 mm dia. a charge of 990 mm length would constitute a spherical charge.

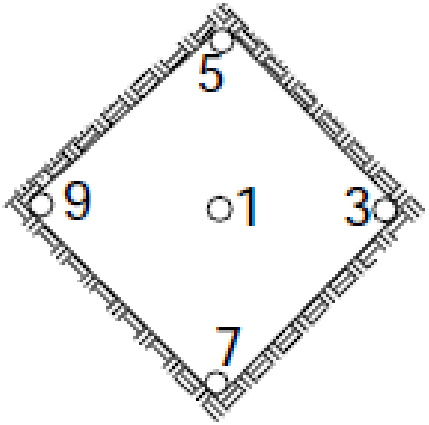
- The charge is fired in the upward direction, enabling crater to form towards a horizontal free face.
- In the underground mining , a spherical charge is blasted in the down ward direction towards a free face.
- The blasting operation when carried out in this manner, the method is known as Vertical Crater Retreat (VCR).

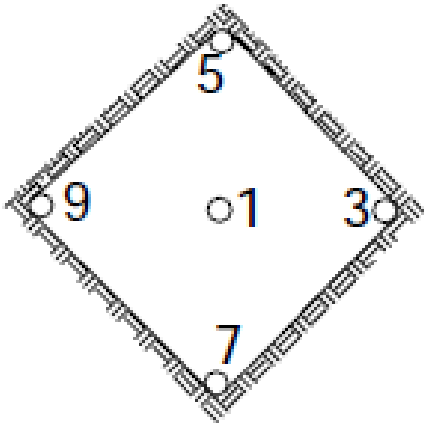
- A crater is consists of 5 holes, one at the center and rest four at the corners of a raise.
- Crater theory is valid for the central hole only, and for the rest of the holes, the charge depth increases from 10–20 cm between each hole,

Charge length, $l = 6 \, x \, d$ d is big-blast-hole diameter in mm

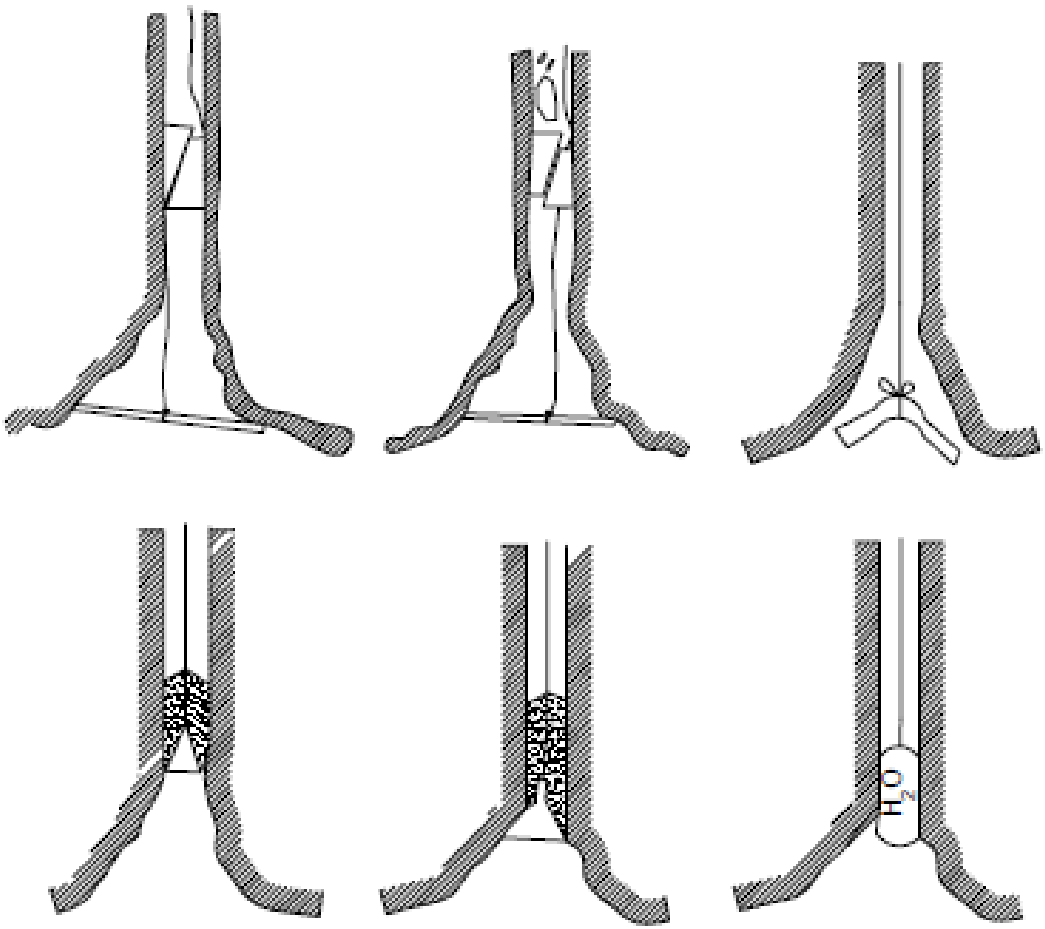








Techniques to plug bottoms of big-blast holes



Optimum charge depth is 50% of the critical depth; $L_{opt} = 0.5 \times L_{crit}$

$$L_{crit} = S \times Q^{1/3}$$

Charge weigh $Q = 3 \times d^3 \times \pi \times \rho / 2$ (in kg);
ρ explosive density in gm/cc

Thus, $L_{opt} = 0.5 \times S \times Q^{1/3}$

S is the Strain Energy Factor usually 1.5 but depends upon explosive and type of rock.

- *Drilling: D*own-the-hole (DTH)
- *Blocking the blast holes*

  As in the conventional crater formation the charge covers the bottom of hole for some length and rest of the hole length remains empty.

- Inverting this figure or the scenario, it will reveal that the charge should be placed at a certain height (which can yield the desirable results) from the free face, and hence, blocking the hole at a certain height above the free face is essential.

- *Blasting:* amount depends upon its density and ratio of hole dia. to length (spherical charge)
- For example for a 165 mm dia. hole, the charge amount of an explosive of 1.40gm/cm3 density works out to be 27.2 kg;
- Hence, as per this calculation half the weight of the explosive is first dropped or charged, then booster primer with proper delay is lowered down.
- The rest of the explosive i.e. the other half is then charged. The hole is then stemmed, for a length of 1–2 m or so, using suitable material.
- The same procedure is repeated while charging rest of the holes.

- *Performance:*

- *Scope, advantages and limitations:*