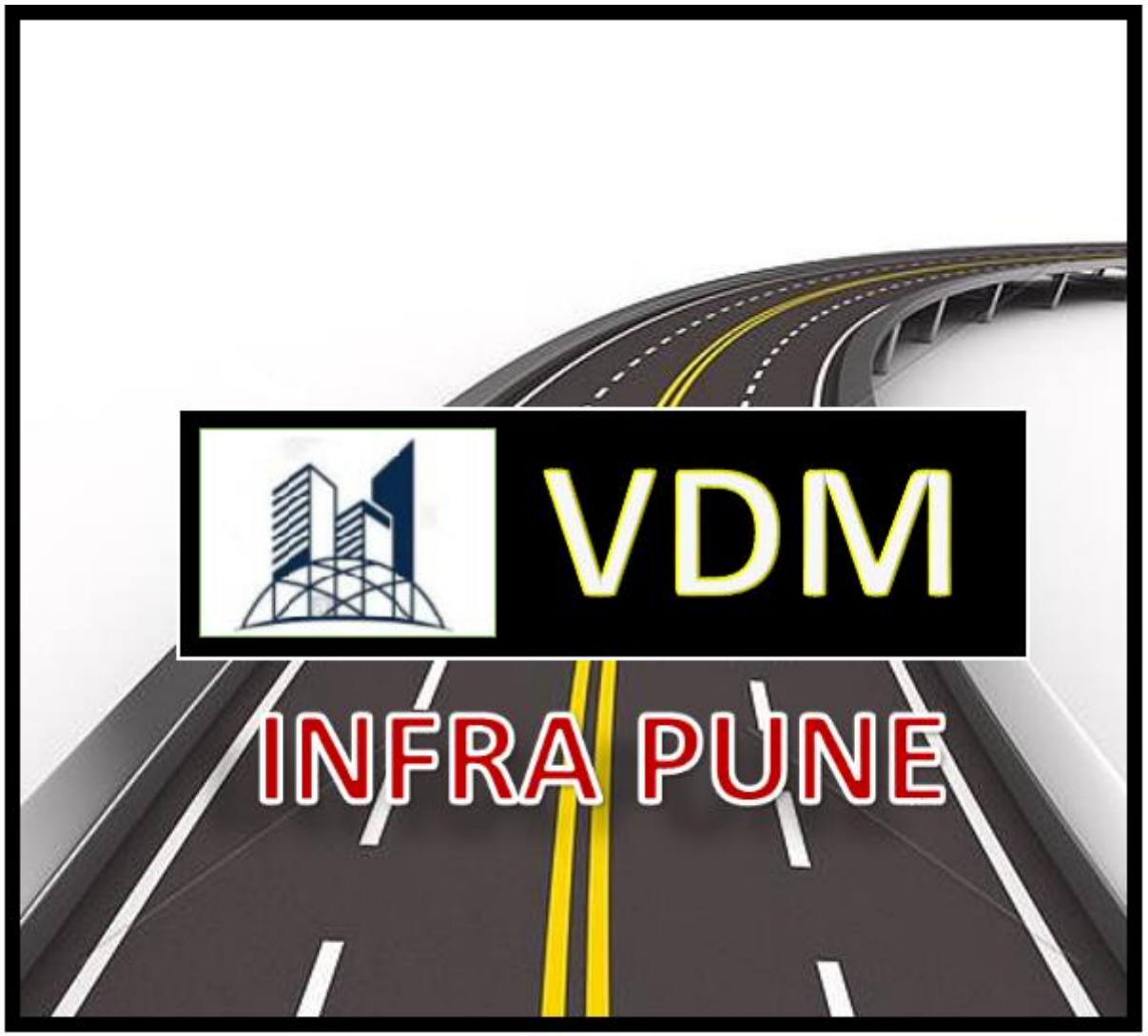

VDM
INFRA PUNE

BORE BLASTING

- **Blasting** means explosion. Blasting is done to break the hard rock coming in the way of any project. In Railways, we need blasting to make room for proposed alignment in rocky region.As the site may be in the vicinity of human population and near Railway track, disappointment of public and safety of track are apprehended due to air blast and sound. Hence blasting in controlled way is preferred.

Explosives

- A solid or liquid substance or mixture of substances, which on the application of suitable stimulus to a small portion of the mass, is converted into other more stable substances, largely or entirely gaseous, with the development of heat and high pressure in a very short interval of time.

Use of Explosives

- Military purposes
- Mining
- Civil engineering
- Agriculture

Blasting Operation

- Conditions effecting on blasting operations,
- Explosive parameters
- Charge loading parameters
- Rock parameters

Controlled Blasting in Open Cut

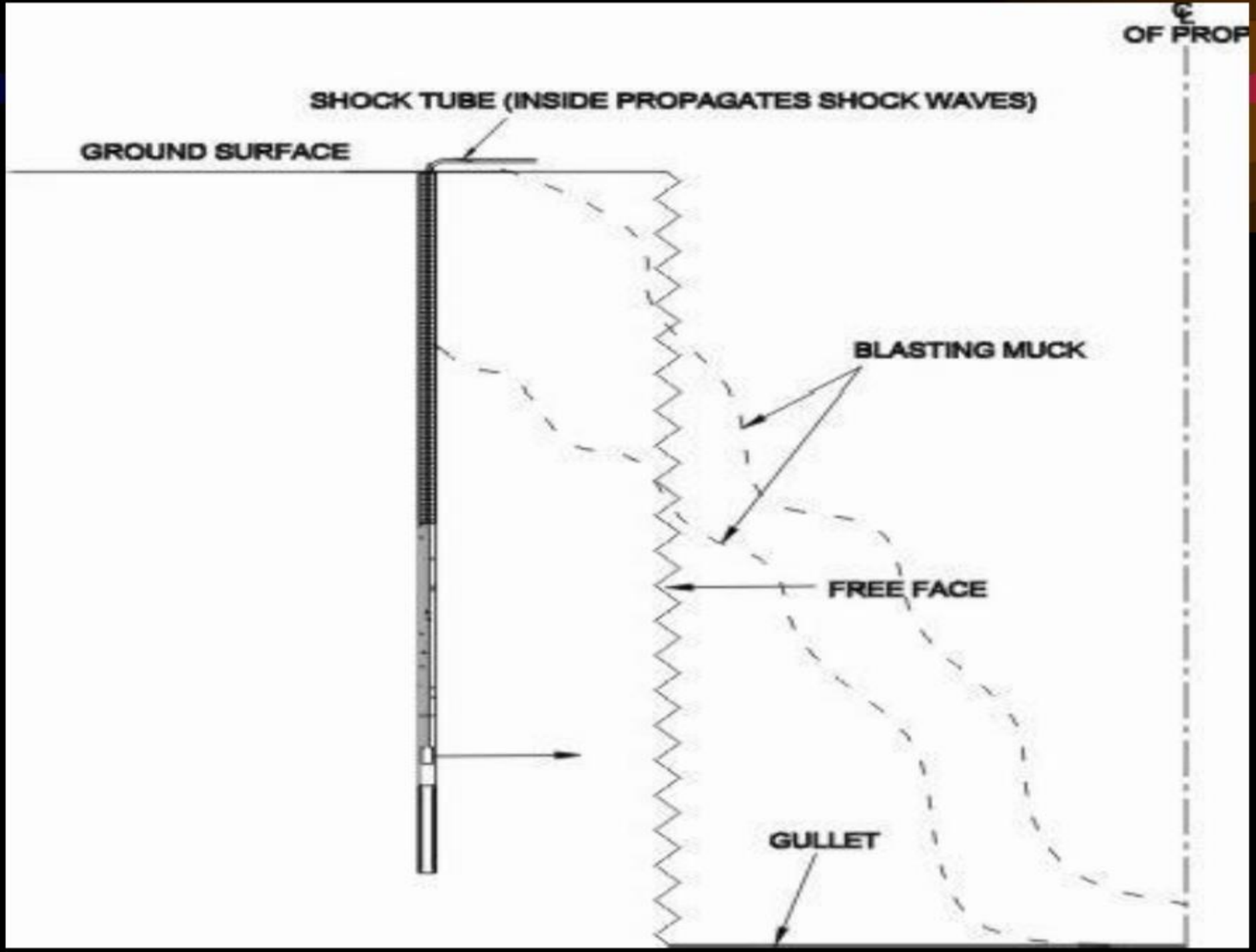
- Use non electric detonators
- Bottom initiation
- Free face
- Burden
- Spacing
- Stemming
- Delay detonators
- Pre-splitting
- muffling

Non-Electric Detonators(Nonel)

- These detonators are detonated by shock wave which travels through the tube.
- There is huge reduction in the Air Blast. The noise created has adverse effect on the peoples living in adjoining locality. The noise may create fear and resentment among the local people against the Project Work and which may invite opposition from the local people. Therefore controlled blasting should ensure reduction in the air blast.
- Use of Nonel shock tube in place of detonating cord(D- cord) for the detonation of blast hole ensures reduction in the noise/air blast.
- EXCEL is the non electrical detonators available in Market.

Bottom Initiation

- Both Electric and non electric detonators ensures bottom initiation, i.e. detonation takes place at the bottom of blast hole.
- For bore blast(Hole dia-100mm) having depth 4m to 8m the nonel shock tube is required to be used.
- When detonation takes place at the bottom, the rock between the blast hole and free vertical face get displaced horizontally. This also creates the space for the displacement of balance rock and thus flying of rock can completely avoided.
- The blasting with bottom initiation and free face is just like cutting of cake except displacement starts from bottom towards the ground surface.


℄
OF PROP
SHOCK TUBE (INSIDE PROPAGATES SHOCK WAVES)
GROUND SURFACE
BLASTING MUCK
FREE FACE
GULLET

Free Face

- The availability of Free vertical face for blasting is the most important factor in any type of blasting. The availability of free face has following advantages-

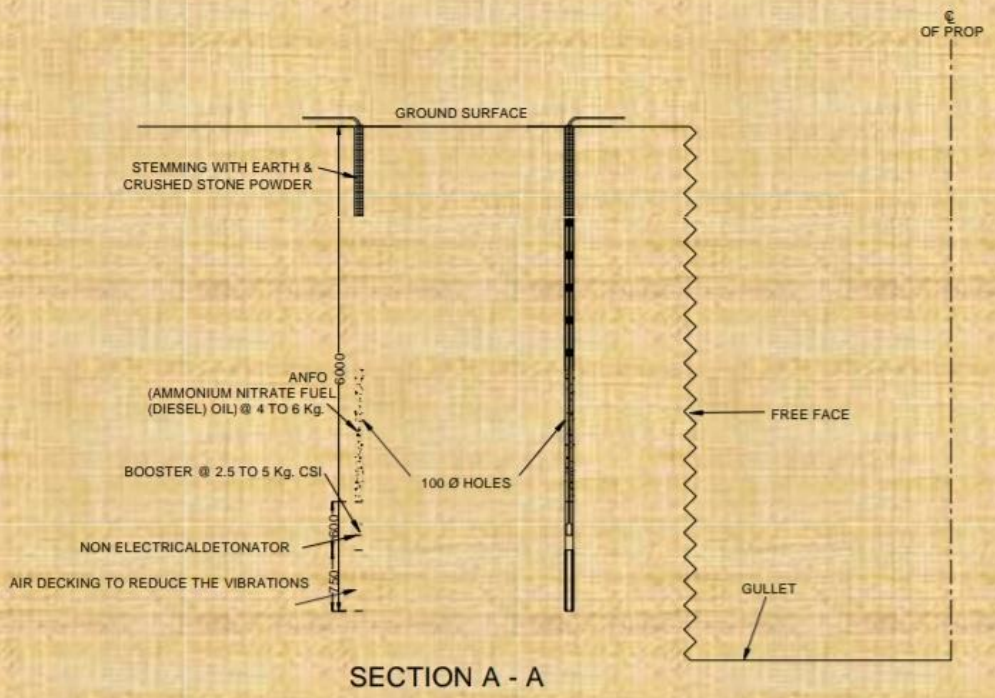
1) Increase in productivity in term of length of drilling per m3 and blasting material in terms of kg perm3.
2) The flying of rock always takes place towards the direction where there is lesser load i.e. burden. Therefore free face available gives the weaker plane for the displacement of rock. Thus in case of vertical free face the movement of rock is horizontal. Hence rock fly is avoided.
3) Free face for 2nd and subsequent rows is obtained by use of delay system in between successive rows. For open cut short delay detonators are used.

Burden

- The distance between the free face and the first hole/row of hole is called as burden. The burden should be designed by field trials.
- The distance between two rows of blast holes is also called as burden.
- If burden is more it will defeat the very purpose of free face and will result in fly of rock from ground.
- The burden is always less than the spacing i.e. the distance between two holes in same row. In practice the burden of 0.6m for 32mm dia blast hole and 2 to 2.5m for 100mm dia blast hole may be adopted.

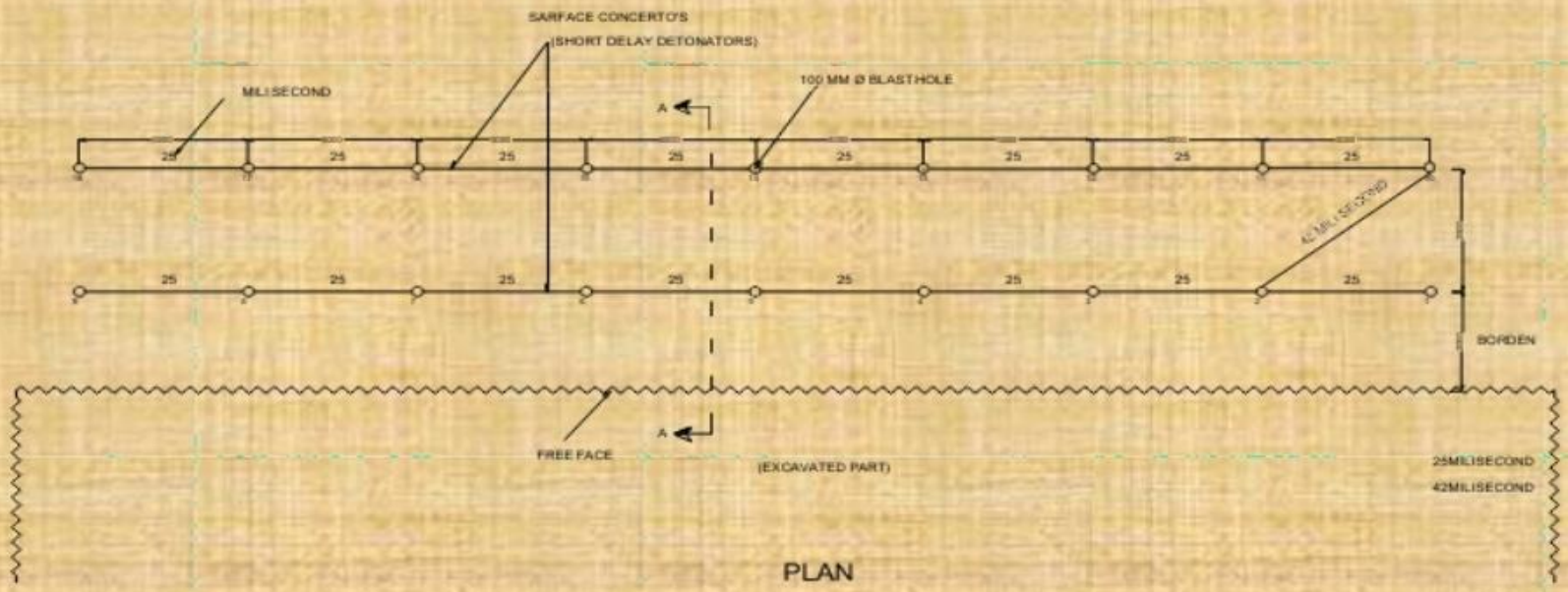
Spacing

- The distance between the individual hole in a row is called spacing. The spacing is measured parallel to free face.
- The spacing is kept about 1.2 to 1.3 times of burden.
- The purpose of keeping spacing more than burden is to direct the blasting forces towards the free face and avoid fly rock.


℄
OF PROP
GROUND SURFACE
STEMMING WITH EARTH &
CRUSHED STONE POWDER
6000
ANFO
(AMMONIUM NITRATE FUEL
(DIESEL) OIL) @ 4 TO 6 Kg.
BOOSTER @ 2.5 TO 5 Kg. CSI
100 Ø HOLES
FREE FACE
NON ELECTRICALDETONATOR
AIR DECKING TO REDUCE THE VIBRATIONS
GULLET

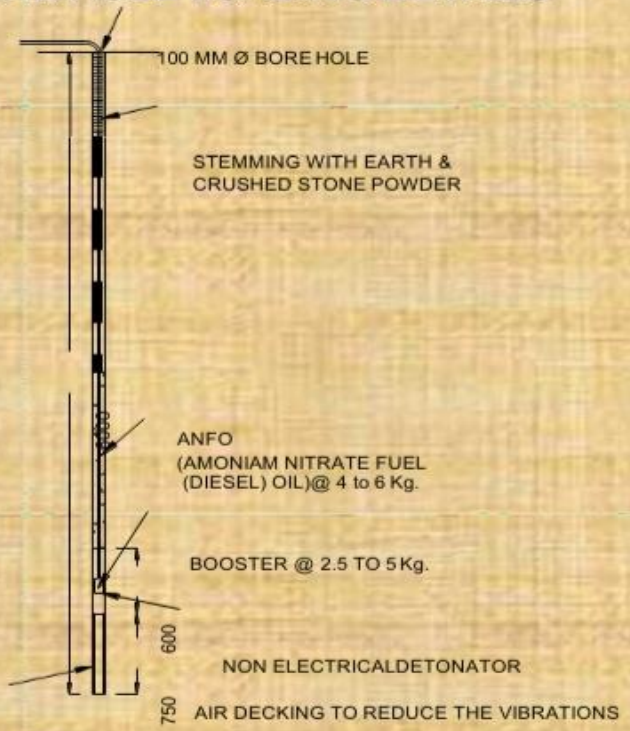
SECTION A - A

DRILLING PATTERN FOR OPEN CUT



PLAN

SECTION OF BORE HOLE LOADING DETAILS



Stemming

- The stemming of the blast hole is necessary to ensure confinement of the blasting materials and the gases(fumes) produced after the blasting. Generally stone dust, fine earth, sand, clay may be used as stemming material. Minimum length of stemming should be equal to spacing of blast holes.
- In any case stemming should not be less than 20 D of blast hole.

Delay Detonators

- The vibrations are controlled by three methods

1) Use of delay detonators:- the quantum of vibrations depend upon the charge per delay i.e. the quantity of explosives detonated at a time. To reduce charge per delay, short delay detonators/relays are used. The connections between the every hole is done such that only one hole is blasted at a time. Minimum delay of 8 miles second is required in each hole. The use of short delay ensures reduction in vibration. At the same time the blasting energy of each hole is compounded for the displacement of rock.

2)The delay should always be designed such that the next hole is blasted before the cracks from the earlier hole are propagated. Hence unnecessary long delay may result misfire by propagation of cracks and escape of fumes.

3) Air decking:-Leaving voids at bottom or in-between the blasting material is called air decking. The vibrations are reduced by Air decking.

Air decking can be done by use of PVC pipe, bamboo etc.

Short Delay Detonators

- The short delay detonators are available with following delays,
  - 18millisecond
  - 25millisecond
  - 42millisecond
- The short delay detonators are also called surface connectors.

Pre-Splitting

- This is the methodology of controlled blasting in which the area which is required to blasted is separated by adjoining ground by drilling of blast hole in one line as per the periphery. Only one row of blast holes is drilled. The spacing of blast holes and charging is such that after blasting the vertical crack is developed along the line in which the holes are drilled. Thus the ground to be broken is separated from the adjoining structure. Pre-splitting ensures creation of the weaker plane which defines the blasting area and avoids propagation of vibrations beyond this line.

Muffing

- After the connection of blast holes the area shall be covered by wire mesh/conveyor belts and sand/earth bags. Initially while creating free face in existing ground this arrangement is must. Once the vertical face is prepared, the fly of rock is controlled by correct design of controlled blasting in terms of charging, delay, burden, spacing etc.

Over Break Control

- Contracts which call for the rock excavations commonly contain a penalty clause for unbroken rock left inside a certain gauge line near the nominal perimeter of the excavation; On the other hand whether the excavation is to be lined the contractor may have to pay for the extra concrete required where the over break has occurred. Consequently it is important that the walls of excavation be as smooth and as close to the nominal gauge line as possible.

Used

- The controlled blasting for open cut was adopted in Kurdwadi–Latur section in approaches of Usmanabad Tunnel of **C. Rly.** The excavation of about 2 Lakhs M^3 was carried out in the vicinity of residential area (up to 50m distance)safely.
- The controlled blasting is also economical as quantity of blasting material as low as 0.2 to 0.4 Kg/M^3 of rock blasted. Only difference is Nonel shock tube is used in place of D – cord.

Explosive Used

- (ANFO) Ammonium Nitrate Fuel(Oil)
- Booster Slurry (Blasting agent)

Advantages of Short Delay Blasting

- The advantages of **Short-delay blast** over Instantaneous blast are:-
- Reduction of ground vibration.
- Reduction in air blast.
- Reduction in over break.
- Improved fragmentation.
- Better control offly - rock.

Conclusion

- Framing of the contract shall not be done simply by mentioning the controlled blasting but it should include,
- Type of explosives to be used.
- Tentative blasting pattern.
- The payment may be related to 1) length of blast holes per cum. 2) penalty for over break etc.
- By use of controlled blasting technique long term safety of the railway cuttings can be achieved.

THANK YOU
FOR YOUR
VALUABLE TIME

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