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# OBJECTIVES OF CONTROLLED BLASTING

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- To prevent over and under fragmentation
- To reduce ground vibrations
- To reduce noise
- To reduce dilution/waste of ore
- Reduce fractures within remaining rock walls
- To confine the blasting area
- To reduce flyrocks

# TECHNIQUES OF CONTROLLED BLASTING

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- Line Drilling
- Trim (cushion) blasting
- Smooth (contour) blasting
- Pre-splitting
- Muffle blasting
- Precise delay intervals
- Optimizing the parameters of blast design

# LINE DRILLING

- Heavily charged holes (away from the periphery) which provides the primary blasting is termed as the primary holes or production holes
- Uncharged holes are drilled along the periphery of the blasting zone
- Spacing between these holes is kept around 2-4 times the hole diameter
- These uncharged holes causes some of the shock waves to reflect
- Lightly charged holes adjacent to the uncharged holes are called buffer holes (50% less explosive than primary blast holes and 50-75% closer as compared to them)
- This technique gives maximum protection to the host rock
- It is costly, as the no. of holes to be drilled is too high

# TRIM (CUSHION) BLASTING

- It consists of single row of blast holes along the periphery of the blasting zone
- The holes are of larger diameter (2 – 4 inch)
- Holes are loaded with light charge and fired after the main excavation is removed
- It is simple and economical, as the no. of holes drilled are less (spacing between them is more)

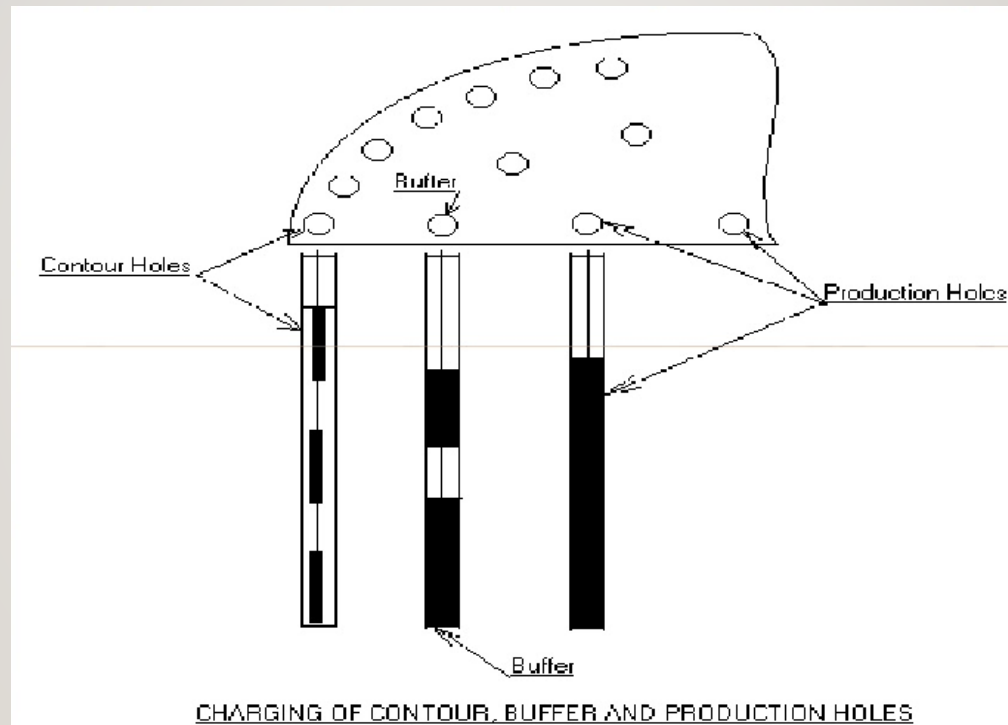


# SMOOTH (CONTOUR) BLASTING

- Contour holes are drilled along the neat excavation line and are lightly loaded than the buffer and production holes
- Spacing is kept closer than buffer and production holes
- The contour holes are fired simultaneously to produce an excavation contour without fracturing the adjacent rocks
- Generally, 10-12 times hole diameter in medium to tough rock and 5-6 times hole diameter in soft rock, are kept as spacing

# CHARGING FOR SMOOTH BLASTING IN TUNNELING

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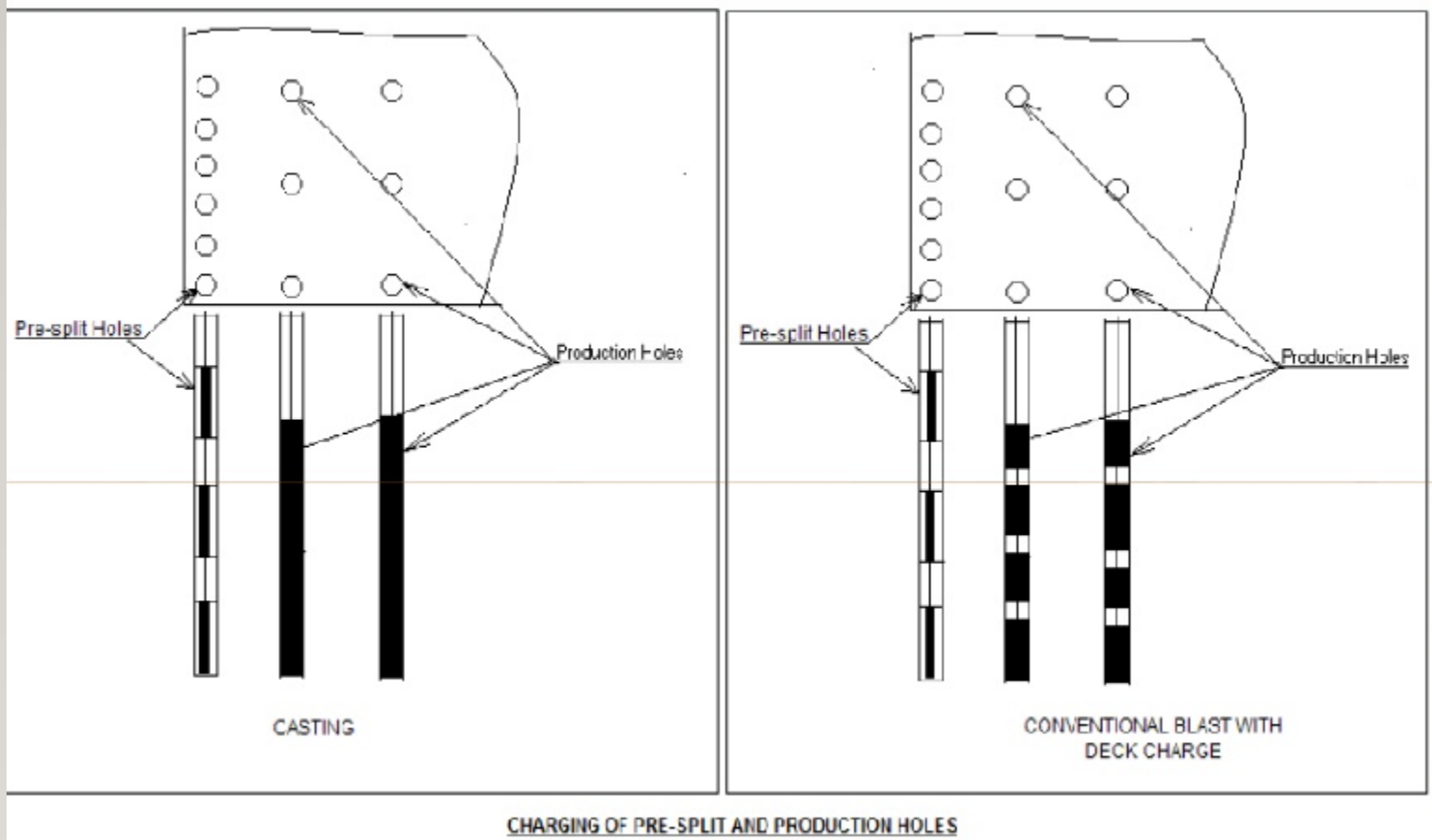


# PRE-SPLITTING

- Primarily used in quarrying
- Lightly charged holes are fired along the periphery to generate cracks, prior to production blasting
- Cracks form a plane of discontinuity
- Some of the shock waves get reflected, thus, hindering the ground vibration henceforth



# CHARGING OF PRE-SPLIT AND PRODUCTION HOLES



# MUFFLE BLASTING

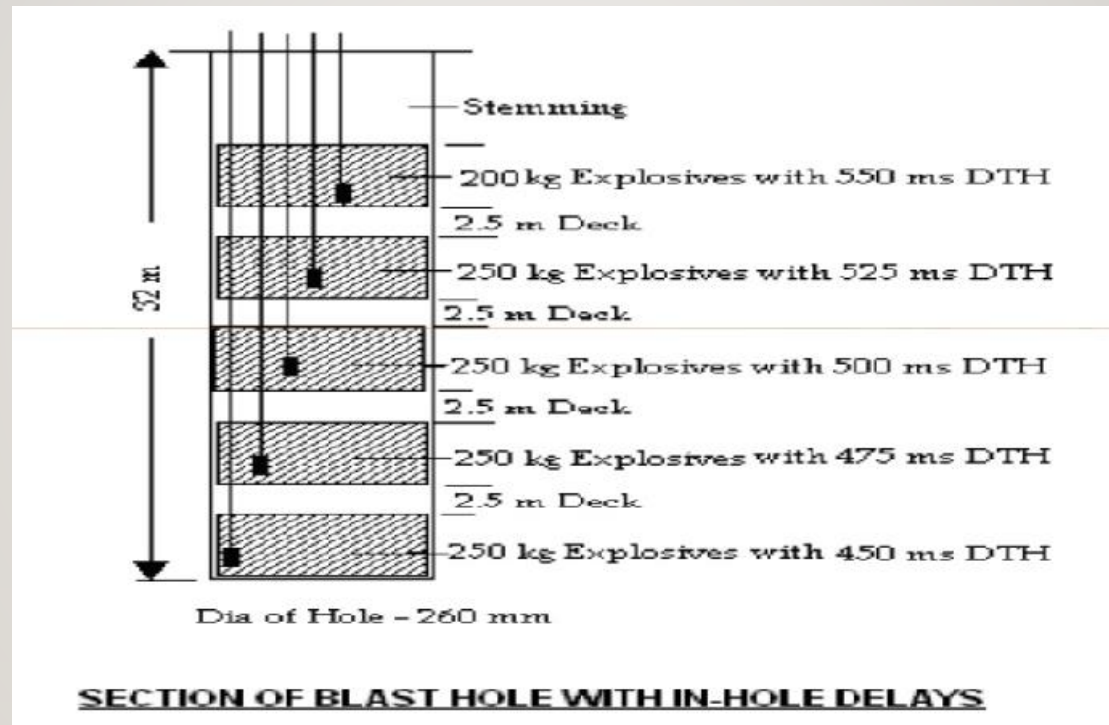
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- Mainly employed to tackle flyrocks
- Based on the principle of covering the blasting zone
- Wire mesh or mat is laid on the blasting zone
- Sand bags (40 – 50kg) are kept over the mesh/mat at an interval of 3m
- Wire mesh is generally made of steel ropes

# IMPORTANCE OF DELAY IN BLASTING

- Improved fragmentation
- Reduction in ground vibration
- Reduction in fly rocks
- Improved productivity and lower cost
- Reduction of over break
- It is popular in open pit, quarry, tunneling, shaft sinking and u.g blasting

# DELAY IN OPEN -PITS

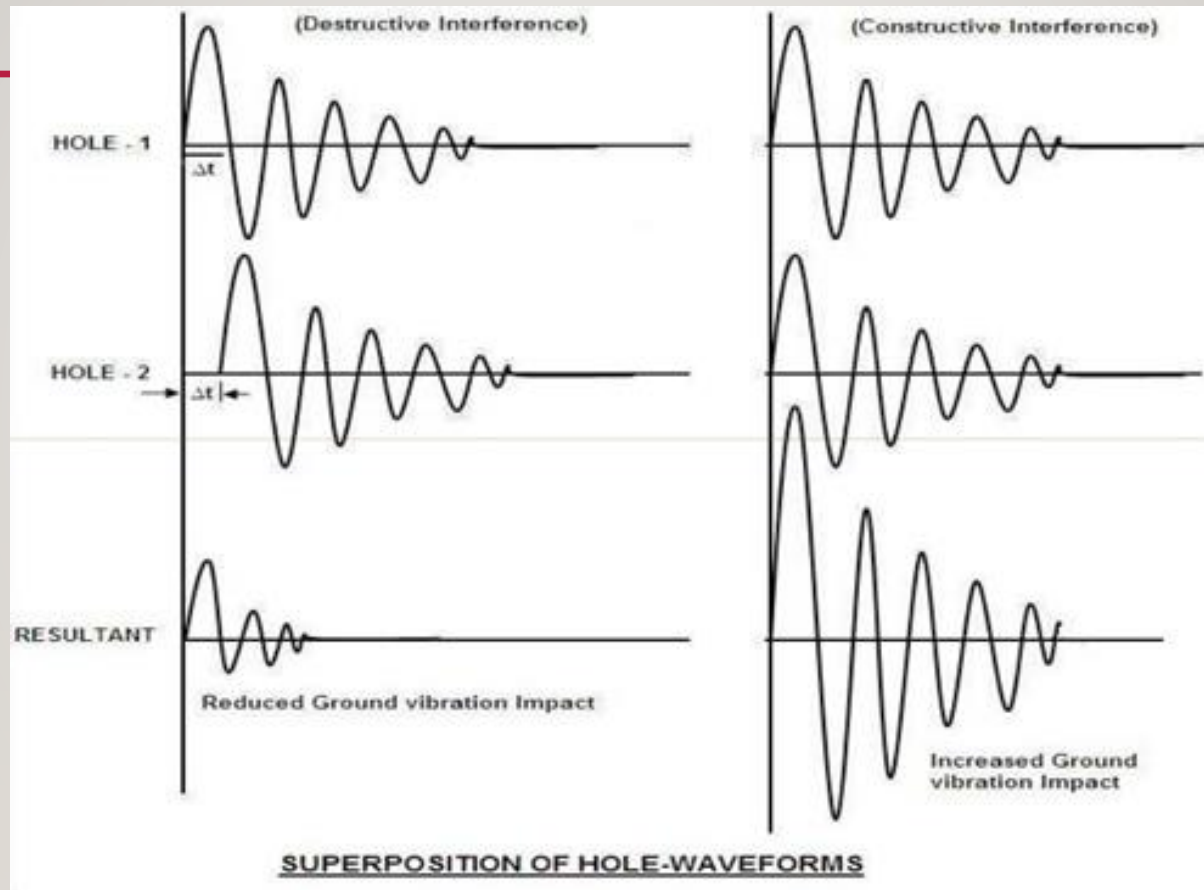


# SIGNATURE HOLE BLAST ANALYSIS

- Maximum vibration of the building takes place when the ~~frequency of the ground vibration matches with the resonant frequency of the building~~
- Resonant frequency of the building depends on – height, stiffness and mass of the building
- When little or no energy at the resonant frequency of the building, the vibration is minimum
- Pilot blast holes takes into account the seismic properties of the inhabited geology, between blast and the target location
- Delay intervals are so adjusted to obtain destructive interference of the generated seismic waves



# WAVE INTERFERENCE



# ADVANTAGES OF BLAST HOLE ANALYSIS

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- This technique provides optimum electronic timing while maintaining high level of production
- Overall structural safety of blast surroundings
- Much larger blasts can be taken with better operational performance
- This method can be employed in underground mining in ring pattern blast as well