

* Methods of Tunnelling in Hard Rocks :-

In hard rocks, generally following methods are more common:-

- ① Full Face Method
- ② Heading and benching method
- ③ Drift method

① Full Face Method :- • This method is adopted for tunnels whose length is not more than 3 metres.

- Large size tunnels in rocks are always driven by this method.
- With the development of drill carriage, this method is becoming more and more popular.
- In this method vertical columns are fixed at the face of the tunnel to which a large number of drills may be mounted or fixed at any suitable height as shown in fig (a)

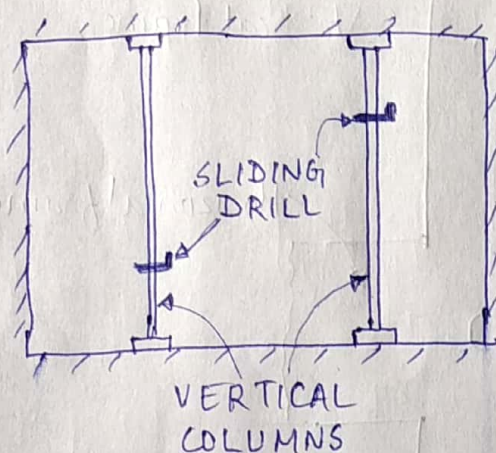


Fig. 1 - full face method

- A series of drill holes are drilled at about 120 cm centre to centre in any number of desired rows, preferably in two rows.
- The size of the holes may vary from 10 to 40 mm.
- These holes are then charged with explosives and ignited.
- The muck is removed before the next operation of drilling holes.

- This tunnel is more suitable for diameters less than 6m and face area less than 19 m^2 .

Advantages of full face method

- ① It requires minimum equipment. Hence it is simple in operation
- ② The magnitude of ground disturbance and settlement is minimum in this method
- ③ The work is easily and speedily completed by this method
- ④ The mucking trucks can be laid once for all on the tunnel floor and extended progressively
- ⑤ It is found advantageous in sensitive ground conditions where multiple phase excavation could generate excessive ground pressure and settlement effects.

② Heading and bench method :-

- The top portion is known as the heading and the bottom portion as bench.
- Usually this method is adopted for railway tunnels.
- In this method of tunnelling the top portion of heading will be about 3.70 to 9.6m ahead of the bottom portion as shown in Fig (a)

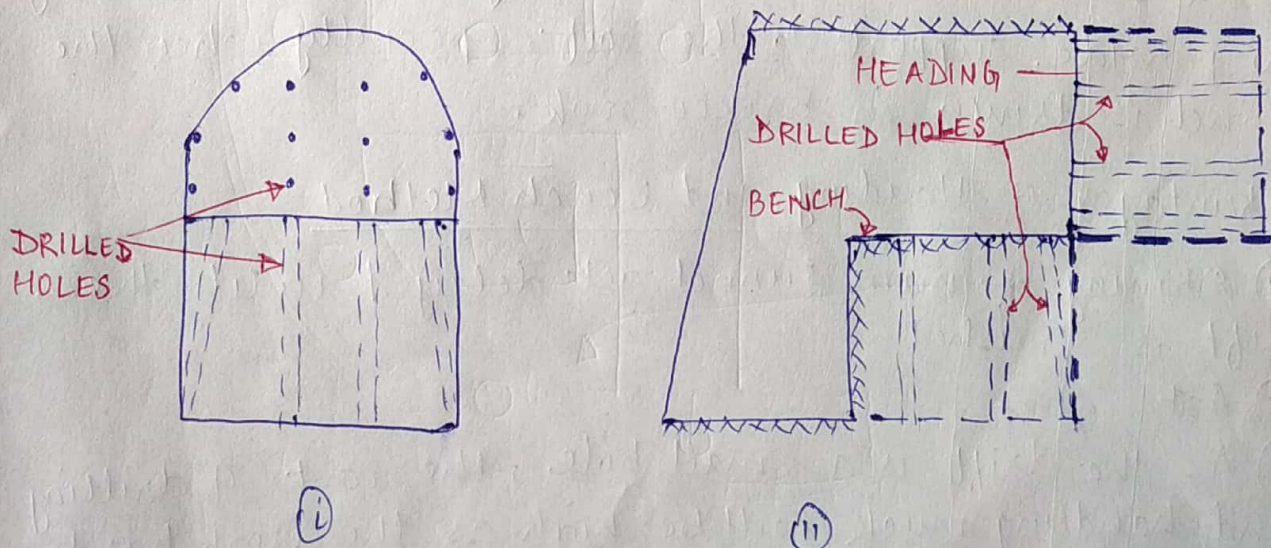


Fig. (a) Heading and Bench Method

- In hard rock which may permit the roof to withstand without supports, the top heading usually is advanced by one round of the bottom portion.
- If the rock is broken then heading may be driven well ahead of the bottom portion and after giving proper support to the roof, the bottom portion is completed.
- In hard rock, the heading is bored first and the drill holes are driven for the bench or bottom portion at the same time as the removal of the muck.
- This is the main advantage of this method
- It requires less explosive than full face method, but due to the development of drill carriage or the jumbo, the use of this method is decreasing.

Advantages of Heading and Bench Method

- By this method, any ~~hard rock~~ bad rock or excessive water will be discovered prior to driving full tunnel enabling to take corrective measures at the earliest.
- The drift assists in ~~vental~~ ventilating the tunnel during later operations.
- The quantity of explosive required is reduced.
- The side drifts provide facility to install timbering to provide support to the roof, specially when the tunnel is driven in broken rock.

Disadvantages of Heading and Bench Method

- Driving of main tunnel get delayed until the drift is finished.
- ~~As~~
- As the drift is a small hole, the cost of drilling and handling muck will be high as the work has to be performed manually instead of power driven equipment.

G.P.V.
Civil Enng., Sem IV
Assignment

classmate

Date _____

Page _____

Sub:- Transportation Enng (Bridge Enng Portion)
(1615404)

- ① Define Bridge. What are the factors affecting selection of site of a bridge.
- ② Describe classification of Bridges.
- ③ Define abutment and describe its function.
- ④ Define Culvert. Enlist types and sketches.
- ⑤ Explain RCC girder bridge with types and sketch.