

★ Tunnel Investigations

- The most important part in the process of making a tunnel is to identify a proper place and route at which tunnel is to be made. This is called tunnel investigation

• Following investigations must be made :-

- (i) Geological Survey
- (ii) Alignment of tunnel and allied considerations
- (iii) Selection of tunnel type

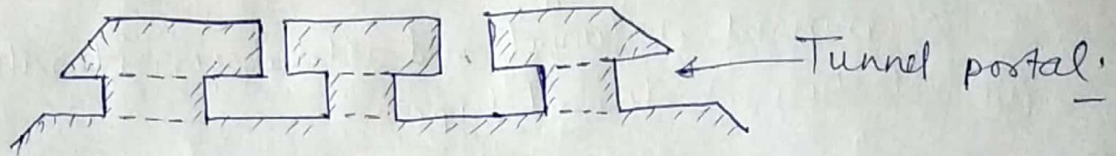
(i) Geological Survey :-

- Geological survey confirms the nature and type of strata through which the tunnel has been planned. It also confirms the underground rivers, fault planes and zones of shattered rock etc.
- After taking into account all of these informations, it becomes easy to decide the suitable method for making tunnel in that particular area. Geological survey includes map study, use of various electronic gadgets to determine underground structures and core drilling etc.
- Geological survey prepares us to anticipate problems which can crop up during the tunnel construction and provide us information to keep us ready to deal with them.

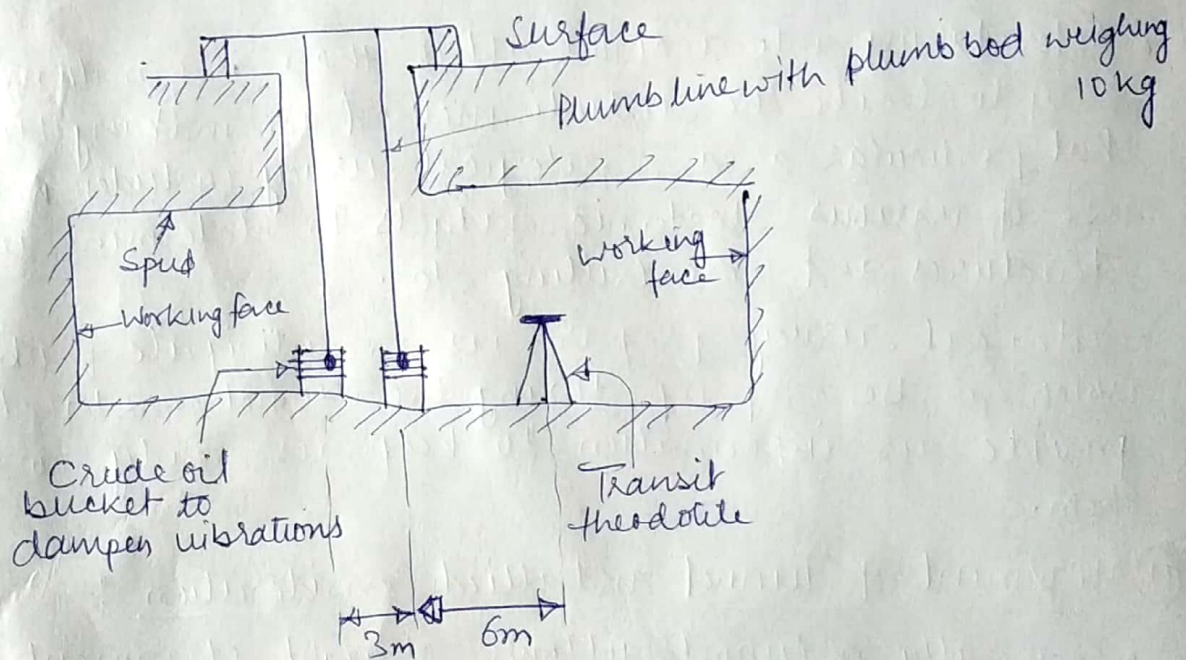
(ii) Alignment of Tunnel and allied Consideration :-

- Generally, a tunnel follows straight alignment path for connecting two given points unless there comes a difficult tunnelling zone in between them.
- In case, it is not possible to follow the straight path curves are introduced. The route survey is done with precision survey instruments and electronic gadgets.
- In case, the ground to be tunnelled is accessible from the surface, it is easily possible to set the centre line of the tunnel on the surface.

- This is the simplest and easy method in which tunnel driving is done by digging vertical shafts along the path of the tunnel.
- The vertical shafts provide ~~a~~ extra working faces as well as ventilation to the tunnel (fig a)



Fig(a) Tunnel driving with the help of vertical shafts



Fig(b) Transfer of alignment from surface to tunnel

- Centre line from the surface to the inside of the Tunnel to be constructed is transferred through tube shaft ~~is~~ with the help of plumb bob as shown in fig(b)

* Tunnel Surveying

The process of setting out the alignment of the tunnel on the ground and then transferring the same to inside of the tunnel through shafts is called Tunnel Surveying.

The survey work of a tunnel involves the following operations :-

- (i) Locating centre line of the tunnel on ground
- (ii) Constructing the shafts over the centre line.
- (iii) Transferring the alignment to inside of the tunnel

(i) Locating centre line of the tunnel on ground :-

- After fixing the route for the tunnel, its centre line (alignment) is accurately set out on the hills or ground.
- When the length of the tunnel is small, the centre line can be located by means of theodolite.

When the tunnel is long and to be constructed under high mountains, the centre line is set out by triangulation preferably with the help of a micrometer transit theodolite.

In the ground, pegs are driven at regular intervals and centre line is marked.

If it is not possible to drive pegs into the ground, the surface of the rock pointed white and centre line is marked with Black paint on it.

(ii) Constructing the shaft over the centre line :-

After locating centre lines, shafts are constructed at regular interval.

(iii) Transferring the alignment to the inside of the tunnel.

- After constructing the shafts, the alignment of the tunnel is to be transferred down the shafts.

- For this, two small pillars are constructed on opposite edges of the shaft along the centre line of the tunnel.
- On the top of these pillars, the points corresponding to the centre line are correctly marked and wire is then stretched between them.
- Two plumb bobs are suspended inside the shaft as shown in fig. (a)

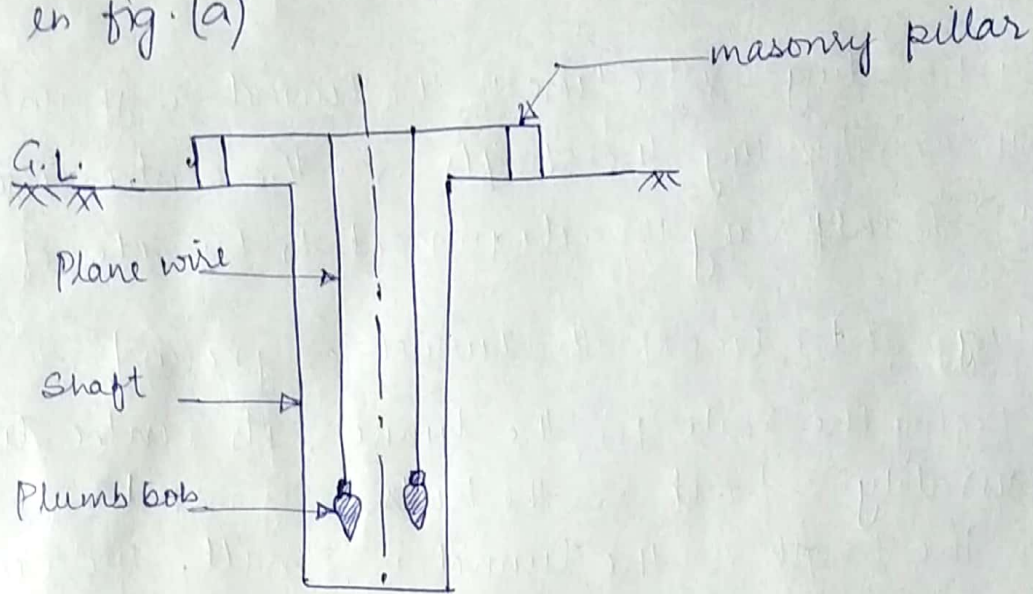


fig (a) Transferring the alignment (centre line) at the bottom of the shaft.

- By lowering both plumb-bobs to the bottom of the shaft, two points are marked.
- The line joining the points represents the centre line of the tunnel marked on the ground.
- This line is further extended into the tunnel, as work advances, by a theodolite placed in the shaft as shown in fig. (b)

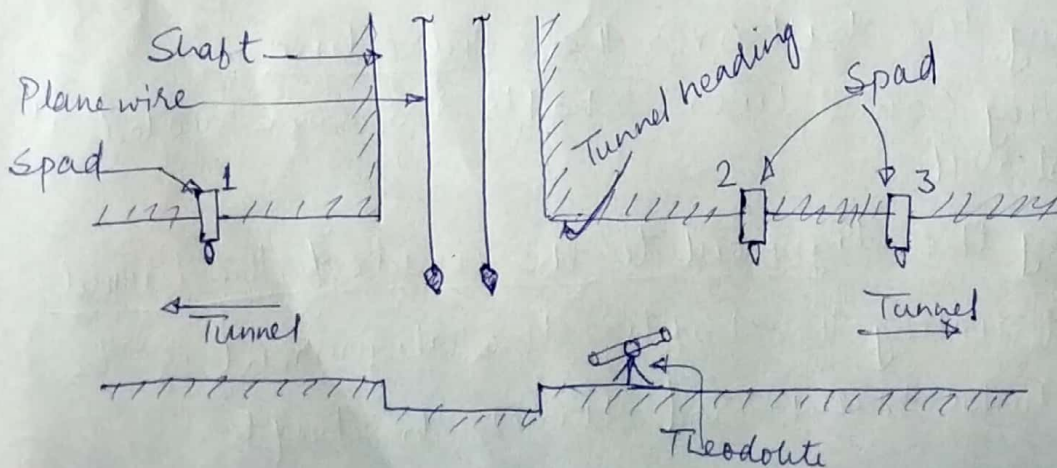


Fig (b) :- Transferring the alignment to inside of the tunnel