

## Unit 4.1

### \* Definition of Tunnel Engg :-

- Tunnels are underground artificial passage which are constructed without disturbing the ground surface.
- It is also defined as "an engineering structure, artificial gallery, passage or roadway beneath the ground, under the bed of a stream or through a hill or mountain".
- Tunnels are constructed for the transportation of passengers, freight, water, gas, sewage, etc.

### \* Necessity of Tunnels :-

- To avoid longer surface route of railway track or road for reaching the other side of a hill.
- To avoid more depth of open cut for reaching the other side of a hill. As depth of open cut larger than 20m is difficult to construct and maintain.
- To connect two terminal stations separated by a mountain.
- To carry road or railway traffic under the river bed when the provision of a bridge across the river is inconvenient and costlier.
- To avoid acquisition of valuable land and property for a road or railway project.
- To provide rapid transportation system in big cities and to avoid holding of traffic for long periods due to traffic congestion.
- To protect railway track or road at high altitudes from blockage due to landslides or snow fall.
- To economically carry public amenities like water, oil, gas etc. across a stream or mountain.
- To avoid damage to transportation system of strategic importance and for safety of traffic during aerial war.

## Advantages of Tunnels :-

- (i) They avoid dangerous open-cut adjacent to the structure.
- (ii) They carry public utilities like water, gas, railway lines or roads across a stream or mountain.
- (iii) Due to lighter grades possible in tunnels cost of hauling is decreased.
- (iv) Tunnels protect pavements from snow, rain and other natural influences and hence less maintenance and operating cost.
- (v) They facilitate conduction of water to generate power.
- (vi) Tunnels are very useful during aerial warfare.

## Disadvantages of Tunnels :-

- (i) Tunnels require more time to construct as compared to open cut.
- (ii) Construction of tunnels is costlier than open cut.
- (iii) They require specialised equipments and methods for their construction.
- (iv) Construction of tunnels requires skilled labour.

\* Classification of Tunnels :-

Tunnels are generally classified on the basis of the purpose for which they are constructed, the type of material through which they pass and according to their position or alignment

(A) Classification based on the purpose

Based on purpose tunnels are classified as :-

(a) Traffic Tunnels :- Traffic Tunnels are of following types :-

- (i) Highway Tunnels
- (ii) Railway Tunnels
- (iii) Navigation Tunnels
- (iv) Pedestrian Tunnels
- (v) Subway Tunnels.

(b) Conveyance Tunnels :- Conveyance tunnels are of following types :-

- (i) Water supply tunnels
- (ii) Hydro electric power tunnels
- (iii) Sewer Tunnels
- (iv) Tunnels for intake and conduit of public utilities
- (v) Transporting tunnels in industrial plant.

(B) Classification based on type of material

Based on type of material through which they pass, tunnels are classified as :-

- (i) Tunnels in hard rock
- (ii) Tunnels in soft rock
- (iii) Tunnels in loose sand
- (iv) Tunnels in quick sand
- (v) Open-cut tunnels
- (vi) Tunnels in river bed.

## (C) Classification based on position or alignment

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Based on position or alignment, tunnels are classified as :-

(i) Spiral Tunnels :- Spiral tunnels are the tunnels in which the additional length for minimum permissible radius is obtained by forming a loop into the interior of mountain. These are provided in narrow valleys.

(ii) Saddle and Base Tunnels :- Saddle and base tunnels are tunnels in which the track is led through valleys as long as natural slope of valley does not become steeper than ruling gradient.

(iii) Off-Spur Tunnels :- They are short length tunnels and are made to short cut minor local obstacles.

(iv) Slope Tunnels :- Slope tunnels are constructed in steep mountains to ensure safe operation and protection to railway and highway routes.

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