

(iii) Type of structures supporting the sewers

## 9.17 SEWER APPURTENANCES

The different devices required for location, construction, operation and maintenance of the entire sewerage system are called **appurtenances**. These are the devices required for the efficient working of sewerage system. The different appurtenances are classified as follows:-

- (A) Manholes
- (B) Drop Manhole
- (C) Catch basin
- (D) Inverted syphon or Depressed Sewers
- (E) Flushing tanks
- (F) Grease and oil traps
- (G) Storm water regulators
- (H) Ventilating shafts
- (I) Lamp-hole,

The location, function and features of different sewer appurtenances are as follows:

### (A) MANHOLES :

It is an opening constructed in a sewer for the purposes of permitting a man to enter in the sewer. These are the opening constructed on the alignment of a sewer

#### Location of Manholes:

Manholes are, generally located

- (i) At the junctions of main and branch sewer lines.
- (ii) At sufficient distances varying from 50 m to 200 m if the length is straight.
- (iii) At all the changes of directions and sizes.



(iv) At all change of gradients.

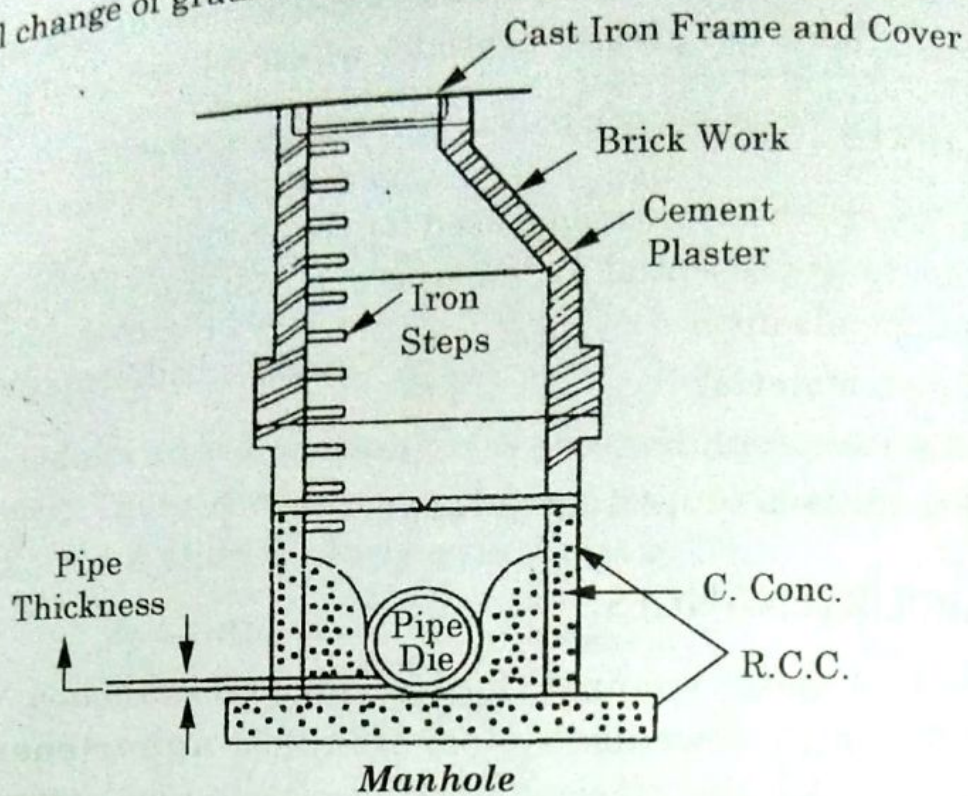


Fig. 9.7 : Manhole

### Functions of Providing Manholes:

The purposes of providing manholes are as:

- ✓ (i) For the ventilation of sewers.
- ✓ (ii) For laying thesewer lines in convenient lengths.
- ✓ (iii) For the purpose of inspection and cleaning of sewer.
- ✓ (iv) To allow the jointing of sewers or alignment or change in the direction or both.
- ✓ (v) For joining of sewers in case of change in direction of sewer.

### Constructional features of Manholes:

Manholes are classified as *shallow manhole* or *normal manhole* or *deep manhole* depending up on the depth. Shallow manhole is also known as *Inspection Chamber*. The manhole has the following constructional parts :

- (i) Cover and frame
- (ii) Access shaft
- (iii) Working chamber
- (iv) Bottom invert
- (v) Steps or Ladder
- (vi) Base

### (B) DROP MANHOLES :

Drop manholes are provided for joining sewers running at different levels.

*The manholes which drop the level of invert of the incoming sewer by providing a vertical shaft are called **drop manholes**.*

**Function of drop manhole :** The drop manhole serves two functions :-

- ✓ (i) To reduce the quantity of earth work. To connect the branch sewer, which is at ground level, with the main sewer which is laid at a greater depth. No gradient is necessary to provide.
- ✓ (ii) The vertical shaft is extended upto the G.L. for the purposes of inspection and cleaning (see fig.).
- ✓ (iii) The main purpose is to avoid the splashing of sewage on the man working and on the masonry work.



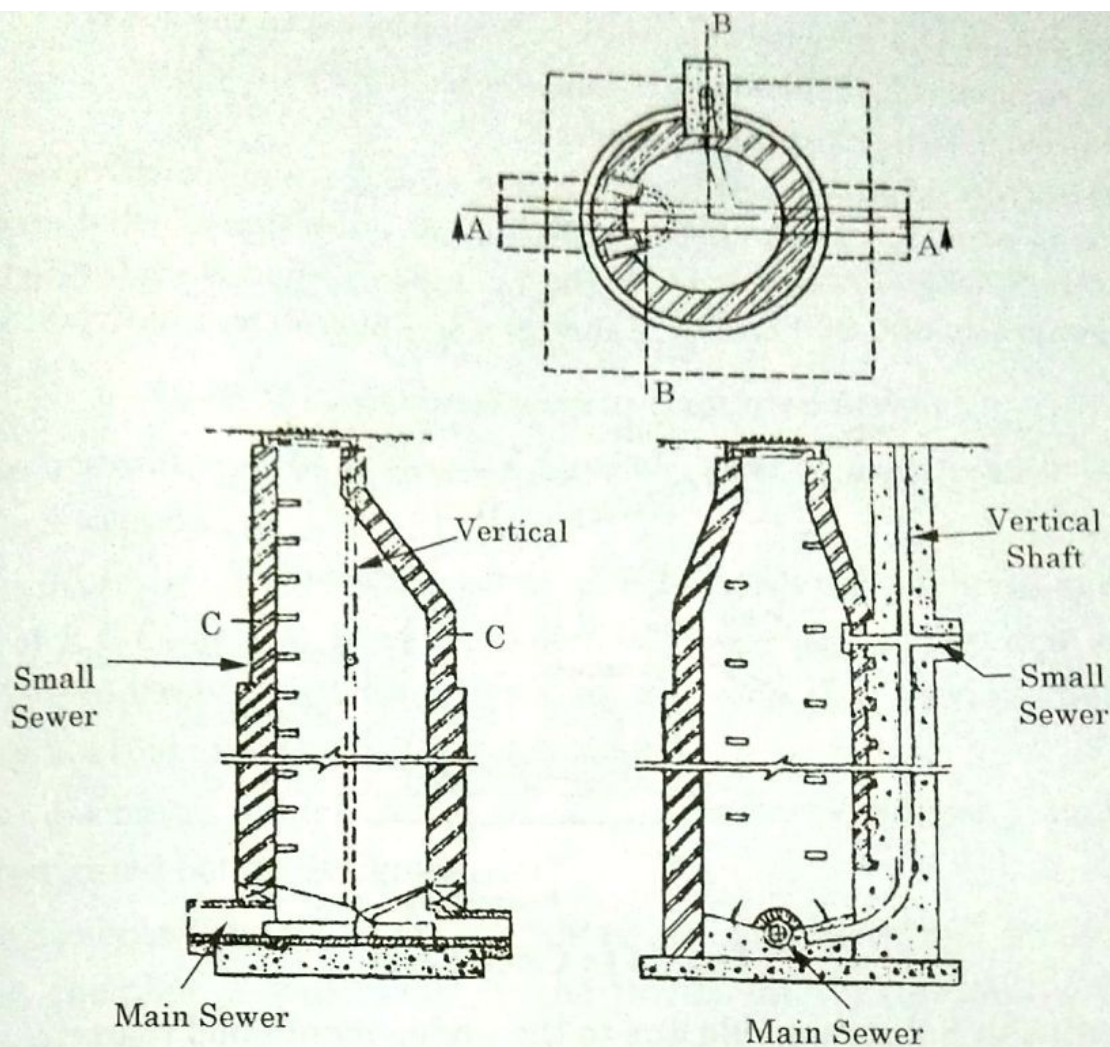


Fig. 9.10 : Drop Manhole

### **Construction of drop manhole**

In drop manhole, the connection is made by constructing a vertical pipe outside the manhole and then joining it to the manhole chamber. The vertical shaft is provided outside the manholes chamber only when it is not possible to arrange the connection within 0.6 m of the invert of the sewer and manhole. If the difference is less then the pipe it can be taken directly through the wall of the manhole chamber. The drop manhole is shown in Fig. 9.10.

### **(C) CATCH BASINS :**

Catch basins are small settling chambers constructed below the street inlets  
These are the chambers provided along the sewer line to collect the rain water free  
from suspended particles.

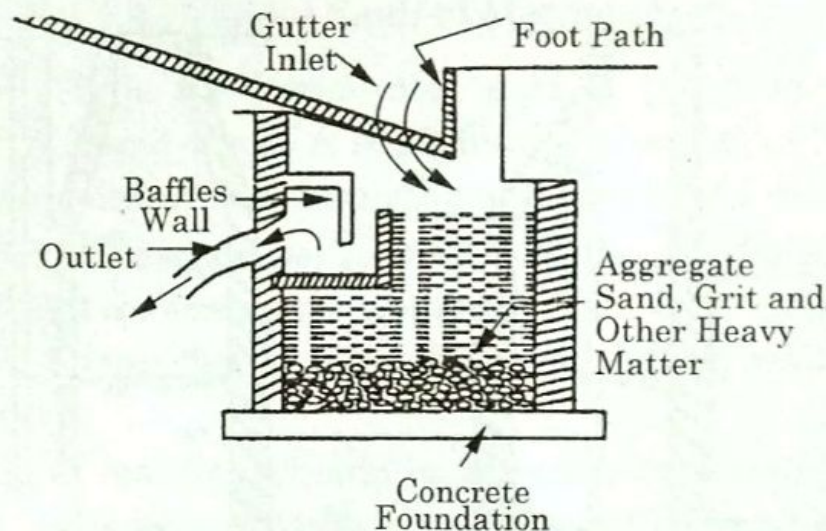
**Locations of catch basin :** These structures are located in the form of a  
chamber along the sewer line. Catch basins are, generally, adopted for combined  
sewerage system.

**Function of catch basin :** Catch basins are used for the following functions:



- (a) To reduce the velocity of sewage before entering in the sewer.
- (b) To remove the suspended grit and sludge from rain water.
- (c) It prevents the clogging of sewers.

**Construction of catch basin :** It consists of a chamber constructed of masonry walls. Space is provided at the bottom for the accumulation of sand, grit and other heavy matter. Sewage enters through the openings provided at the top. The catch basins are generally 600-900 mm in diameter and 660-750 mm in depth.



**Fig. 9.11 : Catch Basin**

Catch basins are objectionable due to the under-mentioned reason :

- (a) It makes the breeding place for mosquitoes and other flying insects.
- (c) They create bad smells in dry weather when the water in the trap gets evaporated.
- (b) They produce offensive odours also due to septic action.

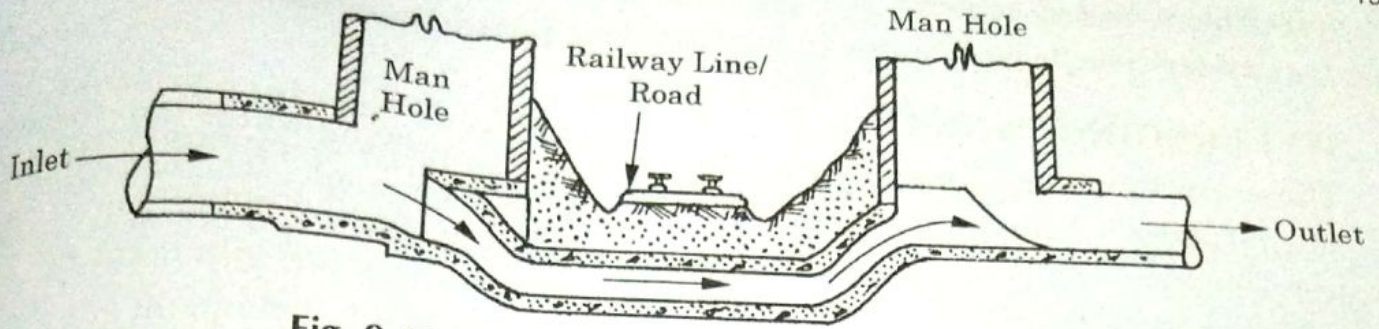
So catch basins must be cleaned periodically.

#### (D) INVERTED SIPHON OR DEPRESSED SEWER

*Inverted syphons or depressed sewers are the section of sewer which are constructed lower than the adjacent sewer.* In this case, water flows under gravity with pressure more than the atmospheric pressure.

**Location of inverted syphon :** In the areas having more depression, the sewer line can be laid above the ground by supporting on piers. The inverted syphons are provided when it is not possible to raise the levels like in case of Railway lines, canals or road crosses the sewer line.





**Fig. 9.12 : Inverted Siphon or Depressed Sewer**

Here the hydraulic gradient line is above the flow line whereas it is below the flow line in true syphon.

**Construction of inverted Syphon :** The inverted siphons are normally constructed of R.C.C. or cast Iron. At the ends manholes are provided for cleaning and inspection. Moreover pipe diameter must be such that sewage may flow with great velocity to avoid silting.

- The discharge under dry and wet weather conditions must be fully investigated before designing.
- The designing should be proper otherwise the sewage will accumulate in the inlet chamber it will result in the inefficient functioning of the inverted syphon.
- The pipe of inverted siphon should be able to withstand the internal pressure.

**Functions of Inverted syphon :** Inverted syphon is used for the following purposes:

To lay the sewer lines below unavoidable obstructions such as railways, rivers.

The following points should be kept in mind while designing inverted syphons : --

- (i) The solids are carried out properly with sufficient velocity without deposition.
- (ii) The syphon must be designed as a pipe running full under pressure. The head losses due to bends must be considered.
- (iii) For proper cleaning, there should not be continuous deposition of silting.
- (iv) The inlet chamber must be provided with screens.
- (v) The arrangement for diverting the flow must be provided in the event of syphon becoming surcharged or choked.



under their own weight in order to prevent their flotation when empty.

### (E) FLUSHING TANKS

These are the devices made for holding and then throwing water into the sewer for the purposes of flushing. Provisions should also be made for inspecting and cleaning the sewer by constructing a separate manhole. These are necessary to flush sewers laid at flat slopes.

**Location :** Flushing tanks should be placed at the upper end of laterals. The tanks are usually provided at the dead end or at head of sewers.

**Function :** The functions of flushing tanks are as follows:

- (i) To enable the sewage to flow with high velocity.
- (ii) To keep the sewers clean when they are designed for minimum velocity.
- (iii) To prevent deposition and clogging by attaining self-cleaning velocity even in those portions of the sewer which are not capable of producing these velocities.
- (iv) To store sewage for sometime.

**Construction :** A flushing tank consists of a concrete or masonry chamber fitted with a tap for filling the tank with water. A U-tube with a bell cap at its one end connected the chamber with sewer.

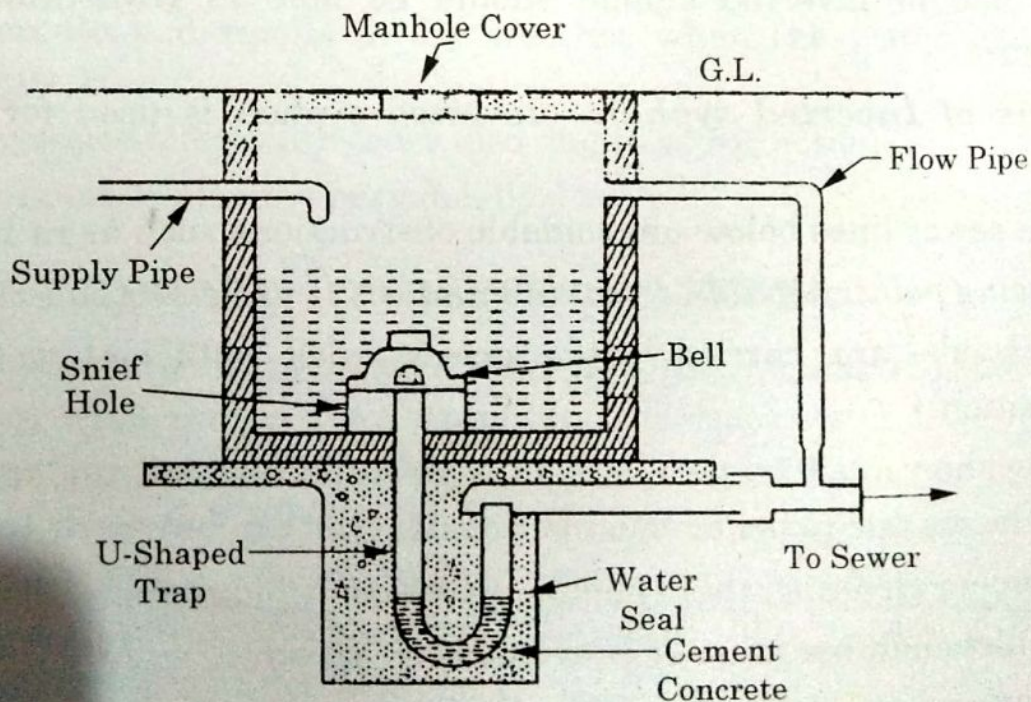


Fig. 9.13 : Flushing Tank



## (F) GREASE AND OIL TRAPS

The sewage from industries, hotels, restaurants, kitchen etc. contains oil and grease. These must be removed before they enter in the sewer. So the oil and grease traps are provided. A simple grease trap is shown in Fig. 9.15.

**Location of grease and oil traps :** Grease traps are provided in the pipe connecting the kitchen with sewer line. These are located near the sources contributing grease and oil to the sewage such as automobile repair workshops, garages, kitchen of hotels, oil industries, grease industries etc. But these traps must be regularly cleaned for their proper working.

**Function of grease and oil traps :** The oil and grease traps are provided for the following functions:

1. To remove the sewage which contains oil or grease otherwise these will stick to the interior surface of the channels and will become hard causing obstruction in the movement of the sewage.
2. These are constructed to remove oil and grease from the sewage before it enters into the sewer line.
3. Oil and grease are light in weight and therefore float on the top surface of the sewage. They are excluded by drawing the sewage from the lower level.

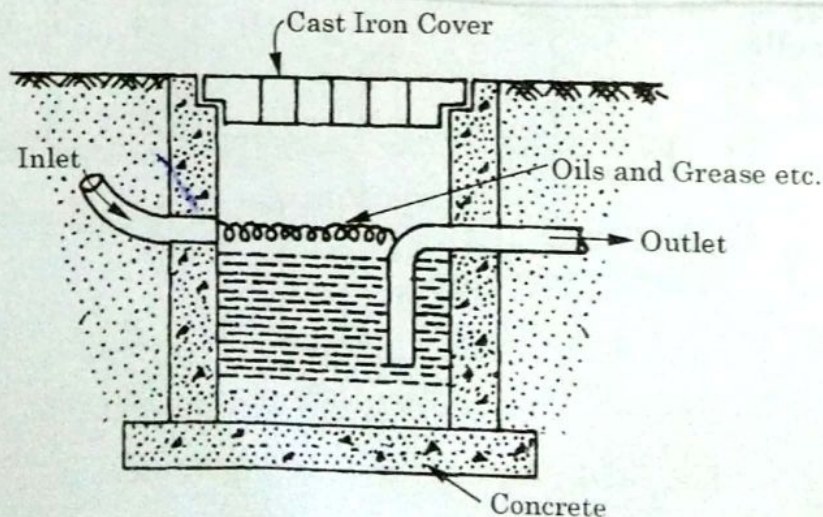


Fig. 9.15 : Simple Grease Trap



**Advantages :** The following are the advantages of providing oil traps:

- (i) They do not stick to the sewer sides.
- (ii) They do not reduce the capacity of sewers.
- (iii) The presence of oil and grease affects the biochemical reactions. They do not make sewage treatment difficult.

### (G) STORM REGULATOR

Storm regulators are the openings in manhole or gutter through which storm water is admitted and conveyed to the storm sewer. These are generally located at intersections of streets. For this, street corners are avoided.

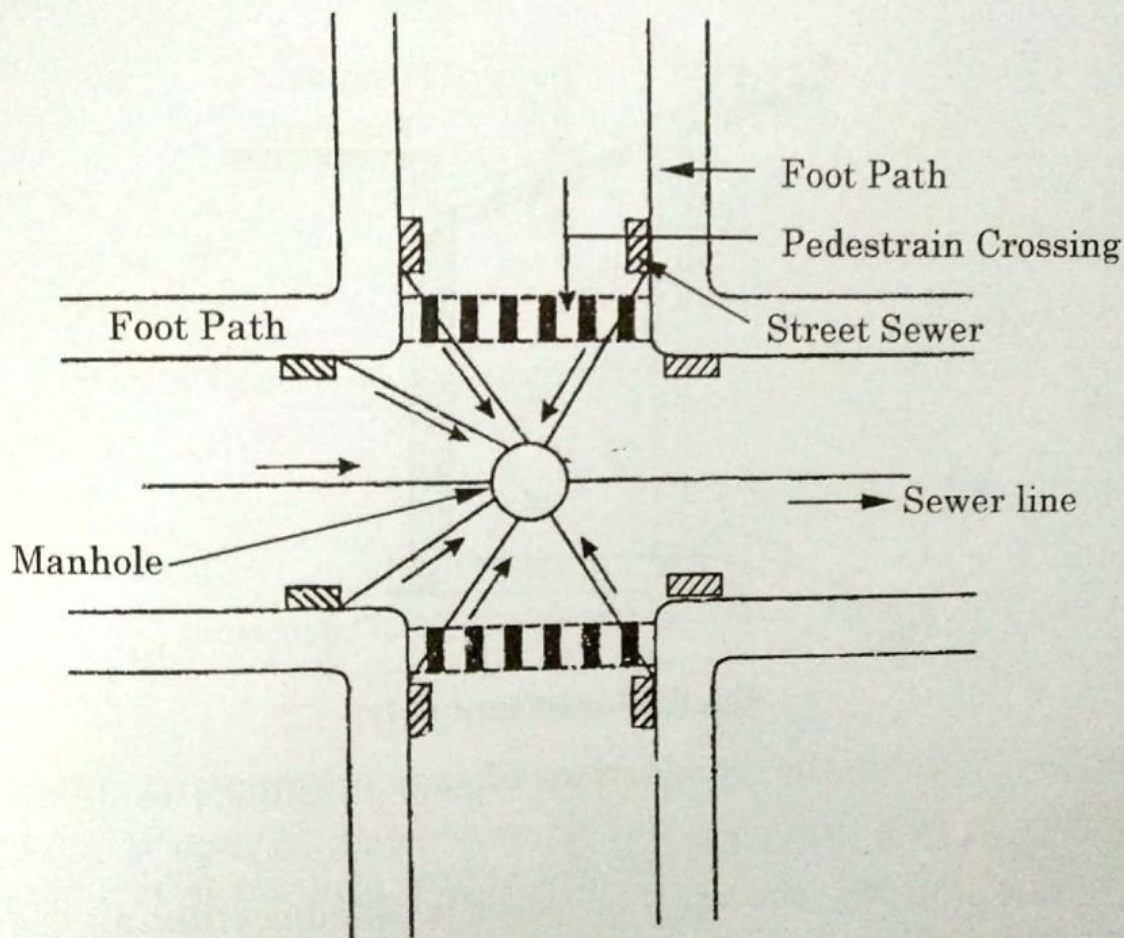


Fig. 9.16 : Street Inlet

There are three types of storm regulator or street inlets :

- (a) Curb inlets
- (b) Gutter inlets
- (c) Combined inlets

Curb inlets are vertical openings in the road curb through which storm water can pass. The openings are fitted with gratings.



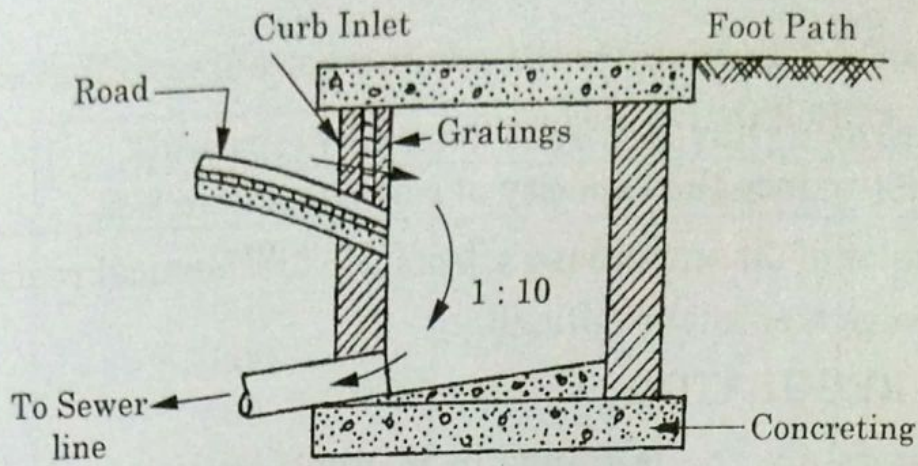


Fig. 9.17 : Curb Inlet

*Gutter inlets are the horizontal openings in the gutter through which flow passes.*

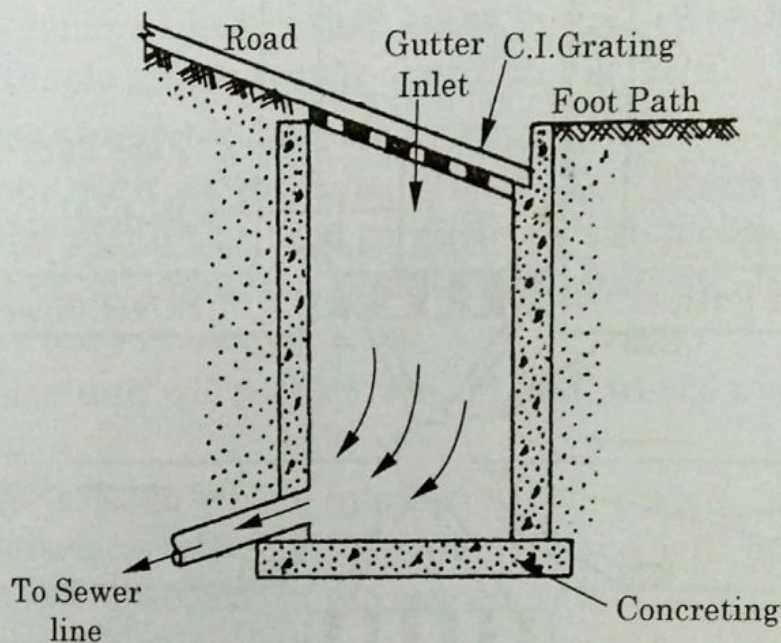


Fig. 9.18 : Gutter Inlet

*Combination inlets are the combinations of curb opening and gutter opening.*

#### (H) VENTILATING SHAFT :

The shaft providing for ventilation purposes is called *ventilating shaft*. The shaft is connected to manhole as shown in fig. 9.19.

**Location of Ventilating Shaft :** Such shafts are provided at every 300 m along the sewer lines.

**Function :** The ventilation has the following functions:

- (i) The accumulation of hydrogen sulphide corrodes concrete and metal exposed to it in sewer. The ventilating shafts are used to prevent the accumulation of this.



- (ii) It also helps in preventing the accumulation of dangerous explosive or gases.
- (iii) To maintain the atmospheric pressure otherwise it may break water seals in plumbing traps.
- (iv) To prevent the concentration of bad smells in the manhole which may cause a nuisance.
- (v) While working in the sewers it provides fresh air to the workers.

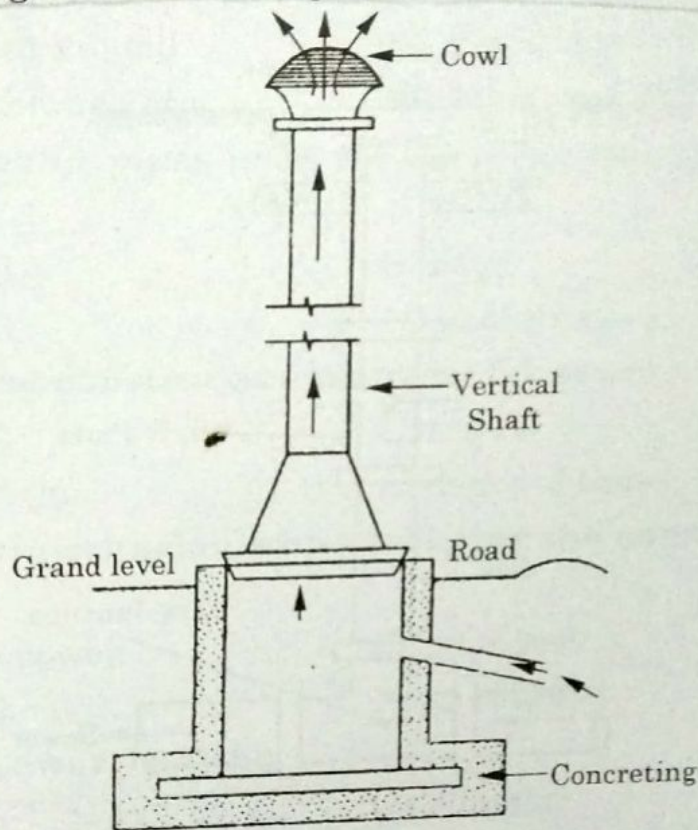


Fig. 9.19 : Ventilating Shaft

**Construction of Ventilating shaft :** The shaft is usually made up of cast iron or steel. At the top a cowl of copper wire is formed. The height of the shaft depends upon the height of the tallest building in the area. The base is surrounded in a concrete block.

**I. LAMPHOLES :** Lamp-hole is a vertical shaft of connected to a sewer. These are the openings, generally of small size. The diameter varies from 25 cm to 35 cm. These are constructed on straight sewer lines between two manholes which are far away to require the insertion of lamp into the sewer. So it is an opening constructed for the purpose of lowering a lamp inside the sewer and covered with suitable material.

**Location:** It is generally provided at change of gradient, curves and where sufficient space is not available for the construction of a manhole.



**Functions :** Following are the functions of installing lamphole:

- (i) Inspection and maintenance of sewer. While carrying out the inspection of sewer, a lamp is lowered in the vertical shaft and is seen from the manholes on either sides to find obstructions in sewer, if any.
- (ii) Ventilation and lightening of sewer.

**Construction:** Lamphole consists of a cast iron pipe. This pipe is connected to sewer line through a T-junction as shown in Fig. 9.20. The diameter of lamphole varies from 200-300 mm.

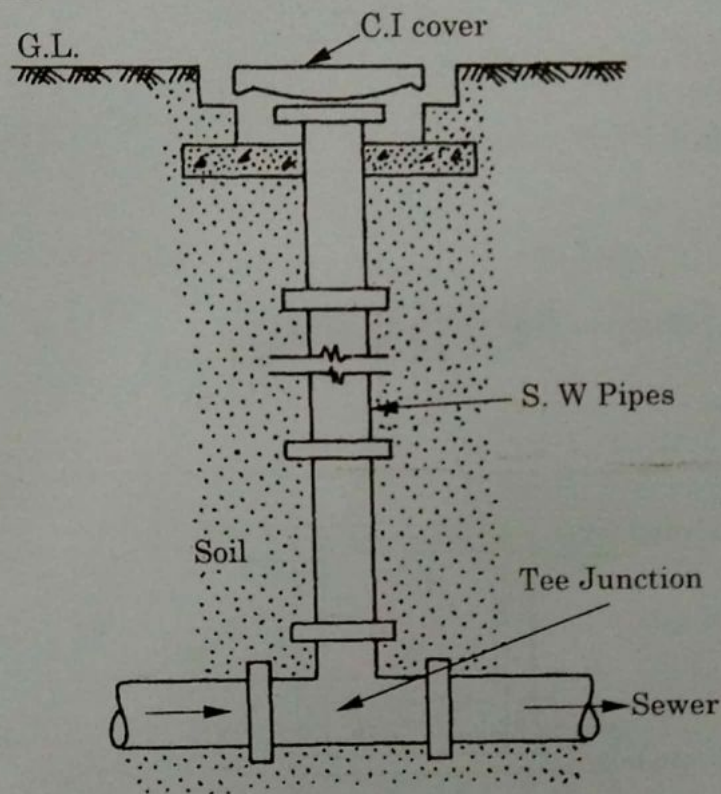


Fig. 9.20 : Lamphole