

House Drainage System



Building Utility & Services



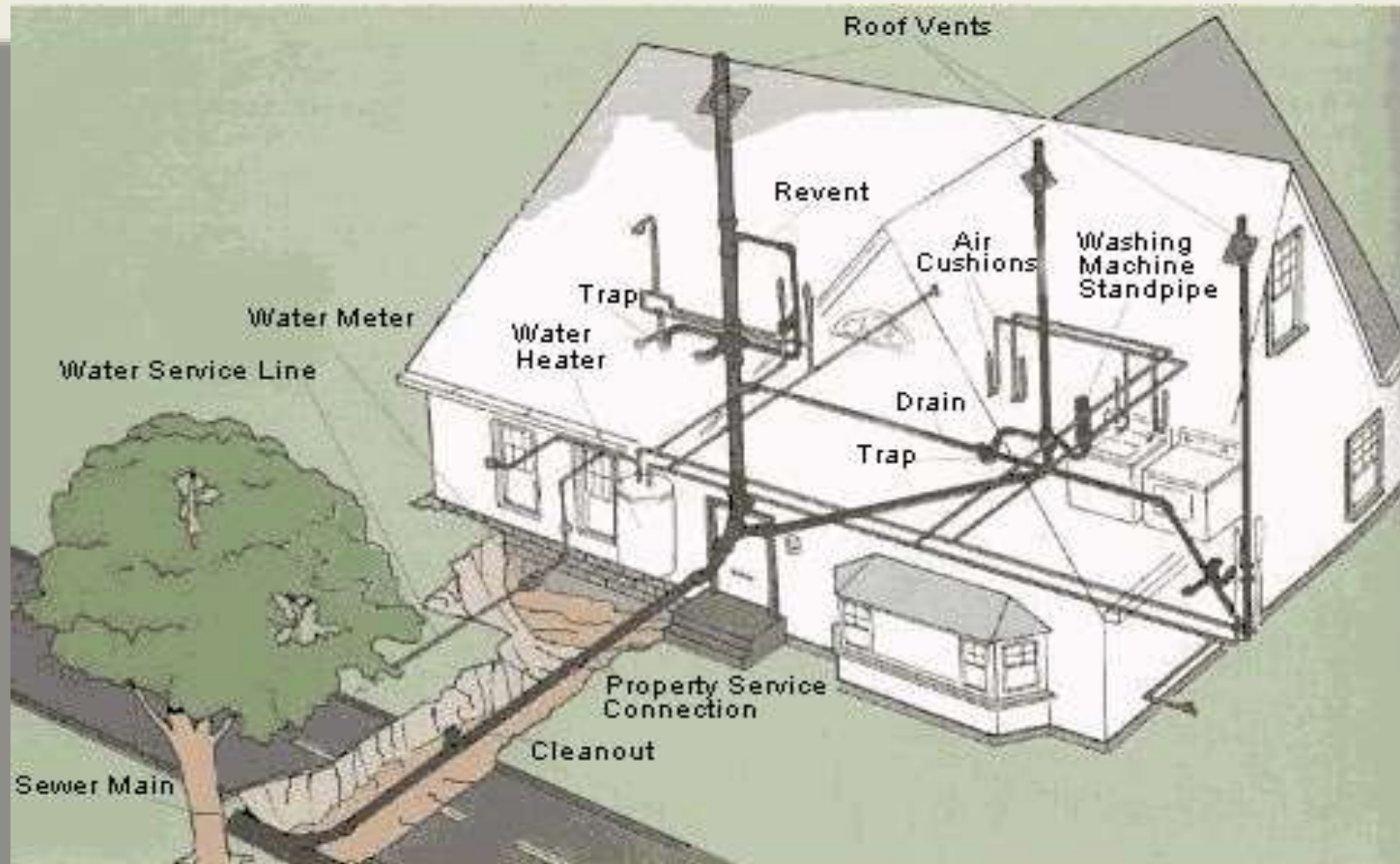
Syllabus

House Drainage: principles of house drainage, pipes and traps, Classification of traps: nahni trap, interception trap, grease-trap, sanitary fittings, system of plumbing, house drainage plan.

House Drainage System

The W.C, Bathrooms, Sinks, Wash basins, etc. are important components of a house. The occupants of the house make use of the above components and as a result of that there is a formation of waste water. The Waste water from W.C, bathrooms, sinks and wash basins is to be properly disposed in to the municipal sewers. It is therefore necessary to construct a system of conveyance of wastewater from W.C, bathrooms, kitchens and washbasins and disposal to the municipal sewer. This system is known as house drainage system

House Drainage System



Definition of Terms

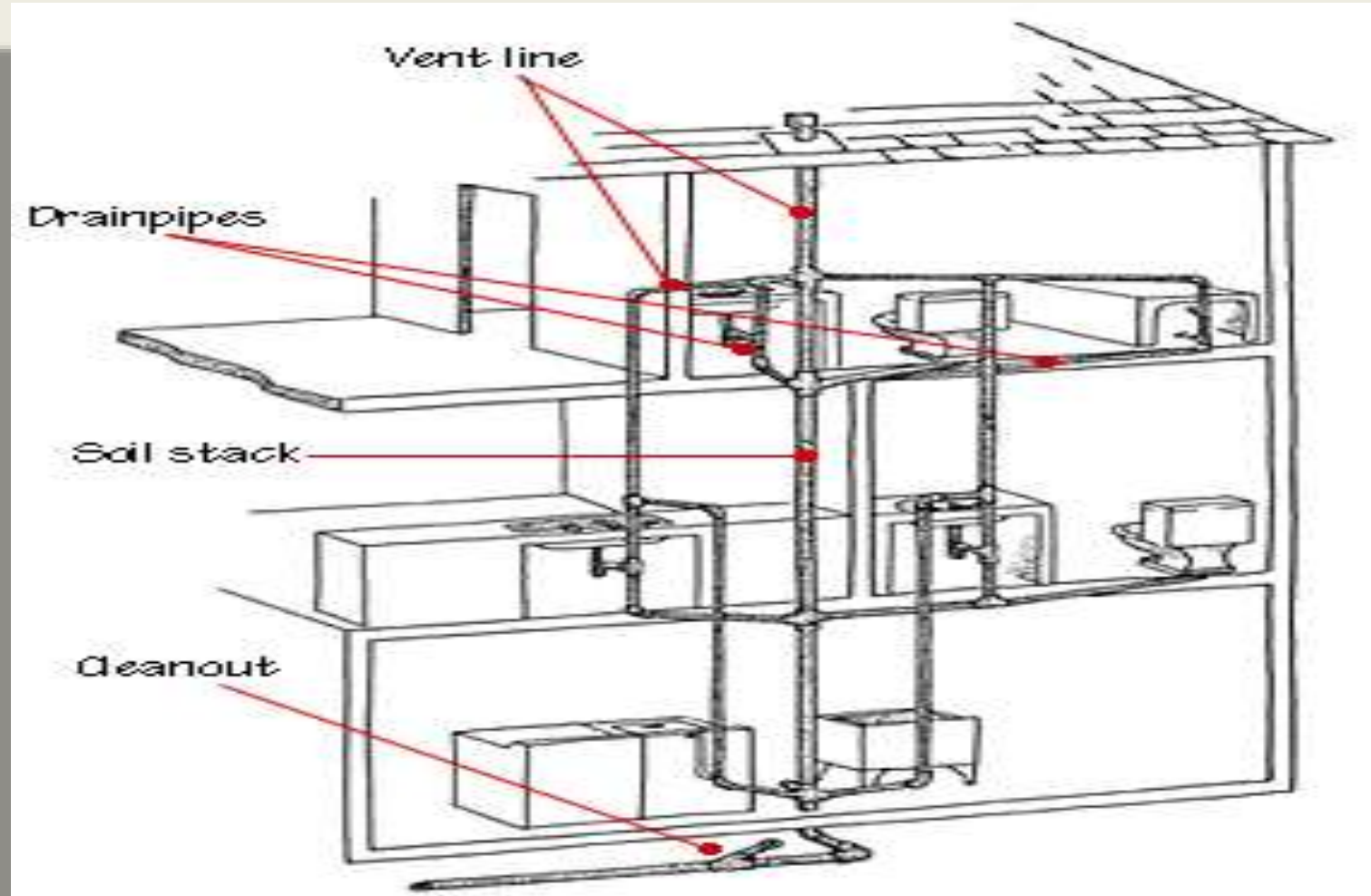
- Before studying the principles for design and construction of house drainage system it is necessary to first understand the basic terms used in subsequent description of topics in this chapter. Important terms are defined as follows:
- **Wastewater:** Water when used for different purpose like domestic commercial, industrial etc., receives impurities and become wastewater. Thus wastewater is used water and it has **physical, chemical, and biological** Impurities in it, wastewater is a general term.
- **Sewage:** The waste water coming from W.C. and containing human excreta is known as sewage.



Definition of Terms

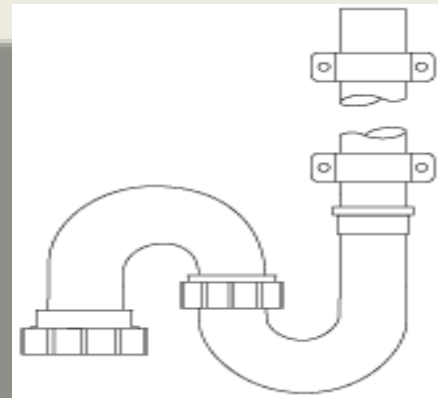
- **Sullage:** The Wastewater coming from bathrooms and kitchens which does not contain fecal matter is known as sullage.
- **Plumbing System:** It is entire system of pipe line for providing water supply to the building or it is a system of pipes for disposal of wastewater from the building.
- **Sewer:** A pipe carrying sewage/ wastewater is called sewer.
- **Soil Pipe:** It is pipe carrying sewage from W.C.
- **Waste Pipe:** It is a pipe carrying sullage from bathrooms, kitchens, sinks, wash basins, etc.
- **Sewerage System:** A system of sewers of different types and sizes in a town collecting wastewater from the town and carrying it to the wastewater treatment plant.

Plumbing systems



Definition of Terms

- **Manhole:** These are RCC/ Masonary chambers constructed at suitable intervals along sewer lines.
- **Traps:** Traps are defined as fittings at the end of soil pipes of waste pipes to prevent foul gases coming out of the soil pipe/ waste pipe.



Principles Of House Drainage

- House Drainage should be **preferable laid by side of the building** to facilitate easy repair and better maintenance.
- House sewer joints should be **leak proof** because leakage if any shall create an odour problem and leaked wastewater shall infiltrate in the ground and shall reduce **bearing capacity of soil** below foundation, which is not desirable.
- The sewage or sullage should **flow under the force of gravity**.
- The house sewer should **always be straight**.
- The entire system should be **well ventilated** from start to the end.
- The house sewer should be connected to the manhole such that the invert level is sufficiently higher to avoid back flow of sewage in house sewer.
- Where ever there is change in direction of sewer line in the premises, provide **inspection chamber at the junction**.
- **Rain water** from roofs or open courtyards **should not be** allowed to flow through the house sewers.
- **Siponage action** can never be permitted and therefore adequate **ventilation systems** should be installed.

Traps And Pipes and other components of house Drainage System

- Following are the main components of house drainage system
- Traps
- Pipes
- Sanitary Fittings

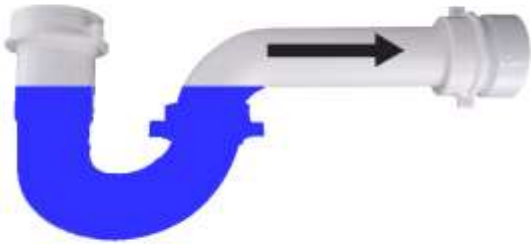
Traps And Pipes and other components of house Drainage System

- Following are the main components of House drainage system.
- **Traps:** Good Traps should have following Qualities:
- *Should provide enough water seal (around 50 mm) with large surface area.*
- *Interiors surface should be smooth so that the flow is not obstructed which enables self cleansing.*
- *An access door should be provided for cleaning the trap.*
- *It should be made of non- adsorbent material.*

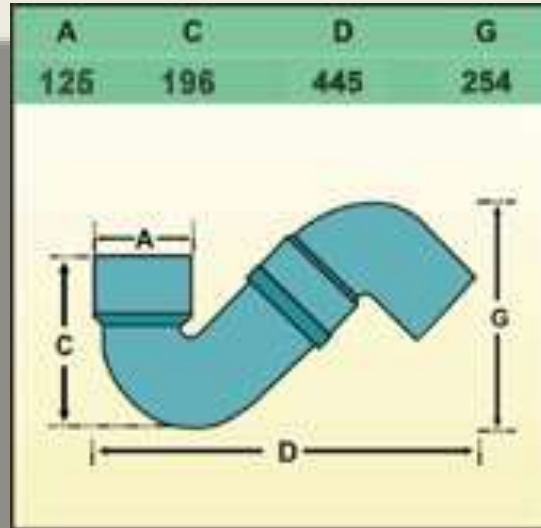
Classification of Traps

- Depending upon the shapes the traps are classified as:
- **P-Trap**
- **Q-Trap**
- **S-Trap**
- Above three types of traps are shown in the following figures.

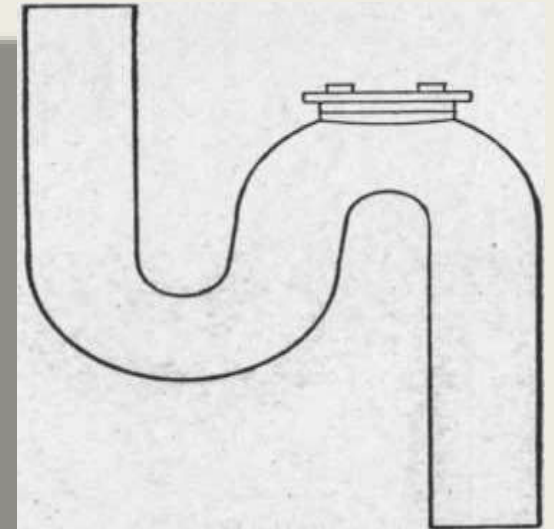
P, Q and S Traps



P Trap



Q Trap



S Trap

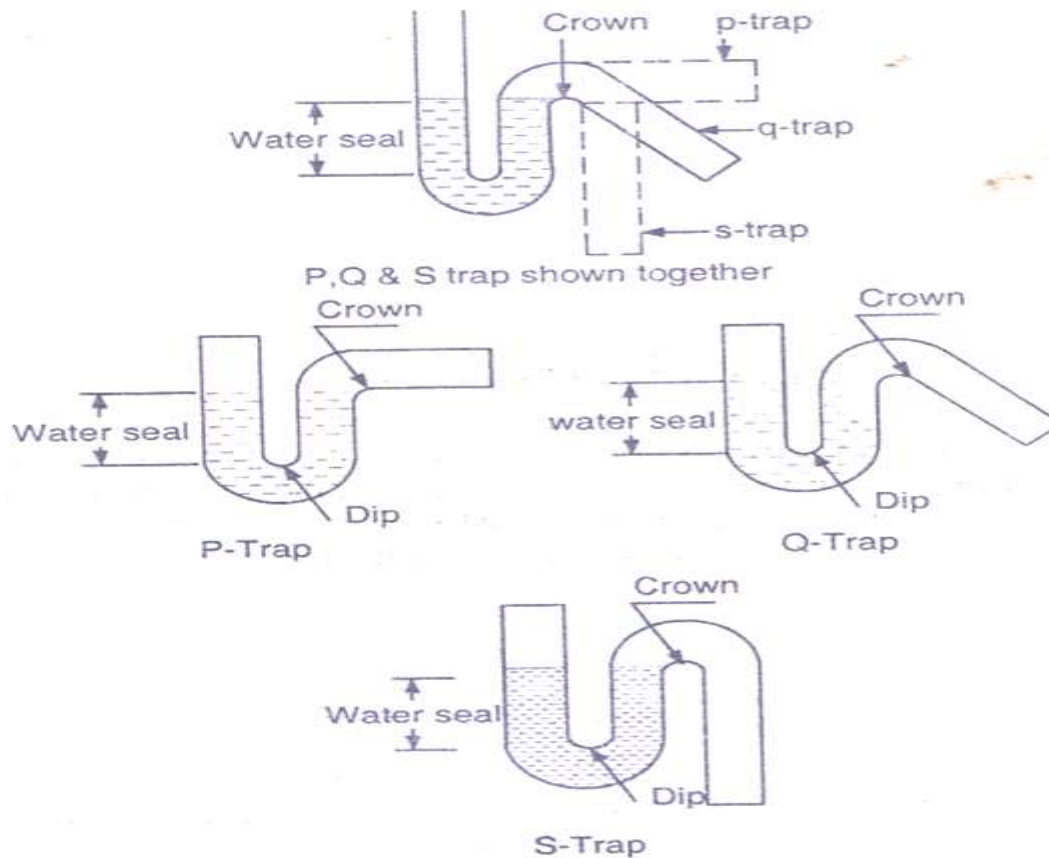
P, Q and S Traps

Classification of Traps

Depending upon the shapes the traps are classified as :

(i) P-trap (ii) Q-trap (iii) S-trap

Above three types of traps are shown in the following figures.



Based on the Use, the traps are classified as:

- Floor Traps (Nahni Trap)
- Gully Traps
- Intercepting Traps
- All the above traps are discussed below

Floor Trap (Nahni Trap)

- **Floor Trap (Nahni Trap):** This trap is generally used to admit sullage from the floors of rooms, bathrooms, kitchen etc. in to the sullage pipe. This is provided with cast iron or stainless steel or galvanised gratings (Jallis) at its top so that the entry of larger matter is prevented thereby chances of blockage are reduced. A commonly used name of trap is Nahni Trap.

Nahni Trap

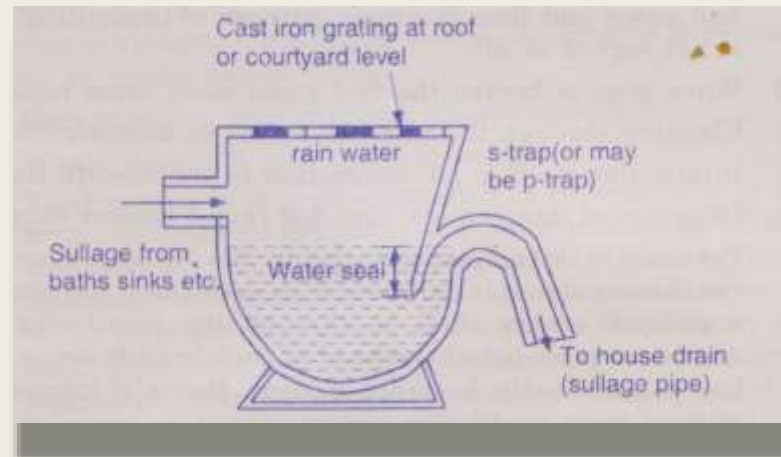
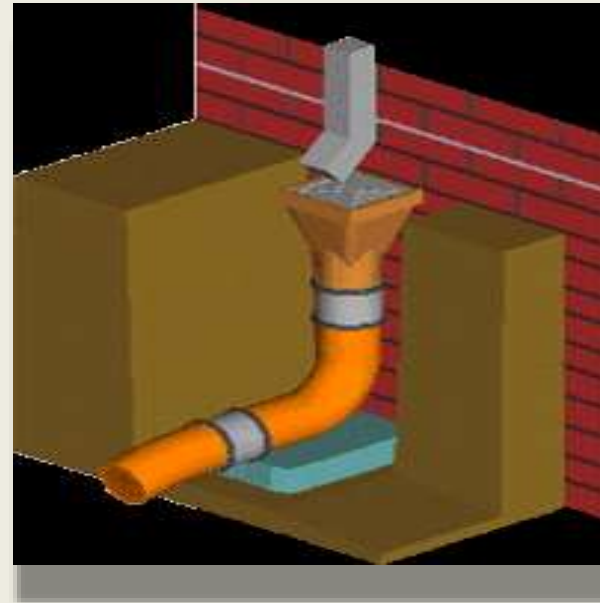


Gully Trap

- **A Gully trap or gully is provided at a junction of a roof drain and other drain coming from kitchen or bathroom. As shown in figure below the foul sullage shall enter through the side inlet which is also called as back inlet and unfoul rain water shall enter from the top which is covered with cast iron grating.**

Gully traps may either have a P shaped or Q shaped water sealing arrangement. The water seal is normally 50 mm to 75 mm deep.

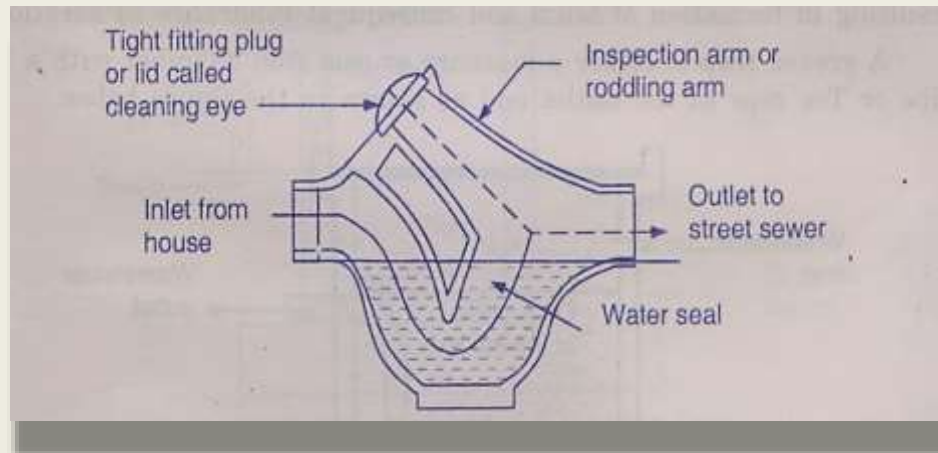
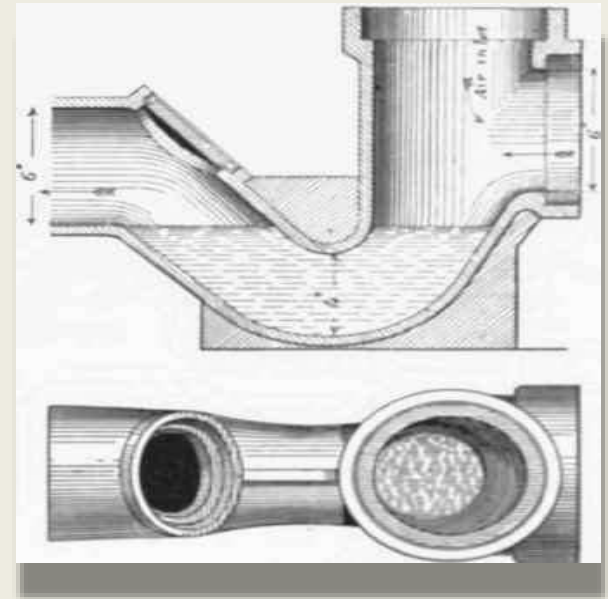
Gully Trap



Intercepting Traps

- **Intercepting Traps:** Intercepting traps is provided at junction of a house sewer and municipal sewer for preventing entry of foul gases of municipal sewer in to the house drainage system. **Intercepting trap is provided in the manhole** as shown in the following figure.

Intercepting Traps



Advantage of Intercepting traps

- **Foul Gases of larger municipal sewers are prevented from entering house drainage system.**
- **Harmful pathogens are not entered in house drains.**
- **Well designed and constructed interceptors can quickly remove foul matter of house drain to municipal sewers.**

Disadvantages

- **Heavy matter shall retain in the trap if the discharge of wastewater is small and the small decompose producing four gases and thus the main purpose of preventing foul gases is not served at all.**
- **When plug is broken the foul gases shall enter house sewers.**
- **Cleaning through the inspection area is difficult.**
- **Interceptor itself is an obstruction to the smooth flow.**
- **Omission of interceptor have not raised serious consequences.**
- **Presence of interceptor installed by the owner is found to affect ventilation of municipal sewer. Hence if interceptors are allowed more ventilation systems are to be provided for public or municipal sewers increased cost of sewerage system and there by increasing taxes too.**
- **Because of the above reason the municipalities decide whether to allow the owner to provide intercepting traps or not.**

Grease Trap

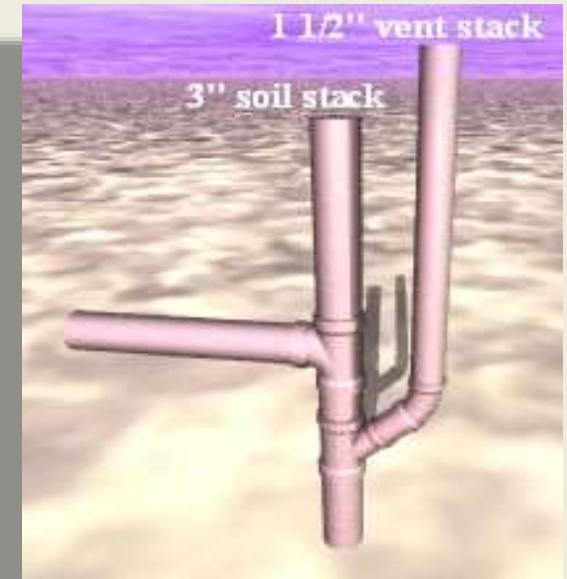
- **These type of traps are used in large hotels restaurants or industries where large quantity of oils waste is generated.** If the oily or greasy matter is not seperated it will stick to the building drainage system resulting in formation of scum and consequent hinderance in aeration.
- **A grease trap is either a masonary or cast iron chamber with a bent pipe or Tee pipe at the outlet.**
- **There is sudden increase in area of flow at the inlet and hence the velocity of flow is reduced which results in seperation of oil and grease from wastewater.** The oil and grease floats on the surface and should be removed periodically.
- **A separate outlet pipe for oil and grease trap can be installed with a valve to stop the flow after complete removal of oil or grease from the top siface.**

Grease Trap



Pipes

- **In house drainage system pipes may be designated** depending upon the function as shown below.
- **Soil Pipe:** A pipe carrying human excreta
- **Waste Pipe:** A pipe carrying sullage
- **Vent Pipe:** It is a pipe installed to provide flow of air to or from the drainage system or to provide circulation of air in the drainage system to protect the water seal of traps against siphonage and backflow.
- **Antisiphonage Pipe:** It is the pipe which is installed to preserve the water seal in the trap through proper ventilation
- **Rain water Pipe:** A pipe carrying only rain water is called rain water pipe.



Sizes of Various Pipes

Type	Size
Soil Pipe	100
Waste Pipe (horizontal)	30 To 50
Waste Pipe (Vertical)	75
Vent Pipe	50
Rain water pipe	75
Antisiponage pipe	50 mm

Sanitary Fittings

- Following sanitary fittings are used in the house drainage system.
- *Wash Basin*
- *Sinks*
- *Bath tubs*
- *Water Closets*
- *Urinals*
- *Flushing Cisterns*

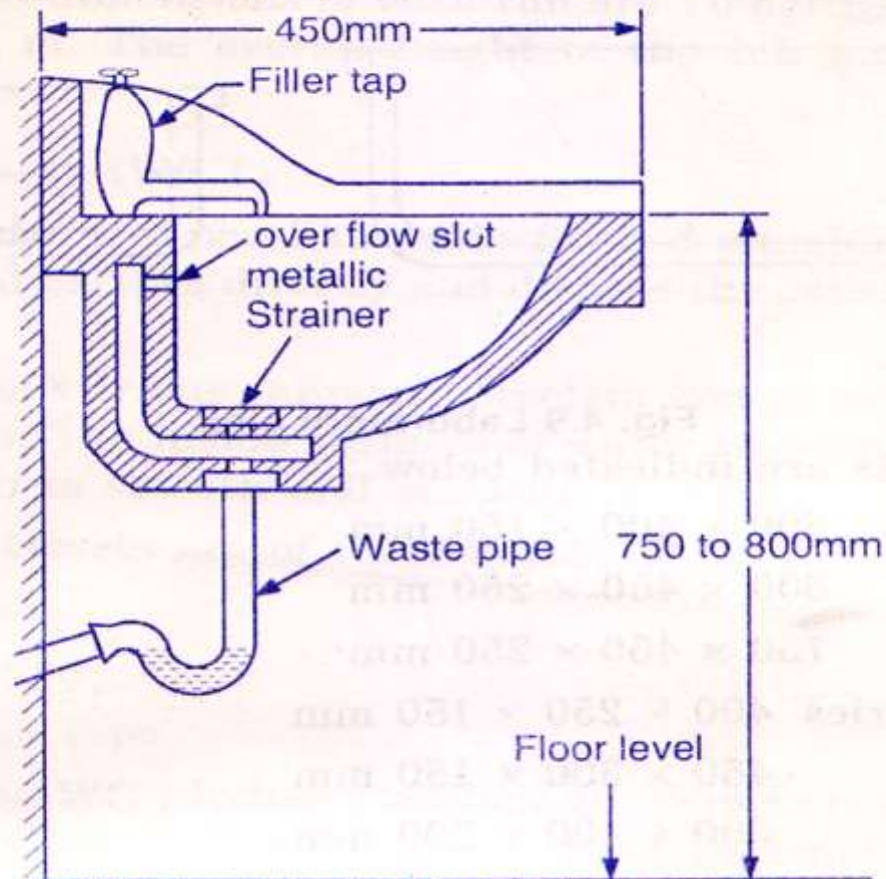
Wash Basins

These are plumbing fixtures mainly used for handwashing.

- These are normally made of glazed earthenware or vitrious china. Sometimes they are also made from iron stainless steel or plastic, specially for the places where users are more.
- Wash basins may be either flat back pattern or angle back pattern. The previous is fixed on walls and latter is used for fixing at corners of walls. The flat back pattern has standard sizes as follows:
 - **630 mm x 450 mm**
 - **550mm x 400 mm**
 - **450 mm x 300 mm**
- Where as the angle back pattern has standard sizes as shown below:
 - **600 mm x 480 mm**
 - **400 mm x 400 mm**

Wash Basin

Section of a flat back pattern wash basin is shown below.



Types of Wash Basins



Sinks

- **Sinks are the plumbing fixtures provided in kitchens for cleaning utensils. Sinks are also provided in laboratories for cleaning laboratory glasswares etc. The plan and section of sink is shown below:**
- **Sizes of sinks are indicated below:**
- **For Kitchen**
- **600 x 400 x 150 mm**
- **600 x 450 x 250 mm**
- **750 x 450 x 250 mm**
- **For laboratories**
- **400 x 250 x 150 mm**
- **450 x 300 x 150 mm**
- **600 x 400 x 200 mm**
- **500 x 350 x 150 mm**



Bath Tubs

- **Bath Tub is the plumbing fixtures provided in the bathroom for taking bath. This is made of glazed earthenware or vitreous china, cement concrete finished with terrazzo or glazed porcelain tiles or marbles and enamelled iron.**
- **A circular waste hole at the bottom of bath tub is provided for drainage purpose. The hole is provided with a metallic waste fitting also called waste coupling having a strainer and clean opening of about 40 mm to 50 mm dia. A waste pipe is fixed to the waste fitting.**
- **The bath tub is provided with tap or shower and overflow pipe of 40 mm located at 40 to 50 mm below the top edge of the tub.**

Bath Tub



Water Closets (W/C)

- **A water closets is a pan like water flushed plumbing fixture designed to remove human excreta directly and dispose the same in to the soil pipe through trap.**
- **It is made of vitreous china or porcelain and is connected to soil pipe through the trap.** The inside surface of water closet and trap are glazed so that the flushing is smooth and efficient.
- *The water closets are of three types:*
- *India Type*
- *European Type*
- *Anglo Indian Type*

Indian Type WC

- **Indian Type WC: Indian standard IS 2556 Part III- 1990 provides detailed specification for the vitreous china Indian type water closets.**
- **Following fig shows the Indian type Water closets**



Indian Type WC

- **It is simple in construction and working but used in squatting position.** Usually it is made from porcelain. The pan and trap are available in two different pieces. **The trap has an opening for antisiphonage pipe. The WC is fixed in squatting position just at floor level.** Indian type WC requires around **10 litre of water** for flushing. The flushing cistern is fitted at **2 m height from the water closet.**

European Type Water Closet

- **Fig shows European type water closet.** It is usually made of porcelain. It is provided with **seat and cover.** The pan has flushing rim to spread the flushing rim to spread the flush water. **The closet is fitted with P-trap or S Trap.**



Anglo Indian Type W/C

- In the european W/C the user can not rest on thin rim conveniently and in indian W/C chances of fouling of excreta are more. The above disadvantages of european and indian water closets are removed in anglo Indian water closet. The closet is fixed 40 cm above from the floor level and upper rim of the pan is enlarged sufficiently so that user can conveniently sit .**

Anglo Indian Type W/C



Urinals

- **(Indian Standard IS 2556 part 6 1992 describes the detailed specification for the vitereous urinals)**
- Urinals mostly in use are of two types:
- *Bowl Type*
- *Stall Type*

Urinals



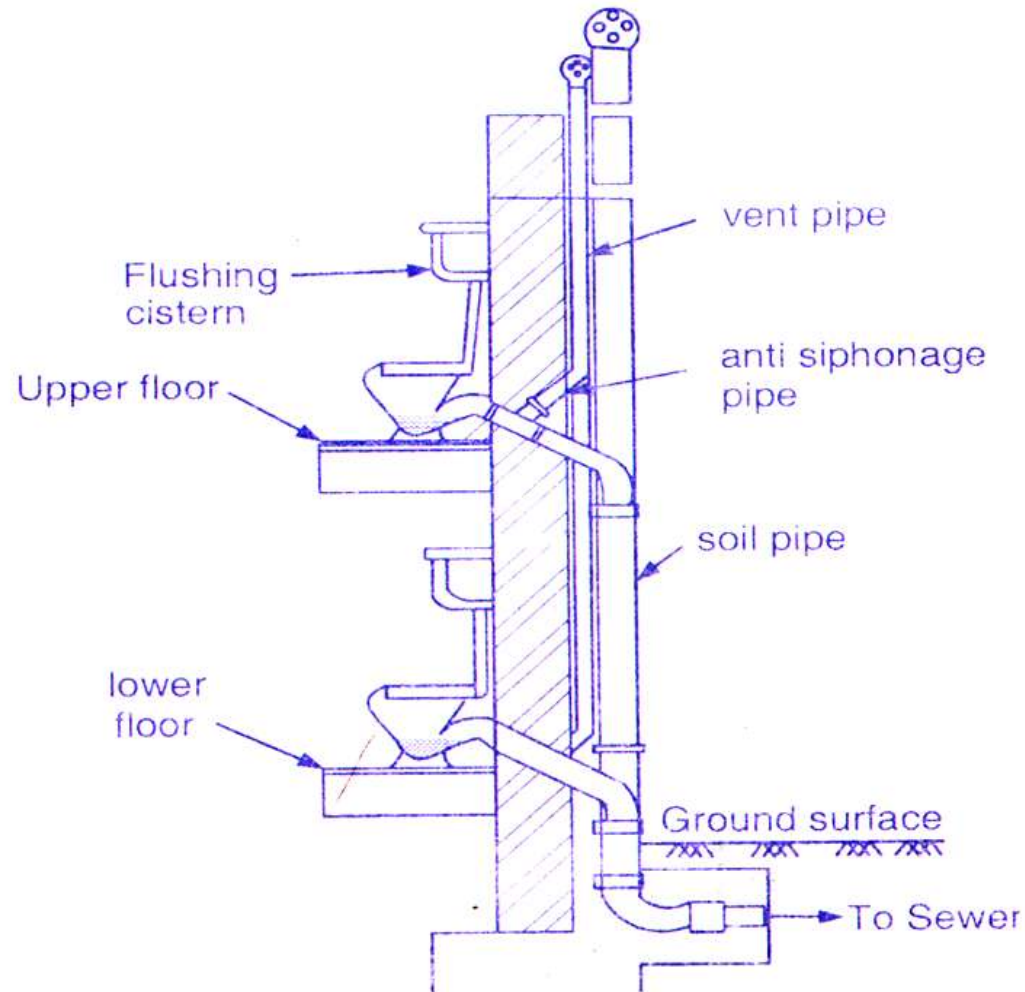
Flushing Cistern:

- **Indian Standards IS 774-1990 provides detailed specification from flushing cisterns for water closets and urinals. Other than plastic cisterns.**
- **The flushing cistern is installed to flush the water closet and urinal.** It is made of cast Iron, glazed earthenware or vitreous china or plastic. For Indian WC the flushing cisterns are made from **cast Iron and fixed at a height of about 1.75 m above the top of closet pan.** They are known as high level flushing cisterns
- **For european and anglo Indian type water closets, normally vitreous china or plastic cisterns are used.** The cisterns are fixed with their bottom at only **height of about 30 cm** from the top of the pan. They are therefore known as low level flushing cisterns.

Flushing Cistern:

- Flushing cisterns are classified as
- *Siponic without valve*
- *Siponic with valve*

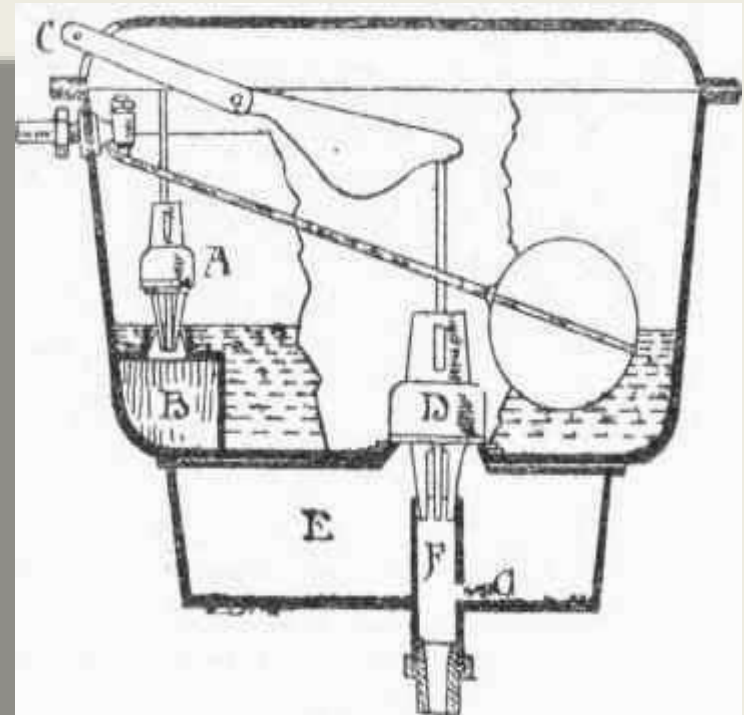
Flushing Cistern



Bell Type flushing

- **Bell type flushing cistern shown below is used with Indian WC. It doesn't have valve.**
- Bell type flushing cistern consists of following parts.
- *Bell*
- *Float*
- *Lever with chain*
- *Inlet outlet and overflow pipes*
- *Cast Iron casing*

Flushing Cistern



Bell Type flushing

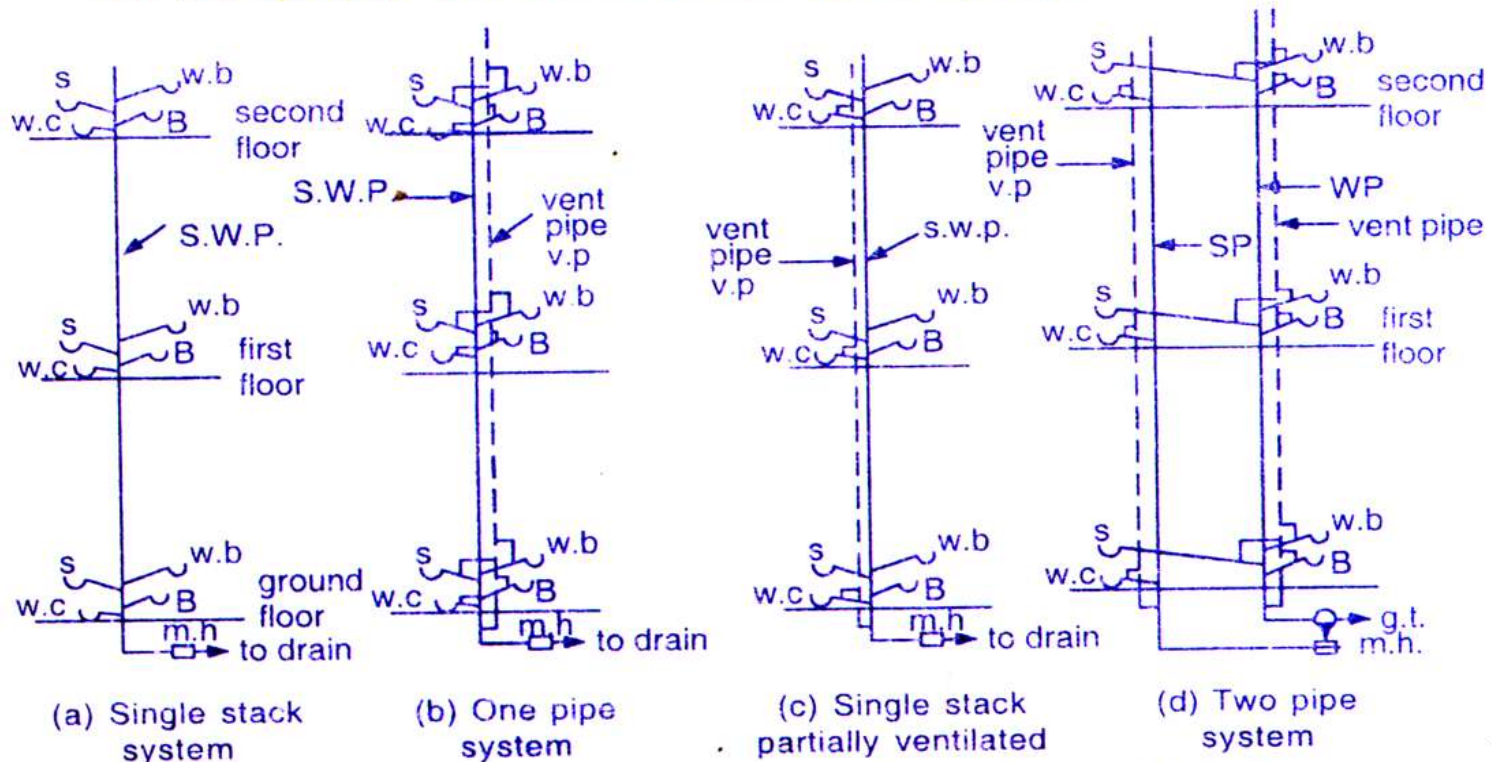
- **The function of the cistern is based on principle of siphonic action.** When the float is at bottom the inlet valve is open and water enters the cistern when water level rises the float also rises and at a certain water level the inlet valve is closed.
- **When the chain is pulled the bell connected it through lever, is lifted up and water splashes inside the bell through the bottom of the bell which carries some air with it and as a result of that partial vacuum is created in the bell which generates the siphonic effect and water continuously flow in the flush pipe through its bottom and siphonic action stops. As the cistern is emptied float comes down and inlet valve is opened allowing water to flow in the cistern.**

System of Plumbing for House Drainage

- **There are four plumbing systems for house drainage**
- *Single Stack System*
- *One pipe system*
- *Single Stack Partially Ventilated System*
- *Two Pipe system*
- All the systems are shown in the following figures

System of plumbing and house Drainage

All the systems are shown in the following figure.



w.c. = Water closet; B = Bath tub, w.b. = Wash basin; s = Kitchen sink; v.p. = Vent pipe;
 S.W.R. = Soil and Waste pipe; S.P. = Soil pipe; W.P. = Waste pipe; M.H. = Manhole; g.t. = Gully Trap
 Note : All pipes terminate as vent pipes at the top.

Single Stack System

- From the figure it is clear that only single pipe acts as soil pipe waste pipe and ventilation pipe.
- *This is poorly ventilated system*
- *It is simple system and easy to construct.*
- *Risk of water seal breaking in the trap is high because of induced siphonage.*
- *Waste or air of the waste pipe may be forced up due to back pressure.*

One Pipe System

- **A Separate vent pipe is provided in this system.** It is clear from the study of sketch that in comparison to single stack system:
- *This system is costly and difficult to construct*
- *Ventilation is provided to sullage pipe and soil pipe too.*
- *Arrangement of pipe work is difficult.*

Single Stack Partially Ventilated System

- Following are the features of this system.
- *Only water closet traps are ventilated.*
- *Traps of baths, washbasins and kitchen are not joined with vent pipe.*
- *This is economical system*
- *It is required to maintain water seal of 75 mm or more.*
- *It has simple arrangement of pipe.*

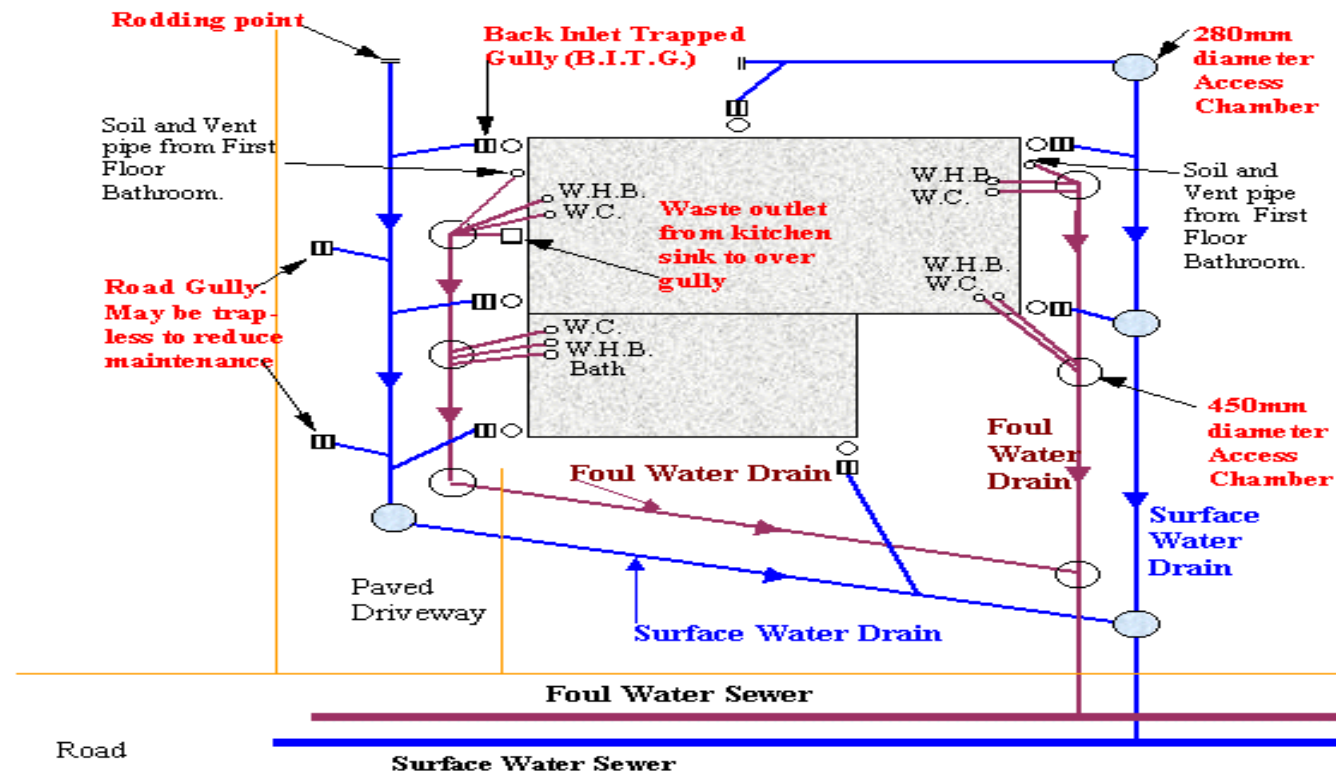
Two Pipe System

- Following are the features of this system.
- *Water closets, bath traps, kitchen traps and wash basin traps all are connected to vent pipes.*
- *Separate soil pipe and waste pipes are provided.*
- *Two vent pipes are provided.*
- *There are four stakes in this system*
- *It is efficient system but costlier than other systems.*

House Drainage Plan

- **Important points to be considered while preparing house drainage plan are mentioned below.**
- *Drainage layout plan should be as simple as possible. Pipes should be laid in straight line.*
- *Both vertical and horizontal pipes shall be laid in straight lines as far as possible.*
- *Where there is change in the direction of pipe, inspection chamber or manhole should be provided.*
- *Sewers should not be laid under a building to avoid the risk of decrease in bearing capacity in case of continuous leakage of sewage from joints. The leaked sewage percolates in the soil and increase moisture content of soil below the foundation. Increased moisture content decreases bearing capacity which is not desirable.*
- *Pipes should be laid at proper gradient and proper size. The usual size of house sewer are 100 mm, 150 mm, 230 mm, and 300 mm. they should be laid with such a gradient that there is no deposit of solid matter.*

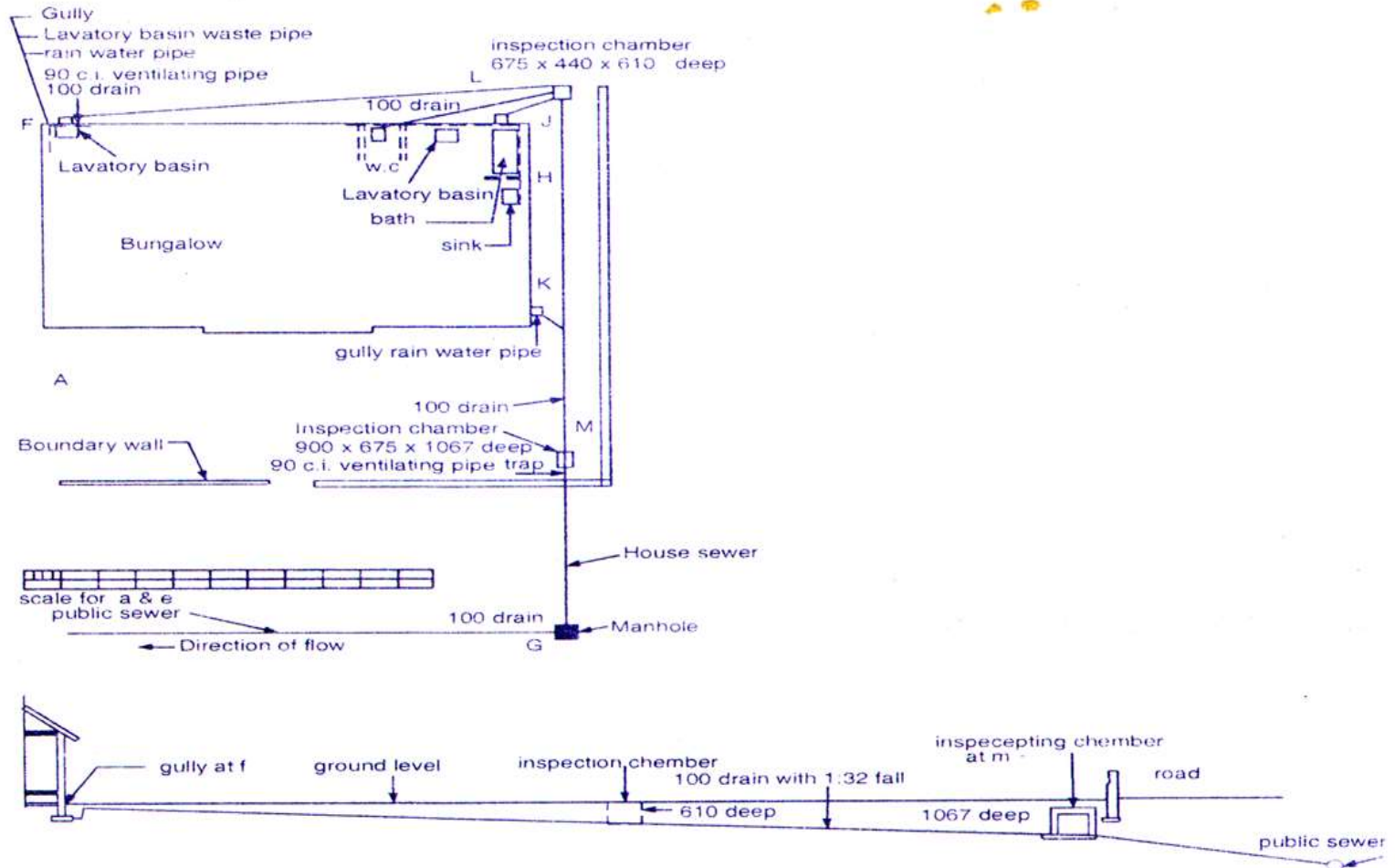
House Drainage Plan



DRAINAGE SCHEME FOR MEDICAL CENTRE

House Drainage Plan

TYPICAL HOUSE DRAINAGE PLAN





References

- **Environmental Engineering : By *Prof B.R.Shah*
*Prof A M Malek***
- **Internet Websites**

Thanks!



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