

Aam Aadmi Series - 11

# HOUSE BUILDING DIGEST

(Sanitary and Drainage)



**bmtpc**

Creating Enabling Environment for Affordable Housing for All

This is an attempt by BMTPC to provide useful but often ignored information about multifarious activities involved in house construction and other technical and non-technical matters associated with building materials and construction technologies. The series is being brought out with a specific rationale to reach out to common people of our nation and make them acquainted about building construction. Every individual has a dream of owning a house and through this series which is aptly named Aam Adami Series, we will slowly unravel myths and misconceptions about building construction. The language used here is lucid and simple to comprehend. The complicated technicalities are explained in a parlance which can be understood by one and all.



## Sanitary and Drainage System

Potable water supplied to the house is distributed to various areas like kitchen, bath, W.C. etc through a network of water supply pipes. The waste water from these areas is then to be drained out of the house through the drainage plumbing pipes. Alongside, it is also to be ensured that the drainage is carried out in a sanitized manner so as to eliminate foul smell and development of bacterial and other forms of diseases, which may be a health hazard for the people living in the house.

In addition to the water supplied through the pipes, rain or storm water from the terraces, balconies and paved areas of the house has also to be drained out of the building to avoid flooding within the house.

A house has to be provided with a good and efficient drainage and sanitary system to facilitate healthy and hygienic living for the inhabitants. Faulty design of the plumbing system, improper installation, faulty fixtures etc result in an unhealthy living environment, causing immense harm to the inhabitants.

Due care has to be taken in this regard and the plumbing system has to be got designed with the help of engineer/architect and has to be installed through a licensed plumber.

In the case of new buildings the architect's plans should show the exact location of the proposed plumbing work in the house. The work should be done according to written specifications, carefully drawn up by the architect or a sanitary engineer, under whose immediate direction the plumber should work.

### Sewage

Before embarking on the essentials of a sanitary and drainage system in a house, it is good to understand some other elements which are closely connected with the system.





Typically, almost 80% of the water supplied in the houses comes out as wastewater. This waste water, also known as sewage, has to be drained out of the house into the sewerage line installed by the Urban Local Body (ULB) or the local municipal authority.

Depending on the origin, the sewage can be classed as Sanitary, Commercial, Industrial or Surface Runoff. The spent water from residences are classified as sanitary sewage, which have been dealt in this booklet.

Wastewater from all the above sources usually carry pathogenic organisms that can transmit disease to human beings. It contains organic matter causing odour problems. The disposal of sewage usually involves its collection from the source, transmission through pipes of various materials and diameters, its treatment and ultimate safe disposal.

It is pertinent to define here that an *effluent sewer* is a collection system that transports only the liquid portion of wastewater through small-diameter pipes laid along the contours of the area; a *sanitary sewer* is a system of pipes used to transport human waste; a *storm drain* is a collection and transportation system for storm water and a *combined sewer* is a system which performs functions of both the sanitary sewer and a storm sewer.

## Sewer Lines

Further to the systems of sewage being deployed, the types of sewer lines being laid are of great importance. These include the Trunk Sewer (or Transmission Main) which is a large diameter line (typically 12" or larger) that collects sewage through several houses. Next is the Collector Line (or Interceptor Line) which is a smaller line (typically 8" in diameter) that collects sewage from the homes and transports it to the trunk sewer. Further, a Lateral is a





smaller section of line that transports sewage from the house to the collection line. These lines have a typical diameters are 4" for houses.

The ULB is responsible for providing and maintaining the sewer lines, whereas the house owner is responsible for providing a proper drainage system in the house and letting it into the main/lateral sewage line. At the junction of the domestic and municipal line a manhole is usually provided, which is maintained by the ULB.

### House Drainage

Having understood some of the basics of sewage system, let us understand about the drainage system of a house. The term drainage or sewerage includes the method/ system of waste water from kitchen, bath, wash basin etc commonly known as sullage and waste from WC and urinals, called soil water.

The drainage system consists of two parts viz. drainage below the ground level and drainage above the ground. The drainage below the ground consists of underground house drains, inspection chambers, manholes etc for disposing the sewage into the city sewer line.

On the other hand the drainage above the ground level consists of vertical and horizontal pipes, traps etc for disposal of sewage into the underground drainage for its final disposal.

### Essentials of a Drainage System

The essentials of a perfect system of house drainage are simple and have to be understood by the house owner. It involves proper way of laying of pipes for collection of waste water, storm water, human waste, waste from the kitchen, installation of plumbing fixtures,





provision of traps to provide a proper seal, installation of ventilation pipes etc.

Depending upon the disposal facilities available, the entire sewage of the dwelling may deliver either into a regular system of sewers provided by ULBs', or into a septic tank.



**Typical External  
Drainage Connections**

The following issues have however to be kept in mind while designing the internal drainage/sewerage system in a house:

- a. Removal of all liquid and semi-liquid wastes, whether a soapy discharge from wash basins or bath tubs etc, or the vegetable refuse/greasy matter from the kitchen sink, or the foul discharges from water closets and urinals.
- b. Prevention of the foul gases, originating from the decomposition of the above matters in the drain, sewer, or flush tank etc, from returning through the same channels into the house.
- c. Neutralization of the foul gases in the drainage system, which may have resulted from decay of waste matters, within the house drains, soil and waste pipes.
- d. Proper protection of all outlets of fixtures from the reentrance of the foul gases.

These issues may be discussed with the architect/. engineer/plumber, by the house owner for ensuring healthy living.





## Plumbing Systems for Houses

The house owner should be conversant with the various types of plumbing system which can be adopted for the purpose of drainage in the house. This would enable him make the correct decision on the system to be adopted from the viewpoint of economy and efficiency.

Broadly speaking, there are three main types of plumbing systems which are commonly adopted in India. These include the following:-

- a. Two Pipe System
- b. One Pipe System
- c. Single Stack System

The Two Pipe System of plumbing is a traditional system wherein the foul matter from the WC and urinals is discharged into one pipe, commonly known as soil pipe. Simultaneously, the waste water from kitchen, bath, wash basin etc is discharged into another pipe, commonly known as the waste pipe.

The soil pipe is directly connected to the building drain whereas the waste pipe is connected to the building drain through a gully trap. In this case separate ventilation pipe is connected to the soil as well as the waste pipe.

In the One Pipe System the entire drainage of the house is discharged through one pipe and a separate vent pipe is provided to which all the floor traps are connected. Gully trap is not provided in this system. This system is economical for multistoried housing where the baths, WC etc are placed near each other at each floor.





The Single Stack System is a simplified version of One Pipe System in which all the soil and waste from the house is discharged into a single pipe which also serves as a vent pipe. In this case deep seal traps are used at each level of the building. This is the most economical system as only one pipe serves all the purpose.

### **Pipes for Drainage System**

The pipes for drainage system have to be selected carefully and due care shall be given for jointing and laying.

### **Materials for Pipes**

The pipes used in a drainage system in a house can be made out of Cast Iron (CI), Reinforced Cement Concrete (RCC), Mild Steel (MS), Stone Ware (SW) or PVC etc. These pipes are commonly available in the market at any sanitary ware shop. Depending upon the requirements, these pipes can be used at different places in the house drainage system.

The interior of these pipes should be well-glazed and smooth throughout; the pipes should be impervious, true in section, perfectly straight, and of a uniform thickness. This ensures a smooth flow of sewage thereby reducing the chances of blockage.

The best material for soil and waste pipes is cast iron. All cast iron pipes used in house drainage should be thoroughly sound, of a uniform thickness throughout, and must allow ready cutting without splitting. The inside of these pipes should be truly cylindrical and of smooth finish.

The size for house drain pipes is dependant to some extent upon the area of the house, number of its occupants, the grade of the drain, the amount of water to be used per head per day and such other factors which would influence the quantum of flow in the pipes.





## Pipe Joints

The joints of the pipes should receive particular attention. The danger arising from imperfect or leaky joints is twofold, viz. first the leaking sewage pollutes the soil and endangers the purity of the water supply in places where houses are dependent on wells and cisterns for water.

Secondly, the solid matter being carried in suspension in the pipes gets deprived of a part of their liquid carrier, and thus tend to accumulate and form deposits in the house drain. These deposits soon undergo decomposition and fill the drains and pipes with noxious gases.

## Laying of Pipes

Care should be taken to lay the pipes on a firm bed of sand or gravel, and if this is not available, a concrete base should be provided in the trench. The pipes should be laid in straight lines, all changes of direction should be effected by curves of as large a radius as possible, formed of bent pipes. All branches should join the main pipe, by using special shaped pieces.

## Rain Water Pipes

As the name suggests, Rain Water Pipes (RWP) are meant exclusively for draining out the rain water from the house. These pipes, when laid on the outer surface of the house, may be of galvanized wrought-iron or of tin. When laid inside of a house they should be of cast iron and their joints treated in all respects as those of soil pipes.

RWPs should never be used as soil pipes and, on the other hand, soil pipes should never be used to carry rain water from the roof or other such open areas in the house.





## Sanitary Fittings and Fixtures

Sanitary fittings and fixtures, which were considered a luxury years ago, are now considered necessary, not only for comfort and convenience, but also from considerations of health and cleanliness. Even a small house is nowadays generally provided with a kitchen sink, a water closet, and sometimes even a bath tub.

It is advisable to provide fixtures in a manner that they are located, as far as possible, in a restricted area of the house. This would help in providing only few vertical pipes of soil and waste and also avoiding long horizontal lengths of pipes. This may be taken care of during the architectural planning of the house.

Further, the encasing of plumbing fixtures should be discouraged for sanitary reasons. Dampness and nasty odours can be prevented by keeping such spaces entirely open so that a free current of pure air sweeps around the fixtures, the most remote corner of which is thus made accessible for cleaning purposes.

There are a number of types of sanitary fittings and fixtures which can be installed in the plumbing system of a house. Some of these are explained here.

### Squatting Pans

Squatting Pans, usually made out of vitreous china, are normally installed in an Indian Type WC. Long pattern, Orissa pattern or integrated type of squatting pans are commonly available in the market, although Orissa pattern pans are preferred in a house.



**Typical Squatting Pan**

At present Glass Fibre Reinforced Polyester (GRP) squatting pans are also being manufactured which can be installed with ease.





High level or low level flushing cisterns can be installed depending upon the choice of the house owner. Low level cisterns are usually preferred for their ease of maintenance.

### Wash Down WC

Wash Down or Western Type WC seat is an alternate to the squatting pan which can be installed in a house. They are quite convenient for the aged and are increasingly becoming popular for common use.



*Western Type WC Seat*

They can have independent cisterns which may be installed either at high or low level or be of a single unit having both the seat and the cistern. The later type of seats are costly and being installed in luxury homes.

### Seat Covers

Seat covers are installed over the seats which have to match the dimensions of the seat below it. These covers help in the use of the seat and prevent any foul smell emanating out of the system when not in use.



*Seat Cover*

### Flushing Cisterns

Flushing cisterns are meant to flush or drain out the human waste from the toilets. These can either be operated manually or can run automatically. In a house, usually the manual cistern are adopted. They can be installed at high levels and operated through a chain or at



*Manual Type WC Cistern*





a low level and operated through a handle. These cisterns can be of cast iron, vitreous china, pressed steel or plastic. They are usually supported on cast iron brackets, embedded in the wall.

### Wash Basins

Wash basins, as the name suggests, are provided in a house for casual washing of hands and face etc as also for the purpose of carrying out morning chores of brushing, shaving etc.



*A Typical Wash Basin*

It is suggested that at least one wash basin be installed in a house in an open area to facilitate easy use by the house owner or guests. Otherwise, even for small usage the bath will get blocked.

Wash basins can be installed as an individual unit having a pipe to drain out the water or as a combined unit having both the basin and the pedestal.

They are usually made of vitreous china and are commonly available in various designs and colours.

### Bath Tubs

Bath tubs can be provided in houses where there is sufficient area available in the bath rooms. They can be made out of galvanized sheets, stainless steel or cast iron stone ware, porcelain, PVC etc. Any of these may be used, the selection depending chiefly upon their cost and upon the personal preference of house owners. Porcelain bath tubs, although perfectly non-absorbent, clean and attractive in appearance are not much in use, being very expensive and heavy.





## Kitchen Sinks

Kitchen sinks are an essential feature of a house as it not only helps in the cleaning of utensils, but also serves as a part storage of the used utensils. It thereby gives more working space on the kitchen platform.



*Kitchen Sink*

These sinks are available in different sizes and shapes to suit the working platform and easy workability in the kitchen. The most commonly used sinks are of stainless steel, which are easy to install and can be cleaned easily.



*Stainless Steel Kitchen Sink*

## Overflow Pipes

It is customary to provide bath tubs wash bowls, and pantry sinks with an overflow pipe, in order to prevent flooding of floors, if the outlet of any of the fixtures gets closed or a tap in a fixture is left running.

Since overflow pipes are seldom flushed they are liable to become foul with soap foam etc, emitting unpleasant odors over a period of time.

## Traps

Traps are an essential feature of a drainage system in a house or any other type of building. They are provided to prevent the entry of foul gases into the house from the sewer or drain. This is achieved by providing a double bend pipe for retaining water, which serves as a seal.

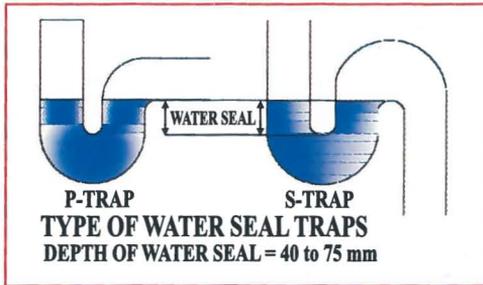


*A Typical Water Seal Trap*





A number of different types of traps are available in the market for installation at different sections of the house plumbing system. The most common ones used in a house are the P and S shaped traps, called the P-trap and S-trap respectively. They are so shaped so as to be perfectly self-cleansing. They are of uniform diameter throughout, have no nooks or corners to accumulate undesired matter.



Traps under fixtures have become a necessity, as much of the so-called "sewer gas" is actually generated in the drain and soil pipes of the house and the traps help in providing a seal. Traps should be located as close as possible to fixtures, in order to reduce the length of waste pipe.

The sealing of foul gases depends on a proper size of traps for waste pipes: the smaller the trap the better will it be washed clean.

Traps can broadly be classified as under, depending upon the use and location:-

- a. Floor Trap or Nahani Trap
- b. Gully Trap
- c. Intercepting Trap
- d. Grease Trap
- e. Silt Trap





Floor Traps or Nahani Traps are provided in floors to collect used water from the floors, bathrooms, kitchen etc. They are provided with a removable grating at the top. Gully Trap is a deep seal trap and is provided on the external face of the wall for disconnecting the waste water coming from the kitchen, bath, wash basin and floors from the main drainage system.

Intercepting Traps are provided at the junction of the house drain and the street sewer for preventing the foul smell of the street sewer into the house drain.

Grease Traps and Silt Traps are normally not provided in the house drainage system. They are provided where large amounts of grease or silt is expected to flow into the street sewer.

### Venting of Pipes

A proper vent pipe has to be provided for the traps under fixtures as otherwise the water seal is liable to be siphoned off. The vent pipe also serves the purpose of letting the foul smell out of the house.

All types of pipe, including wrought, cast, and galvanized iron, lead, brass, plastic, and copper, have been used for vents, depending on the pipe used in other parts of the system, the cost involved, and the type of sewage handled by the drainage system. As certain kinds of sewage emit different gases, they may corrode certain metals more readily than others.

### House Drainage Plumbing System

The plumbing installation for the house itself begins with the laying of the pipe, called the house drain, that receives all waste and water discharged by the soil stacks and waste lines. The house drain is laid from a point just outside the building foundation wall where it connects to the house sewer. It, then, runs through the wall to the point where connection with the soil stack is made.





There are mainly two types of drains provided in the houses. The first being the sanitary drain, which receives the sanitary and domestic wastes, and second the storm drain, which is meant for receiving the rain water. Often the discharges from both these drains are kept separate. The sanitary drain is connected to the main sewer or septic tank and the storm drain to the street storm water drain or system. However, in many cases, both soil and storm stacks fall into a common or combination drain and flow together into the sewage system.

### **The House Drain**

Like the sewer, the house drain must be of sufficient size to service the pipes draining into it. Much depends on whether the drain is serving as a combination for both soil and storm stacks.

### **Turns, connections, supports**

As in all drainage-system piping, changes in direction must not be abrupt. A sharp turn causes solid waste to accumulate and may eventually result in its stoppage. Therefore, if turns are necessary, they should be as few as possible.

Good and airtight connections not only forestall leaks, they also prevent foul-smelling sewer gases from escaping. Special care should be taken to inspect all fittings and junctions and testing the system thoroughly before making final attachments to house and drain fixtures.

### **Installation**

For installing a plumbing system, work should begin from the outside connection with the house sewer towards the soil stacks of the house. To avoid impeding the flow of waste, all changes of direction should be made with fittings giving a large radius, rather than a one having a small radius.





## Testing

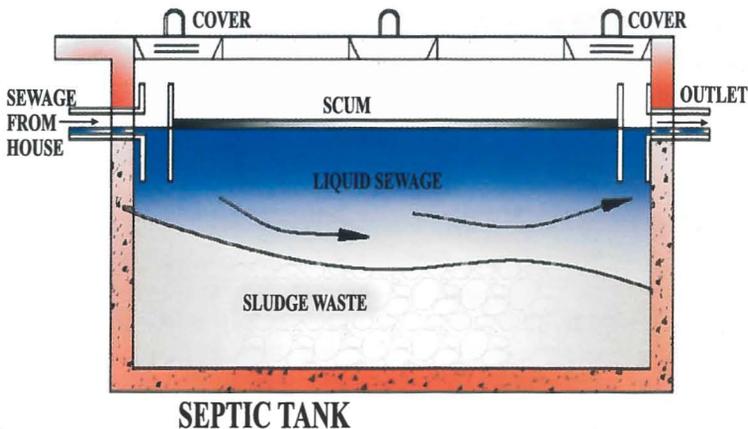
When all the piping in the house is completed, the tightness of the joints has to be thoroughly tested, before connecting the fixtures. The test which is mostly used is the "water pressure test."

## Disposal of Sewage

The total discharge from the house has to be disposed off in the Municipal sewers in a manner that it does not cause any harm to the human beings. This is because the sewage contains large quantities of organic matter which emanates foul smell on decay. It also contains harmful bacteria which can cause danger to human life.

Accordingly, in towns and cities where proper sewer lines are laid, the sewage is ultimately lead to the Sewage Treatment Plants (STPs) where the sewage is treated to remove the harmful ingredients.

In places where sewer lines are not laid, the sewage from individual/group of houses is disposed off into Septic Tanks. In case of an individual house, the sewage can be disposed off by providing a sludge soak pit.





## Plumbing Regulations

Urban Local Bodies normally issue regulations for plumbing of buildings, and require the plans for plumbing to be submitted to them for approval and for filing. The plumbing, before being covered up, is usually examined by the local authority.

These regulations help in reducing the frequent complaint about bad plumbing in houses, and the consequent entrance of foul gases.

## Records of Drainage and Plumbing

The house owner is advised to keep for future reference, for cases of inspection or repairs and alterations, a complete plan of all the drain, soil and waste pipes in and outside of the house. These records will help the house owner for the purpose of maintenance as also when the system is proposed to be modified or upgraded.

The records would include the location, depth and sizes of the drain pipes, material of pipes, location of junctions, traps, vent pipes etc.

## In Conclusion

A proper piping work for sewerage and plumbing ensures hygienic conditions in a house. It has to be kept in mind that the soil, waste and building sewer pipes should be of the required material and diameter, as per the design of the plumbing system of the house.

All connections should be provided in a manner so as to prevent cross flow from one appliance to another. Further, the slope of the pipes should be adequate and in the direction of flow.

The following points should be kept in mind while designing and executing layout of sanitary pipes for the drainage in a house:-

- Pipe works and appliances should be arranged in a manner to allow close grouping of connections with water closet near the main soil pipe.





- Joints in pipes should be properly sealed.
- Pipe joints should be avoided in walls.
- Branch pipes should be kept as short as possible.
- Bends in waste pipe should be of large radius.
- Vent pipes should be installed in a vertical manner, unless the requirement is otherwise.
- All the pipes should ultimately be accessible for maintenance purposes.
- The soil, waste and building sewer pipes should not be reduced in diameter in the direction of flow.
- Cast iron fittings and branches for waste pipes should be of same quality.
- PVC pipes could be a good alternative for storm water drainage in the house.
- Proper water proofing should be provided in the depressed portions, where sanitary seats etc are installed.
- Plumbing works should be got done by a licensed plumber.
- Where no sewerage lines are available, the sewage from the house(s) should be drained into a properly designed septic tank or soak pits etc, as per requirements.

The objective of house drainage has to be ultimately achieved by the plumbing system i.e. instant removal of all liquid and semi-liquid waste matter from the house, prevention of foul smell entering into the house and proper jointing of pipes etc.

**BMTPC is bringing out a series of HOUSE BUILDING DIGESTS for Common Mans' Know-how. This is eleventh in the series.**



## **BMTPC**

The Building Materials & Technology Promotion Council (BMTPC) was setup in 1990 as an inter ministerial organisation under the Ministry of Housing and Urban Poverty Alleviation to bridge the gap between the laboratory research and field level application.

## **VISION**

BMTPC to be world class knowledge and demonstration hub for providing solutions to all with special focus on common man in the area of sustainable building materials, appropriate construction technologies & systems including disaster resistant construction.

## **MISSION**

To work towards a comprehensive and integrated approach for promotion and transfer of potential, cost effective, environment-friendly, disaster resistant building materials and technologies including locally available building materials from lab to land for sustainable development of housing.

For your queries please contact :-  
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