Designing and Waterproofing of Internal Wet Areas

[Excerpts from "Good Industry Practices - Waterproofing for Internal Wet area", Building and Construction Authority, Singapore, 2003 and Dr. Fixit Healthy Construction Booklet "Construct Your Ideas", 2012, pp.34]

1.0 Introduction

Bathrooms, kitchens, water closets etc. are the designated wet areas of a building. They are the main sources of leakage and dampness which lead to unhygienic conditions. This affects the health and comfort of its occupants and seriously deteriorates the building, reducing its stability.

Decisions made during the design stages have serious implications on the construction and future maintainability of wet areas. Wet areas that suffer from water leakages, ponding, staining and other defects are usually result of poor designs and specifications.

Water may penetrate wall and floor finishes in wet areas. Depending on the frequency, the intensity and the length of time these surfaces are exposed to water; unintercepted, the water may damage the moisture-sensitive materials lying beneath, and reach adjoining rooms and their finishes. Consequently, careful attention should be paid to the design and installation of all materials, components and systems to prevent damage by water.

2.0 Design Consideration & Precautions

2.1 Water Closet

In case of water closets, the source of water leakages is in the joints of water closets, between the flushing cistern and the flushing pipe, between the flooring tiles and in the faulty pipes which are used for down take and made of material susceptible to corrosion. Similarly, water leakages may happen at various other junctions such as the flushing pipe with the WC (Water Closet) pan, the WC and the foot rest with flooring, the WC and traps with the branch pipe and at the floor trap. The other reasons may be depressed reinforced concrete slabs to accommodate the pan and trap, incorrect placement of the overflow pipe, a cut out in the structure for the branch pipe and the Indian type WC fixed loosely. All these source of leakages are shown in Fig. 1.

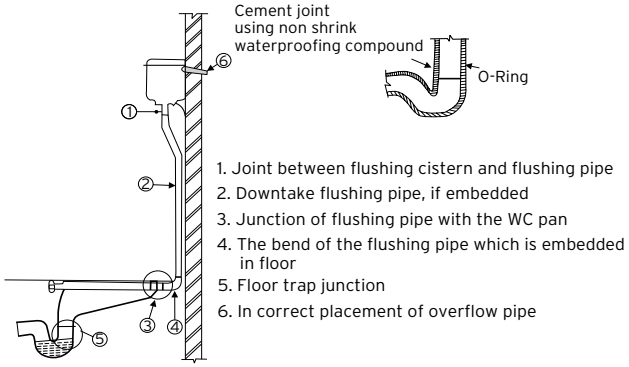


Fig. 1: Sources of leakages in WC & flushing cisterns

The recommendation for prevention of leakage is given as follows:

2.1.1 Flush Pipe

- It should be securely connected to the cistern outlet and made airtight by means of a coupling nut. The nuts made of moulded HDPE / PVC may be used only if the end pipe is also made of HDPE / PVC.
- It should not be made of iron, as it is likely to corrode.
- If, a GI pipe is used, the pipe should be completely protected by bitumen painting and taping where it is embedded in concrete.
- It should be properly fixed with rubber gasket or gold size quality putty at the entry hole of the WC pan.

2.1.2 Where Squatting Pan is Provided with Traps

- Firstly, temporary laying of pipe line and WC pan should be done by giving temporary pickings.
- The level should be checked and corrected taking into account the final finish level of the flooring.
- After the WC pan is fitted and jointed, cement concrete blocks should be put around this joint and then the depressed portion should be filled up.
- A suitable portion should be given to the depressed RCC floor which accommodates the pan and trap to lead the water to the rear portion of the WC pan.
- A corrosion resistant GI pipe of 25 mm dia should be provided to drain off any water accumulated in the depressed area as shown in Fig. 2.

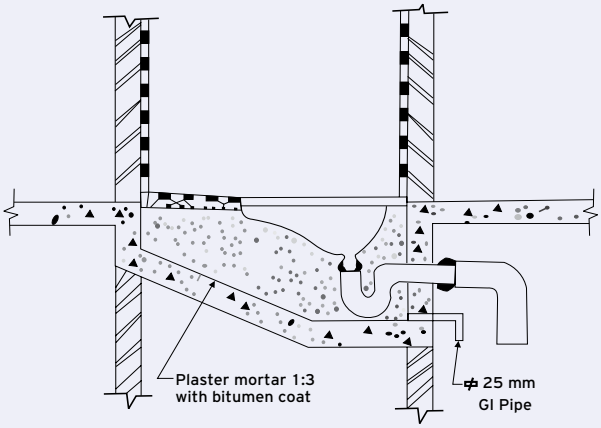


Fig. 2: Depressed slab and arrangement of joints in WC

- In addition to the draining of the depressed portion, the depressed area should be made waterproof.
- The finished floor should be sunken by 25 mm from the adjoining floor, and walls up to at least 300 mm should be made from an impervious material such as cement plaster, terrazzo in situ or tiles, glazed and ceramic tiles.
- Where a squatting pan is fixed with a rim either in line with tile flooring or below the flooring junction of flooring tiles, the rim is the main point of leakage. To avoid this, suitable nonshrink, bonding material should be used for fixing the last tile and the joint between the flooring and the rim of the WC.

2.1.3 Indian Type WC

- Where the bath and Indian type WC are accommodated in a single toilet connected to a septic tank, the slope of the floor in the bath area should be away from the WC to avoid drainage of soapy water.
- As far as possible, integral tread WC pan should be preferred to avoid seepage from the joints. Where separate footrest is used, the joints between tread and flooring should be made leakproof by using non-shrink waterproof mortar.
- The overflow pipe from cistern should be brought right up to floor level and provided with a right angle bend outlet over the floor.

2.1.4 European Type WC

- In the European type WC, the WC is fixed by screws using rubber washer to the floor. A rubber gasket should be used at the joint to avoid leakage. The junction between the pan pedestals with the flooring should be filled with cement mortar mixed with a non-shrink waterproofing compound.
- The joint between the pan and trap should be made leak-proof with cement mortar at 1:2 or at 1:3 with a non-shrink waterproofing compound. The detail of fixing WC is shown in Fig. 3.

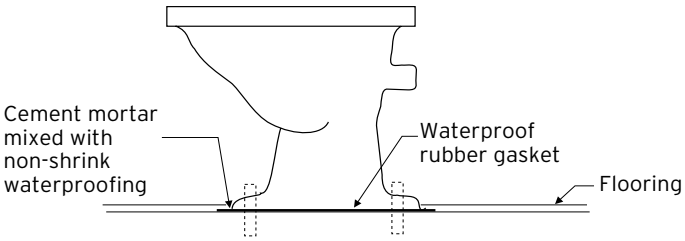


Fig. 3: European type WC

As far as possible, a joint-less floor should be laid. However, where flooring tiles have been used, these should be laid on a bed of waterproofing mortar, and care should be taken to fill the joints effectively.

The cut out hole made for the outlet pipe should effectively be sealed with waterproof cement mortar after the pipes are fixed.

2.2 Bathroom

The source of water leakages in a bathroom may be from the junctions of the water pipe and floor / wall, the floor and wall where the shower splashes water, the door frame and floor on account of eventual rotting of door frame, wash basin, concealed piping and fitting, improper slope, joints between flooring tiles, cut out in the structure for a branch pipe and floor trap junction. The recommendation for prevention of leakage is given as follows:

- The floor of the bath room should be constructed of material which does not readily absorb and the entire floor should be sunk by 25 mm from the adjoining floor.
- The surface of the wall and floor should be made of an impervious material.
- The floor should be sloped away from the door (entrance) towards the outlets, a minimum slope of 1 in 60 recommended.
- Bathroom floors and walls to a height of at least 1 m from the finished floor and in case of shower, 2 m from the finished floor should be made of impervious materials such as waterproof cement plaster, terrazzo in-situ tiles or glazed tiles.
- As far as possible jointless floor should be laid, however, where flooring tiles have been used these should lie on a bed of waterproof mortar and care should be taken to fill the joints effectively.

2.3 Kitchen

2.3.1 Sources of Leakage

- Type of sink and placement of draining board.
- Area surrounding the sink.
- Joints between the sink and draining pipe.
- Junction joint between kitchen platform and the wall.
- Improper ventilation leading to condensation.
- Floor traps.
- Floor level washing place.

2.3.2 Recommendation for Prevention of Leakage

- The draining board used with the sinks should be placed in such a way, that water which is being drained does not find the way towards the wall and it should overlap the side of the sink.
- The area surrounding the sink should be made waterproof by using impervious materials such as in-situ terrazzo flooring, mosaic tiles and glazed ceramic tiles.
- The joint between the sink and the draining pipe should be leakproof.
- The waste pipe from the sink must discharge effectively into the floor trap. Preferably a cleanout junction should be used to facilitate periodical rodding.
- Kitchen slabs made of stone or precast cement concrete slabs are normally fixed by being inserted into the wall. The insertion is done by making a chase, and the chase becomes a source of seepage. To avoid seepage, a skirting should be provided at the junction point.
- Proper ventilation should be provided in the kitchen to avoid condensation.
- A slope not less than 1 in 100 should be provided to the washing floor towards the drainage points with floor traps.

3.0 Design Considerations

3.1 Substrate – Floor

The structural slab should be of minimum of M25 grade of concrete admixed with a waterproofing compound. A slope of minimum 1:50 should be maintained. The waterproofing system in a typical wet area consists of the following and is shown in Fig. 4.

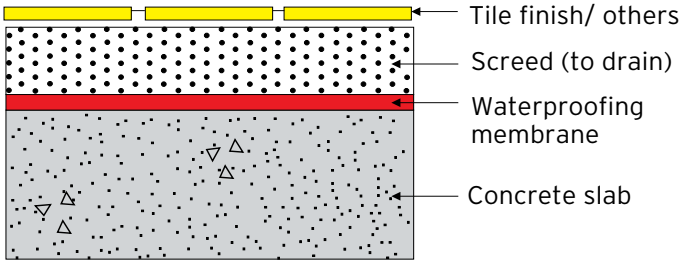


Fig. 4: Floor slab with waterproofing and membrane finishes

An adequate drop during concrete casting should be provided to ensure that the finished level of the wet area is sufficiently lower than the level of the adjacent concrete slab to prevent migration of water into the dry area (Fig. 5).

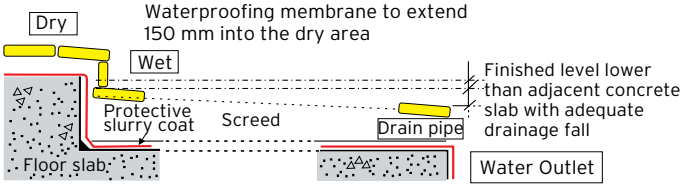


Fig. 5: Adequate drop in floor slab

If pipes are encased in screed, the drop required should take into account the minimum screed thickness of 20 mm required at the lowest level, i.e., at the floor water outlet.

For a wet area adjoining to a dry area, the membrane should extend minimum 150 mm from the wet area into the concrete slab in the adjoining dry area.

It is idea to provide concrete kerbs to prevent migration of moisture into dry areas (Fig. 6). It is also a good practice slab to prevent debonding of the kerb. Kerbs should be constructed at the base of walls to act as barriers against the lateral movement of water. A height of 100 mm for the kerbs should be sufficient for this purpose.

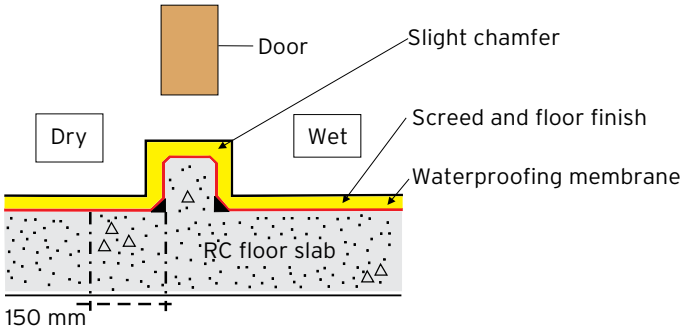


Fig. 6: Kerb between wet and dry area

3.2 Substrate – Wall

The joints at walls of wet areas, such as a brick wall to reinforced concrete columns, should be minimized. Where the joints are unavoidable, the designer should consider specifying reinforcement with polymer modified mortar (Fig. 7) at these areas. The designer should also consider rendering walls to a minimum height of 300 mm from floor level, for a smooth finish to receive the waterproofing membrane upturn.

Fig. 7: Reinforcement installed at brick – RC joint

Showers / bath areas and other parts of the wall that require membrane application should also be rendered to the height and width specified.

The designer may choose to add a waterproofing agent to improve its waterproofing performance.

For wet areas with a high amount of water splash, the waterproofing membrane should turn up to a minimum height of 300 mm. This will create a minimum tanking protection against the migration of water to spaces adjacent or below the wet area.

At the upturn areas, the membrane should extend minimum 100 mm horizontally from the wall floor joint to create sufficient lapping with the subsequent membrane application. The details of waterproofing upturn at a wall are shown in Fig. 8.

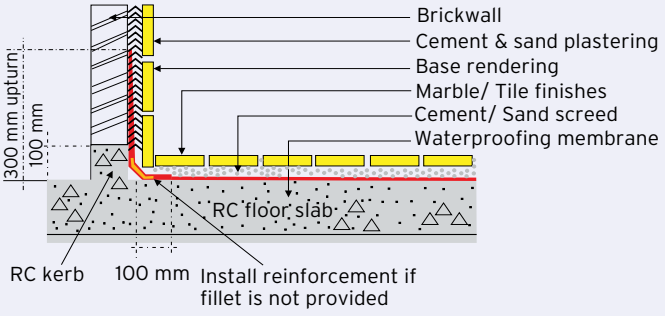


Fig. 8: Details on Waterproofing upturn at walls

At bath and shower areas, ensure that the waterproofing membrane is applied to at least 1800mm height and 1500 mm width of the enclosure (Fig. 9 & Fig. 10). The wall or substrate immediately adjacent or behind a basin, sink or similar fixture

must be applied with membrane to a height not less than 300 mm above the fixture if it is within 75 mm of the wall. At long bath areas, the cross section detail is shown in Fig. 11.

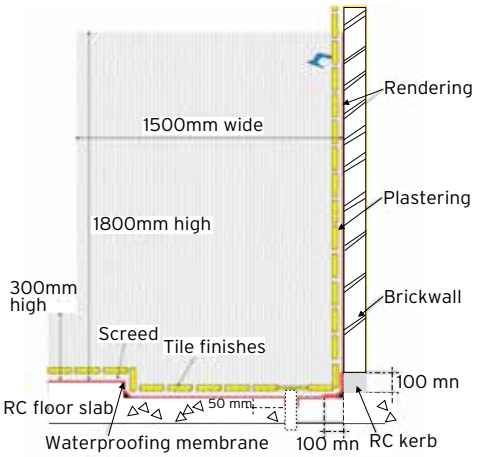


Fig. 9: Waterproofing details of shower area

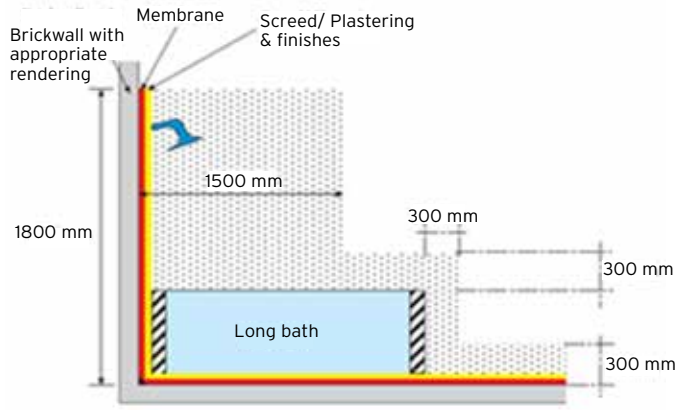


Fig. 10: Waterproofing details at long bath area

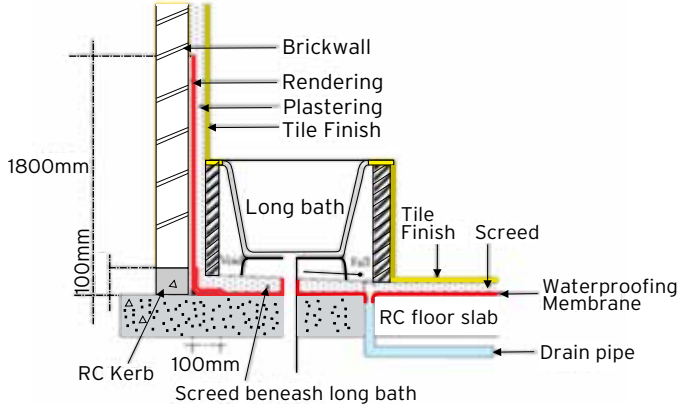


Fig. 11: Detailed cross section at long bath area

At sunken bath areas, the membrane should similarly be applied to a minimum height of 1800 mm (Fig. 12).

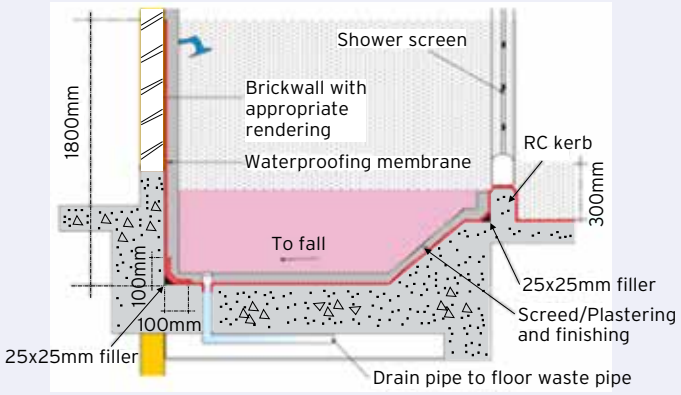


Fig. 12: Waterproofing details at sunken bath

3.3 Pipes and Penetrations

3.3.1 Arrangement of Pipes and Penetrations

Number of penetrations through the slab / wall should be minimised, since it will affect the continuity of the waterproofing membrane and increases the probability of a leakage.

Group common discharge stacks and provides a raised platform at this area, or alternatively provides a shaft / service space to house them.

Avoid chasing of walls and floors.

Connect drain pipes directly to waste pipes.

Avoid concealing drain pipes in the screed of dry areas e.g., bedroom and hall.

Pipes / pipe sleeves should be cast with the floor slab rather than leaving an opening in the slab for the pipes (Fig. 13).

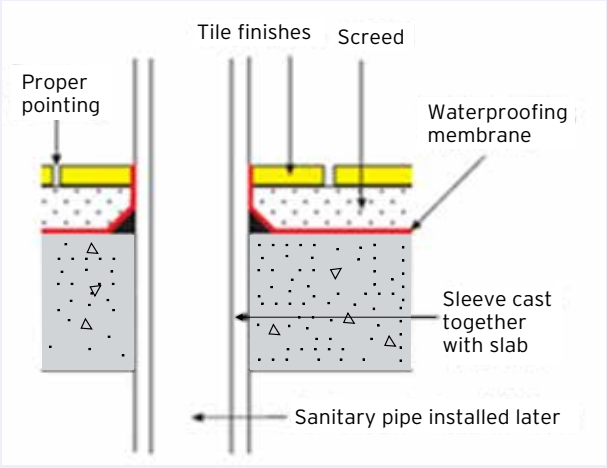


Fig. 13: Pipe sleeve cast with floor slab

3.3.2 Waterproofing Membrane around Pipes and Penetrations

Membranes should be dressed up at pipe penetrations to the finished floor level (Fig. 14) and dressed down to at least 50 mm into the floor outlet (Fig. 15).

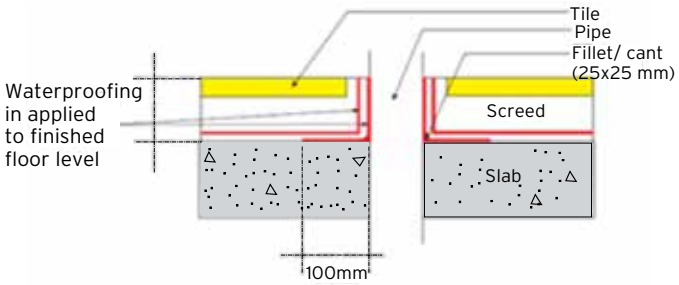


Fig. 14: Waterproofing details at floor penetration

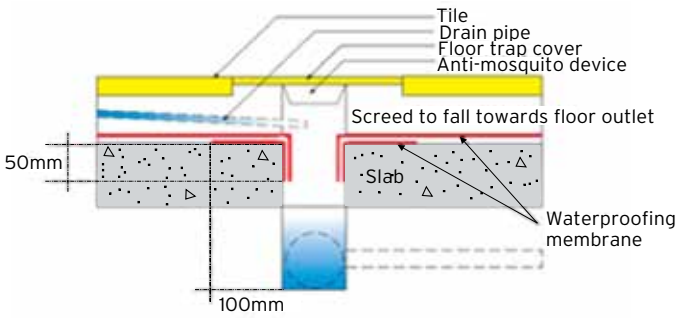


Fig. 15: Waterproofing details at floor outlet

The membrane should be applied 100 mm horizontally around the pipe. This coating should overlap with the subsequent membrane applied to the entire wet area. The cross section of pipes should be fully embedded in the screed (Fig. 16).

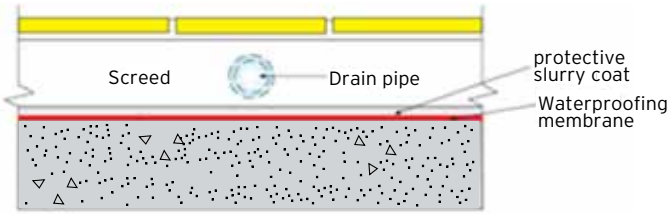


Fig. 16: Pipes embedded in screed

3.4 Ventilation and Air Circulation

Air circulation of wet areas should not only remove odour, but extract dampness and subsequently minimise defects such as the growth of mould on floors, ceilings and walls. Proper air circulation can be achieved by natural means, mechanical means or a combination of both. Exhaust fans and ventilation ducts should be located within 3m of the fan inlet or intake grill. The minimum required outdoor air supply is 10 air exchanges per hour (ACH). For areas that are entirely mechanically ventilated, minimum air exchange rate should be 15 ACH. Intake grills should be provided at low levels near WCs and urinals. This would enable foul-air to be extracted quickly.

The exhaust air should be discharged at least 2m away from the pavement level and at least 5m away from any window.

3.5 Plumbing

3.5.1 Layout

Plumbing and sanitary fittings require some forethought while planning for a leak free bathroom. But often on sites, the works are done in isolation, i.e. no co-ordination between the waterproofing contractors. This results in dampness and leakage, much after the owner has moved in. Since plumbing pipes are nowadays concealed, leakage in the joints shows up as dampness in walls. Hence, the plumbing layout is very important in wet area designs, as efficient plumbing layout ensures the reduction of many discontinuities which affect the homogeneity of the waterproofing membrane and thus minimises the possibilities of membrane failure in the structure.

3.5.2 Important considerations include

- Detailed drawings of the layout of service pipes that are to be cast with the floor slab should be provided. These detailed layouts should include details such as gradients of horizontal pipes, joints and connections.
- The number of wet wall and pipe penetrations through the wall and floor should be minimised so as to maintain high integrity of the structure. Single wet wall design with a common discharge stack can reduce the number of penetrations.
- Raised floors provided around the pipe could minimize contact between water and pipes and reduce the chances of water leakages through pipe penetrations or corrosion of the pipe (cast iron).

3.5.3 Accessibility

The accessibility for repair and replacement of service pipes is one of the major concerns that should be addressed during the design stage. Openable covers can be provided to facilitate access for maintenance. Walk-in pipe ducts can also be included for easy access. In addition, designers should take into consideration the positions of service pipes with regards to the accessibility of the entire floor or wall area for cleaning and maintenance. The pipes should not inhibit the ease of cleaning of floor and wall surfaces. Surface-mounted pipes are typical examples that could increase the difficulty of cleaning.

4.0 Waterproofing System

4.1 General Features

The waterproofing system for wet areas should be as follows:

- Be able to bridge over cold joints.
- Be compatible and easy to apply, especially at pipe penetration areas.
- Be elastic to bridge over different materials.
- Have good adhesion and cohesion strengths.

- Be able to receive screeding and plastering.
- To a certain extent, be resistant to some mechanical damage prior to screed finish.
- Be fully bonded to the substrates to isolate any leaks in the future.

4.2 Limitations of conventional practices of wet area waterproofing

- The PVC pipe inserts do not adhere well with the brickbat coba / cement / concrete used for filling the area and joints around the pipes.
- The polymer waterproof coating and brickbat coba have limited ability to withstand cracks.
- Insufficient attention to detail in the corners and joint areas of the bathroom.

4.3 Selection of Materials

Liquid applied systems are normally preferred over performed systems and integral systems for internal wet areas because of the following advantages:

- Continuity of the membrane between horizontal and vertical planes, around projections and penetrations, and it is self – flashing.
- Membrane adheres to every part of the substrate, which helps in isolating leaks and preventing lateral movement of water.
- Membrane is able to withstand minor cracks.

Apart from standard mechanical properties of flexible cementitious or other water based waterproofing membrane the resistance to water penetration as per DIN 1048, Part 5 should satisfy for no water penetration at 0.2 kgf/cm^2 for 6 hours. A comparison of different characteristics of liquid applied water proofing systems used in internal wet areas is given in Table 1 and images of such waterproofing application are given in Fig. 17-18.

Table 1: Suitable waterproofing system and their characteristic

Typical Characteristic	Rubber Based System	Acrylic Based Systems	Polyurethane System	Cementitious System
Main characteristics	Highly flexible with excellent resilience to cyclic extension and contraction.	Good UV resistance, flexible and good tearing strength (due to fibreglass reinforcement.)	Good flexibility, excellent adhesion to concrete and good tearing strength.	Easy application, excellent compatibility with concrete and good vapour permeability.
Dry film thickness	Generally between 0.8 to 1.5 mm recommended	Minimum 1.2 mm due to fibreglass reinforcement.	Between 1 to 1.5 mm	Between 2 to 3 mm
Application Method	Brush, roller or airless spray.	Application is normally by rollers, to work material into fibreglass reinforcement.	By brush, squeegee or broom. Vertical grade by brush or trowel.	Brush or spray followed by trowelling.
Method of curing & drying time	Air – drying. About 1 hour in exposed condition. 3-4 hours in enclosed areas. 72 hours before flood test.	Air drying. Within 1 hour, but requires minimum 4 to 5 coats due to reinforcement. Total system therefore requires longer drying time. 48 hours before flood test.	Normally moisture cured. Contains solvent therefore requires ventilation. Recommended 24 hours curing time. Most system recommended 72 hours before flood test. For coal tar based system 7 – 10 days is required.	Normally 1-2 hours. Requires curing similar to concrete. Flood test within 24 hours to assist in curing.
Adhesion to concrete substrate and bedding concrete	Generally good adhesion. May be improved by appropriate priming.	Good adhesion to concrete. Vertical application to exclude fibreglass reinforcement for better bonding.	Solvent based is sensitive to moisture. Adhesion may be affected if applied onto damp substrate.	Excellent bonding to concrete for both slabs and vertical walls. Not affected by surface dampness.

Fig. 17: Bituminous elastomeric coating in sunken floor of a bath room

Fig. 18: Polyurethane coating applied in a bathroom

5.0 Application Methodology

5.1 Surface Preparation

- All surfaces must be pressure washed or cleaned with compressed air and then allowed to dry. It should also be free of loose materials, oils, form release agents and other contaminants (Fig. 19).
- The gaps around the pipe inserts and the floor traps etc should not be wider than 50 mm.
- Make angle fillets all around the periphery of the wall with polymer modified mortar prepared with SBR Latex (Fig. 20) and lay a glass fibre mesh (Fig. 21) over the angle fillet all around the periphery while the coating is still wet.

Fig. 19: Surface preparation

Fig. 20: Providing angular fillet around the periphery of wall

Fig. 21: Laying of glass fibre mesh

5.2 Application

- The sanitary pipes entering through the walls and floor are to be sealed with leak-proof sealing tape for pipe wrapping and the gaps should to be grouted with a non shrink cementitious grout (Fig. 22). The 'Nahani' trap, etc., are to be fitted securely in the same manner and the gaps around it to be grouted.
- The 1st coat of Cementitious two components should be applied on the floor (Fig. 23) and extend up to 150 mm on walls and above the finished floor level (FFL) (Fig. 24). Extend the coating in the shower flash zone to 1500 mm wide x 1800 mm high.

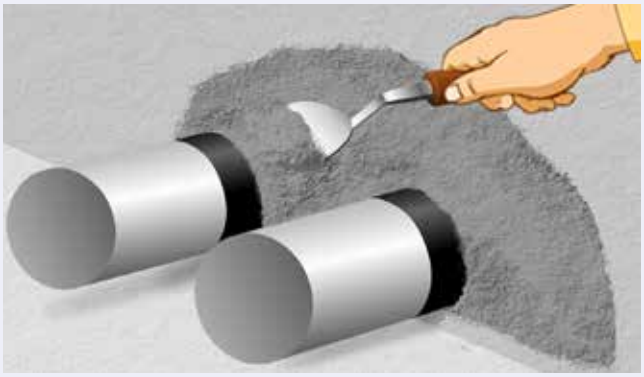


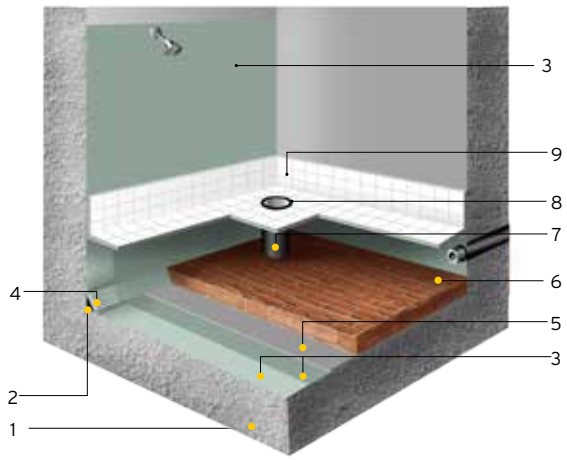
Fig. 22: Fixing the pipes with sealing tape and further doing the grouting

Fig. 23: Cementitious coating on floor

Fig. 24: Application of 1st coat cementitious coating on wall

- While this first coat of Cementitious two components is still wet cover all angle fillets with a 150 mm wide strip of open woven glass fibre mesh of 2 mm X 2 mm immediately over the coating and allow it to soak completely. Cover it with one additional coat of Cementitious two components over the angle fillets and allow it to dry completely.
- Apply a 2nd coat of Cementitious two components after the first coat dries completely. Sprinkle sand over the shower splash zone while the coating is still wet. Also cover the angle fillets during the second coat application.
- 24 to 72 hrs after, the sunken portion must be laid with a concrete screed of 50 mm thickness. Sanitary pipes and traps can be laid over this screed the next day.
- Brickbat coba using an Integral liquid waterproofing compound for plaster and concrete can be laid 24 hrs later to fix these pipes in position.

A typical water proofing detailing in an internal wet area is given in Fig. 25.



1. Concrete slab
2. Angle fillet
3. Two component polymer modified cementitious coatings
4. Glass fibre mesh
5. Concrete screed
6. Brickbat coba
7. Bathseal Tape
8. Cementitious Grout
9. Tiling adhesive & tile grout

Fig. 25: Typical water proofing detailing in internal wet area

6.0 Ponding Test

Before doing the waterproofing the watertightness of bare concrete slab needs to be ensured by the ponding test (Fig. 26). The dampness, leakages need to be detected and according remedial measures need to be taken. The honey combs may be treated by injecting micro fine cementitious or polyurethane grouts material. Any unsound concrete may be removed and repaired with polymer modified mortar. Further ponding should be carried out to ensure water tightness of the structure and proceed further for waterproofing of the substrate. To ensure that the waterproofing membrane is watertight, a water ponding test should be conducted before laying the protective screed. This is not only to ensure the water tightness, but also to check if any remedial measures should be taken for the waterproofing system. Before doing the ponding test it must be ensured that sufficient curing and drying of the waterproofing material has taken place as given in Table. 1. Then all the pipe outlets should be sealed and a temporary bund has to be made at the door sill so that the bath & WC floor is ponded with water for 25 mm depth for a period of minimum 48 hours (Fig. 27). Thereafter an observation has to be made underneath the floor of the applied waterproofing system for any dampness, leakages etc. If required, remedial measures should be taken as per the site condition. If no dampness or leakage is observed then a final protective screed over the waterproofing system should commence. The ponding test should be carried out at a sunken floor slab and all pipe joints should be checked for watertightness before commissioning of the system.

Fig. 26: Water ponding in bare concrete slab of bath room

Fig. 27: Water ponding test after waterproofing in bath room

7.0 Waterproofing Screed

Screed should be laid to slope towards the floor outlet. Performance of screed is important, especially for wet areas and depends on the mix proportions and method of mixing. If the control over such factors is poor, the screed will have shrinkage cracks which may become potential paths of water seepage. This will result in faster deterioration of the waterproofing membrane beneath it and as a result, the life span of the total waterproofing system in wet areas will be shortened. Screeding after waterproofing in bath rooms is shown in Fig. 28.

Fig. 28: Screeding after waterproofing

Design of screeds requires careful consideration of the fitting layout in wet areas to provide required falls and accommodate services for plumbing.

These include:

- Gradient of falls specified should be adequate to allow for efficient drainage of runoff. The directions of slopes should be clearly indicated in the drawings. The minimum gradient of the fall at shower areas or wash areas should be maintained at a minimum of 1:60 towards the floor trap.
- The thickness of screed may be determined by the size of the services that are installed within screed, as the overall depth of the screed is to be increased by the depth of the particular service accommodated.

It is not recommended to lay tiles directly bonded to the waterproofing membrane, as a protective measure against damaging the membrane after the curing of the membrane. Similarly, for waterproofing applications to wall upturns or shower areas, apply a layer of 20 mm thick plaster admixed with waterproof components to protect the membrane before laying the tiles. After installation and commissioning the waterproofing system a final ponding test should be carried on floor and shower water spray test for minimum 15 minutes on the surfaces of the wall to observe the dampness and seepages if any, on underneath of floor slab or other sides of the bath room walls.

8.0 Fixing the Tiles with Tile Adhesives and Tile Grouting

The normal practice followed for fixing glazed tiles in bathrooms, lavatories, kitchens, and other places is the use of stiff neat cement paste and joints with white cement. The cement paste applied at the back of tiles does not often flow towards the edges of the tiles and as such water enters at the edges. In a large number of cases it has been seen that paintings and plaster gets affected behind these glazed tiles, supposedly applied to prevent moisture movement from wet areas.

Cement paste is not the right material for fixing the glazed tiles. The polymer based, hydraulically setting, ready to use, waterproof tile adhesive should be used. They offer many advantages over the conventional method of tile fixing such as better bond and adhesion strengths, faster work and good waterproofing quality to the wall. No curing of the tile surface becomes necessary. If the wall and plastered surface is done to good plumb, a screeding of only 1-2 mm thickness of tile adhesive will be sufficient to fix the tiles. In such a case, the adoption of this material will also become economical.

After finalising the plumbing work in the bathroom floor & wall, tiling work should be done by using the tile adhesives (Fig. 29) & filling the joints with tile grouts (Fig. 30). The tiles should not be put on skinned (dried) adhesive paste. The tile adhesives should have uniform bedding and allowed to be cured for 24hrs without any foot traffic. After filling the tile joints with tile grouts the remaining grout from the surface should be wiped by a dampened cheese cloth or tile cleaner without being pulled from the joint. After finishing all works, the sanitary ware such as wash basin, bath tub, soap stand etc. can be fitted and the gaps around it should be filled with Acrylic Sealant (Fig. 31) to complete the bathroom waterproofing. A view of finished bath room is shown in Fig. 32.

Fig. 29: Fixing the tiles with tile adhesive

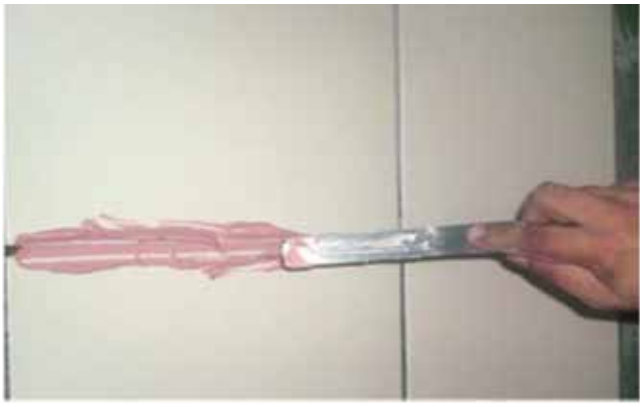


Fig. 30: Filling the joints with tile grouts

Fig. 31: Filling the gap with acrylic sealant

Fig. 32: View of finished internal wet area

9.0 Conclusion

The seepage and leakages in bath rooms and toilets are most common. The problem arises when proper attention is not provided during the planning stage. The pipe joints are most vulnerable for leakages. If waterproofing is designed and laid properly, then the durability of the system improves. But, we are still using old traditional practices of waterproofing, without any modern system in those areas. In terms of prices, the entire bath room waterproofing system is only a fraction of the total cost of a flat. However, we still follow the old traditional practices and face the seepage and leakages, thus creating a dispute between the occupants of upper and lower floor regarding sharing the cost for remedial measures or fixing the leakages.

Remedial Measures in Internal Wet Areas for a Leak-Free Situation

[Excerpts from "Rehabilitation and Repair of Structures", Vol.2, CE& CR, pp.7-8 and Dr. Fixit Healthy Construction Booklet "Construct Your Ideas", 2012, pp. 40-41]

1.0 Introduction

Internal wet areas of a building are those that are prone to be wet internally within structures. These include kitchens, toilets, bathrooms, wash areas, balconies, etc. Water penetration caused due to a lack of water-tightness in the concrete structure manifests in the form of unsightly patches on the walls (Fig. 1) and ceilings (Fig. 2). It can also be seen as the gradual peeling off of the expensive finishes and paints (Fig. 3). Capillary rise of water in the brickwork can bring up dissolved salts leading to 'efflorescence' (Fig.4). In due course, the moisture will lead to corrosion of the steel reinforcement, and the cracking and spalling of concrete. On the whole, the damages due to water penetration are seen in the form of rotting, staining and blistering (Fig. 5), moulding, odouring, swelling, shrinkage, warping, peeling off of paint or wallpaper, water dripping, fungus growth, defective concrete, plaster or tiles, rust staining, decomposition of adhesives, loosening of renderings and weakening of materials. Water could also accumulate ('ponding') if the surfaces are uneven and difficult to drain, like in the kitchen, bath, toilet, etc.

Fig. 1: Internal dampness in a wall causing agony to the inhabitants

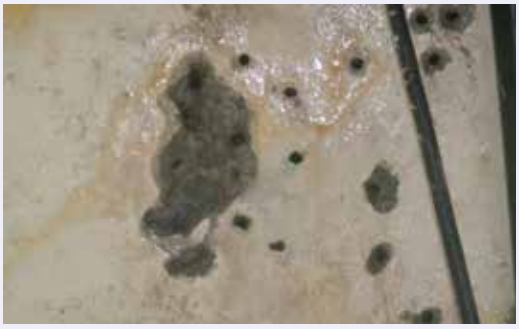


Fig. 2: Water dripping and accumulation on the surface of a roof slab