Drainage of Paved Areas and Buildings

Index

Document Information

Reference 1475 D 001 01

Rev

0 18-01-03

1 22-12-04

Drainage of Paved Areas and Buildings

See 'Approved Document H of Building Regulations' for complete details and specifications.

See also our guide – 'Treatment of Waste Water' for handling foul and grey water disposal.

Drainage and sewer pipes are made from a range of different materials including solid pipes made of vitrified clay, uPVC, concrete, iron and asbestos.

Other materials used for drainage pipes includes ductile and cast iron (CI), glassfibre reinforced plastics (GRP), high density polyethylene (HDPE), concrete, asbestos and pitch fibre.

Most new domestic drainage applications utilising clayware will use plain-ended pipes, rather than the socketed pipes.

- **Plain ended pipes are those that have identical ends and are joined by means of a coupling.**
- **Socketed pipes have identifiable 'male' and 'female' ends, and must be laid with the 'female' end pointing upstream.**
- **Adapters are usually available to allow older imperial sizes to be matched with newer metric sizes.**

Vitrified clayware is much stronger than the plastic equivalents, and is less susceptible to deformation when buried;

- **Clayware relies less on the competence of the granular bedding material to withstand external loading. Clay pipes can often be laid directly into a trimmed and formed trench (known as Class D bedding),**
- **Plasticware must be surrounded by a selected small gravel or pea-shingle. This essential bedding material can often cost as much as, or even more than, the pipes and fittings needed for the job.**

Plastic pipes are much lighter and therefore easier to handle than clayware, and can be easily cut with a hacksaw, whereas clayware is heavy and needs to be cut with special pipe-cutters or a power-saw. Clayware is relatively fragile, and care must be taken during handling to avoid accidental breakage.

Clayware is less likely to be damaged by high-pressure jetting techniques, which are becoming the most popular method of drain and sewer cleaning. Some clayware is now guaranteed to be capable of withstanding jetting pressures of 7,500psi.

Plastics can be susceptible to gnawing by rodents.

When extending an existing drainage system, it is preferred to match the existing type, i.e. extend a clayware system with clayware, and a plastic system with plasticware, unless the client or the specifier insists differently.

For new work, generally clayware is usually a little cheaper and offers better flexibility than plastic, and does not require such expensive bedding.

There are numerous 'classes' of bedding for drainage, designed to suit all sorts of ground conditions, pipe types and anticipated loadings. Each class is identified by a different letter. See Building Regs Part H.

1 Construction & Maintenance

Pipes are typically laid within trenches and extreme caution must be exercised when working in trenches. Collapse of trenches is a frightening experience, and has resulted in moderate to severe injuries, loss of limbs and, in far too many cases, loss of life.

Any trench deeper than 1000 mm must be properly shored up.

- **Never ask workers to take risks! This is especially important where volunteer workers may be employed who may be less aware of dangers and hazards involved with the work.**
- **Do not have trenches open for any longer than absolutely necessary.**
- **Use barrier fencing and/or security barriers to keep children and members of the public out of excavations. See New Roads and Streetworks Code of Practice for details.**
  Make sure that people are at least 600 mm back from the edge of open trenches.
- **Provide adequate signage, including a 25/7 telephone number in case of accidents or failures related to your trenching when your workers are not on site.**
- **Try to avoid having trenches open in inclement weather. If necessary with larger deeper trenches have pumps available during wet weather.**
- **Try not to have trenches open too far in advance of pipe-laying.**
- **Keep trench width to a minimum (generally pipe diameter plus 300 mm) for shallow excavations. Safe working space is necessary for workers in deeper trenches.**
- **Never allow lone workers in a trench - always have a person who stays out of the trench, up on the bank at ground level and monitors the works.**

Manholes and sewers are exceptionally dangerous places.

- **Noxious gases and chemicals may be present that can injure and kill. Always check what chemicals may be being discharged into a pipeline from industrial sites up stream or from contaminated land drainage.**
- **Bacteria and infected rodents may be present. Infections can kill.**
- **When working on sewage pipelines ensure all workers have Hepatitis and Tetanus injections. Available for your GP.**
- **All work on sewage lines must have protective clothing, gloves etc. and hot and cold water for washing must be available.**
- **It is most strongly recommended that all work on live sewers is undertaken by drainage specialists who have successfully completed a 'Confined Spaces' and/or 'Sewer Working' safety course rather than untrained personnel. Properly trained and accredited tradesmen will have certificates to prove their competence.**
- **All utility drainage, gas, electric and water must be constructed to the proper standards. Always check with the Utility Company before making any connections. In some cases the Utility Company will insist on their personnel making and installations or connections.**

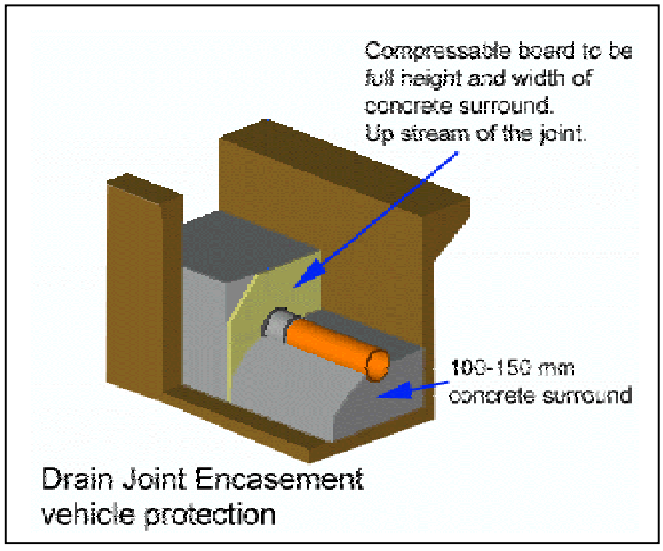
1.1 Gradients and cover

Minimum cover over plastic drainage

- **600 mm in fields/gardens**
- **900 mm beneath light roads/drives**

Minimum cover over clayware drainage

- **300 mm in fields/gardens**
- **400 mm beneath light roads/drives**



Drain Joint Encasement vehicle protection

Where a minimum cover cannot be achieved, the pipe work will need to be encased in concrete. Any pipeline beneath a road that has less than 1000mm of soil/base, cover must also be encased in 100-150 mm of concrete.

A full width/height movement joint consisting of 13 mm compressible board is typically included at every joint, although this may be changed to every alternate joint in some cases.

Minimum Gradient

- **Minimum gradient for surface water drainage = 1:100**
- **Minimum gradient for foul water drainage = 1:40 (WC lines 1:80**

1.2 Access and Joint Fittings

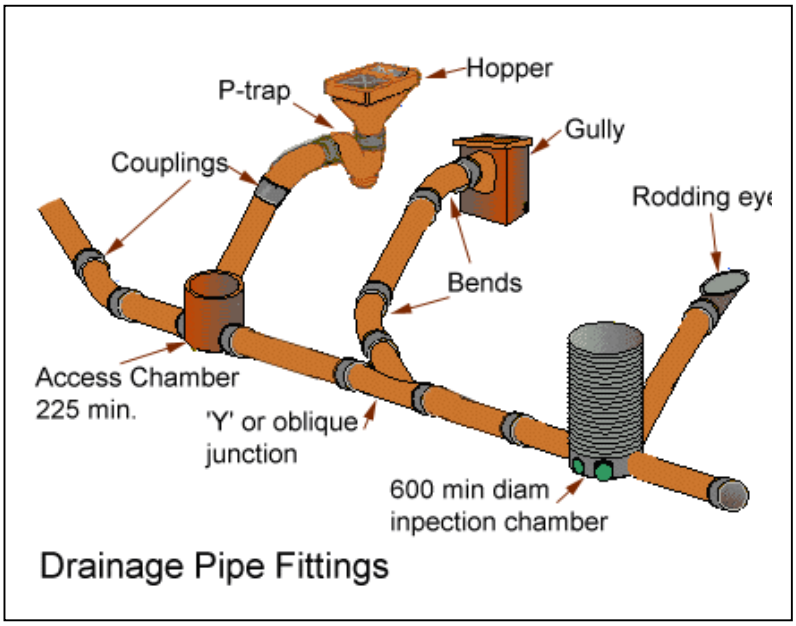
There are a large range of fittings available for all types of drainage systems. Including gullies, hoppers, traps, bends, and junctions as standard items, as well as access chambers, rodding eyes and inspection chambers which are designed to provide access for inspection and/or maintenance.

Manholes tend to be larger chambers (at least 600 mm width), with half-pipes known as 'channels' set into the base (see other drainage pages).

Access points: (Rodding eyes, Access Fittings, Inspection chambers and Manholes)

Must be installed at:

- **Bend or change of direction**
- **Change in pipe diameter**
- **Head of run**
- **Junction, unless all runs connected to junction can be rodded from another access point.**



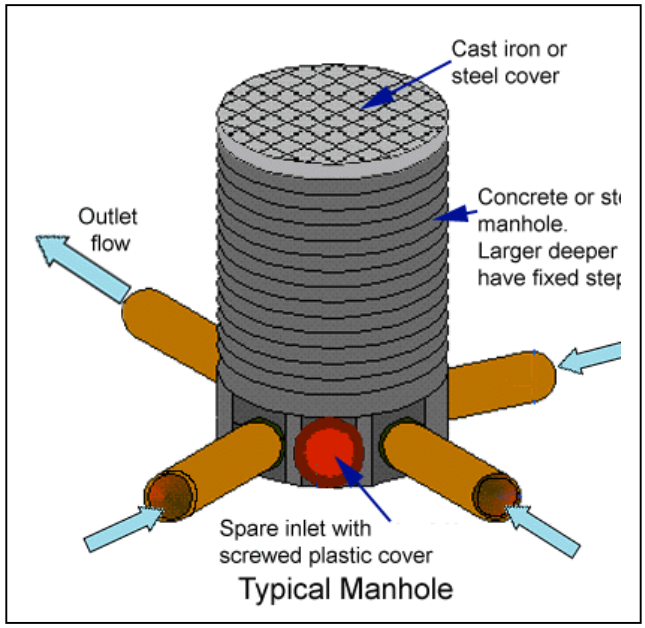
Drainage Pipe Fittings

1.2.1 Manholes

Manholes are typically made from concrete or steel tubes (some newer manholes may be made from polypropylene or UPVC, These are generally suitable for depths up to 1000 mm.), at least 600 mm in diameter, deeper manholes may be brick/block built in domestic and small industrial services.

Manholes of the same/similar construction can be used for other utilities such as gas and electric. However, connections are made more securely by direct joining of gas pipes.

For depths up to 2.7m, the minimum internal dimensions for a brick/block built rectangular manhole are 1200x750mm, although manholes with more than 3 branches may be even larger. Any access manhole deeper than 2.7m is a project which should be undertaken by professional/trained drainage contractors.



Typical Manhole

Additional new drainage can be connected to the system via one of these inlets provided that the inlet is the same size or larger than the pipework to be connected. Excavating outside the chamber will expose the stopper cap, which is then removed and the new pipework connected in its place.

In cases where the inlet is a larger diameter than the pipework being connected, the use of a taper pipe will allow the connection to be made.

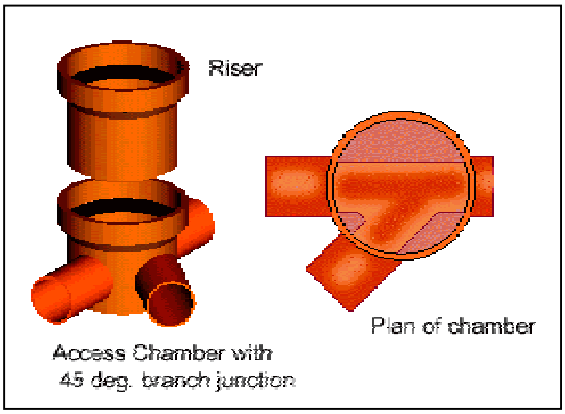
Care must be taken when adding a new connection that the outlet pipe is not overloaded causing backing-up in the manhole.

Connections must be adequately sealed to prevent leakage of gases or liquids from the joint.

1.2.2 Access Chambers

Access chamber fittings are ideal for making single connections.

By using raising pieces, they are suitable to a depth of around 600mm.



Access Chamber with
45 deg. branch junction

Chambers typically have a lightweight aluminium or heavy cast iron cover.

They should be set to level on a 100mm thick concrete bed but do not normally require a concrete haunch (side and top support).

A variety of sizes, pipe diameters and number of branches are available.

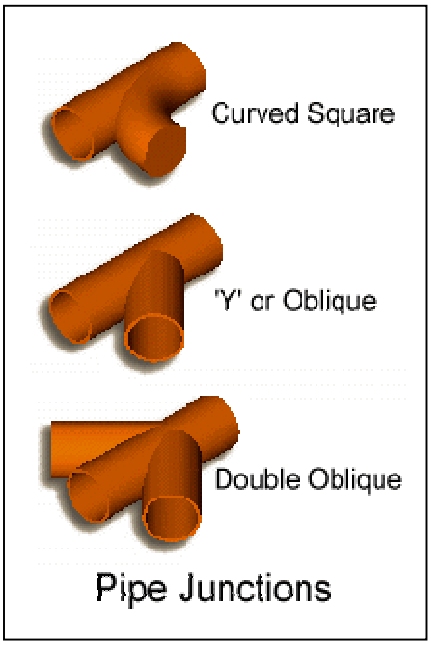
1.2.3 Branches/Junctions

There are two basic forms of branch junction, determined by the angle of the incoming spur, namely oblique or square. These are shown in the diagram opposite.

Oblique junctions have the spur joining the main channel at approximately 45°.

Square junctions have the spur coming in perpendicular (90°) to the main channel, although this is 'softened' by the adjoining spur being slightly curved.

Branch junctions may be single or double, depending on the number of spurs to be connected to the main channel.



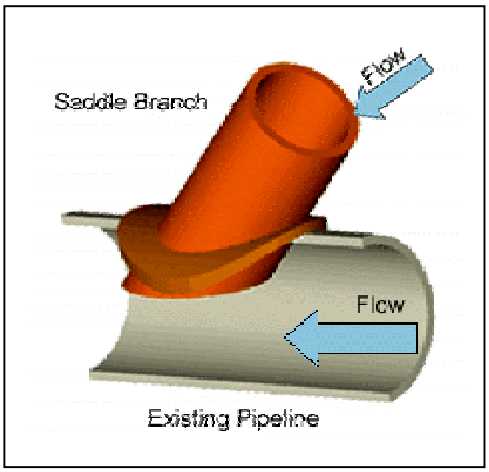
Pipe Junctions

1.2.4 Pipe Saddle Branch

'Pipe Saddles' are a way of connecting a new branch to an existing pipe. This is done by breaking into the pipe via an elliptical or circular hole. This can be used rather than cutting out a whole section of pipe and replacing it with a branch junction.

Saddles should normally be fitted into the top (or crown) of the pipe with an angle to help reduce turbulence in the water flow.

It is essential that any saddle connection is properly sealed to the receiving pipe to prevent ingress of debris and leakage of effluent.



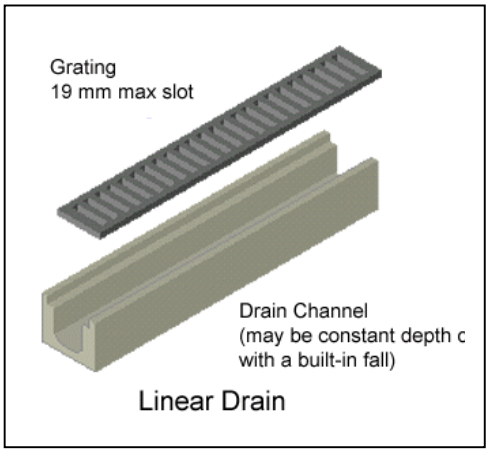
- **With clayware saddles, a mortar joint is usually created, bedding the saddle onto the receiving pipe, and then haunching and backfilling around the saddle with concrete.**
- **Plasticware saddles design and installation vary with the manufacturer; some are heat or solvent-welded, others may incorporate a collar that encircles the receiving pipe.**

In all cases, guidance given in the manufacturer's literature should be followed

1.3 Linear Drains

A linear drain is the formal are equivalent of an open culvert. These are manufactured in two basic types, the constant depth and those with a built-in fall.

Where pedestrians or vehicles may cross them they are provided with steel gratings. Gaps should not be wider than 19 mm.



Linear Drain

The cross-section and grating dimensions are dependent on the weight of the load they are expected to carry, and the width and depth of the channel are related to the area they are intended to drain.

2 Damp Prevention Level Protection

Above Damp Course Protection Level DPL External Surface Level

2.1 Scope

The following section shows how a Damp Course Layer can be protected when the external surface level is required to be above the level of the layer.

It should be noted that it is preferred that the damp course layer is not below external surface level. If the following methods are to be used the contractor should obtain written approval of the local authority before commencement.

2.2 Notes & References

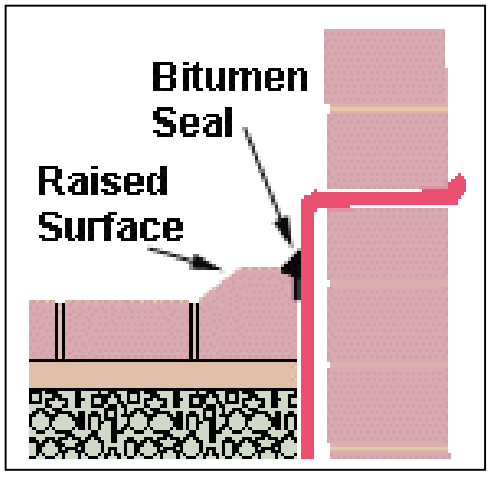
For the best results the external materials should leave a gap between any pavement and the wall. For short low (eg one step height) runs a 50 mm gap between the new surface and the wall could be used.

For greater rises a drained 300 mm gap is preferred so that any detritus which falls in can be cleared. Use of canopies along the effected wall length will reduce water at the flashing and reduce the chance of water penetration. Door thresholds should always have a canopy sufficient to prevent blown surface water and rain entering the building at floor level.

2.2.1 References

Building Regulations Part H - Drainage of paved areas

2.3 External Surface



The external surface should always fall away from the building at 1:40 minimum.

Where vehicles or other potential sources of splashing of pooled water may occur, a raised surface close to the wall is recommended. A slope faced paver with a Bitumen (or similar) seal to the flashing.

2.4 External Wall surface

To help assure that water does not travel up the wall behind the flashing and penetrate the wall the surface can/should be coated with a silicon or polymer sealant. Alternatively the surface may be armoured with a water proofing screed layer.

It is preferable that the flashing is held away from the wall to prevent capillary action allowing water to flow upward between the flashing and brick/block. Small raised studs scattered at intervals across the back (wall side) of the flashing will help resist the force of the external materials pressing it against the wall.

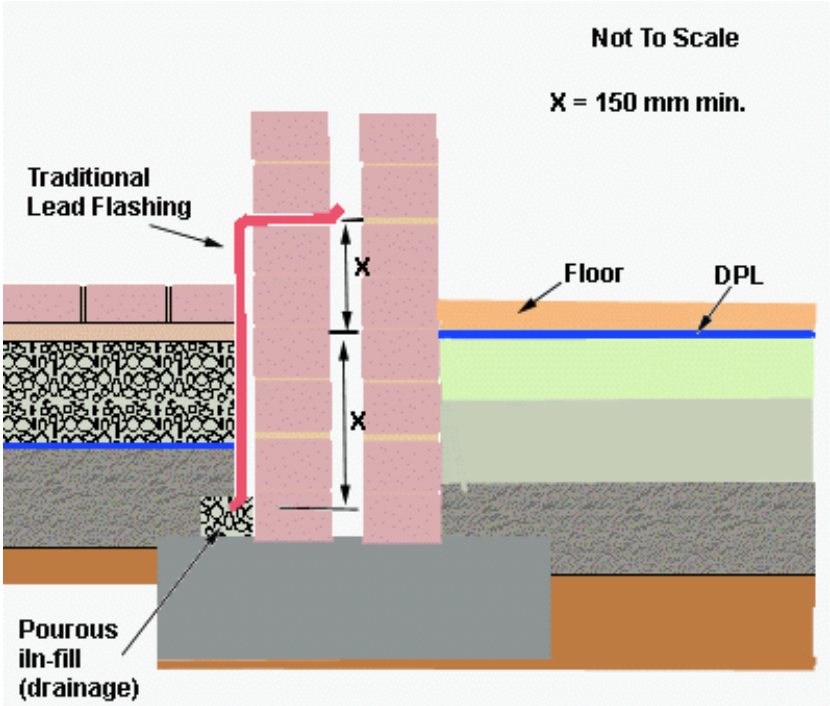
Glazed walls must never be overlaid by external ground or paving materials, they are unsuitable for carrying the forces which might be applied.. Where glazing reaches below the projected new surface level brick/block work should be used to bring the lower edge of the glazing frame to at least 150mm above the new surface.

2.5 Cavity wall drainage

To help combat the potential ingress of water to the cavity holes may be drilled through the wall at the base of the cavity to the outside drainage channel.

2.6 Traditional Lead Flashing

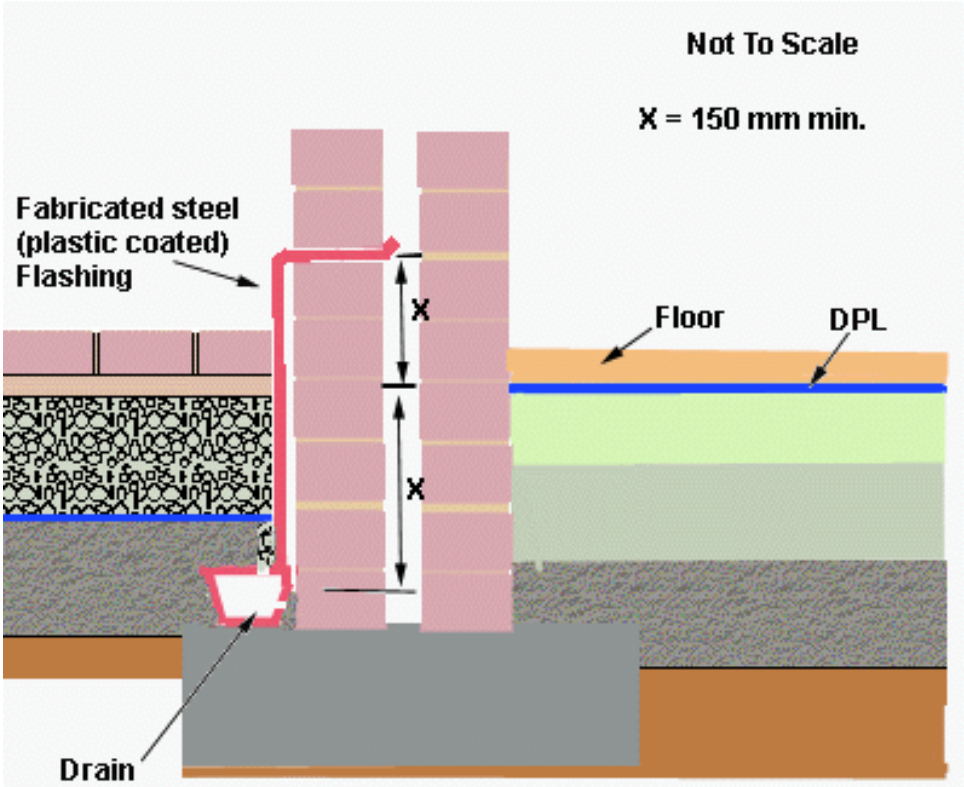
This drawing shows how a traditional lead flashing can be used. This can be quite effective but for long wall lengths can be expensive to use.



Use of traditional lead flashing to protect damp course, where external surface level is above the internal DPL.

2.7 Steel flashing

As an alternative a stainless steel or plastic coated steel, or even a UPVC (or similar) flashing can be used. There are commercially available types with built in drain channels to aid water dispersal.

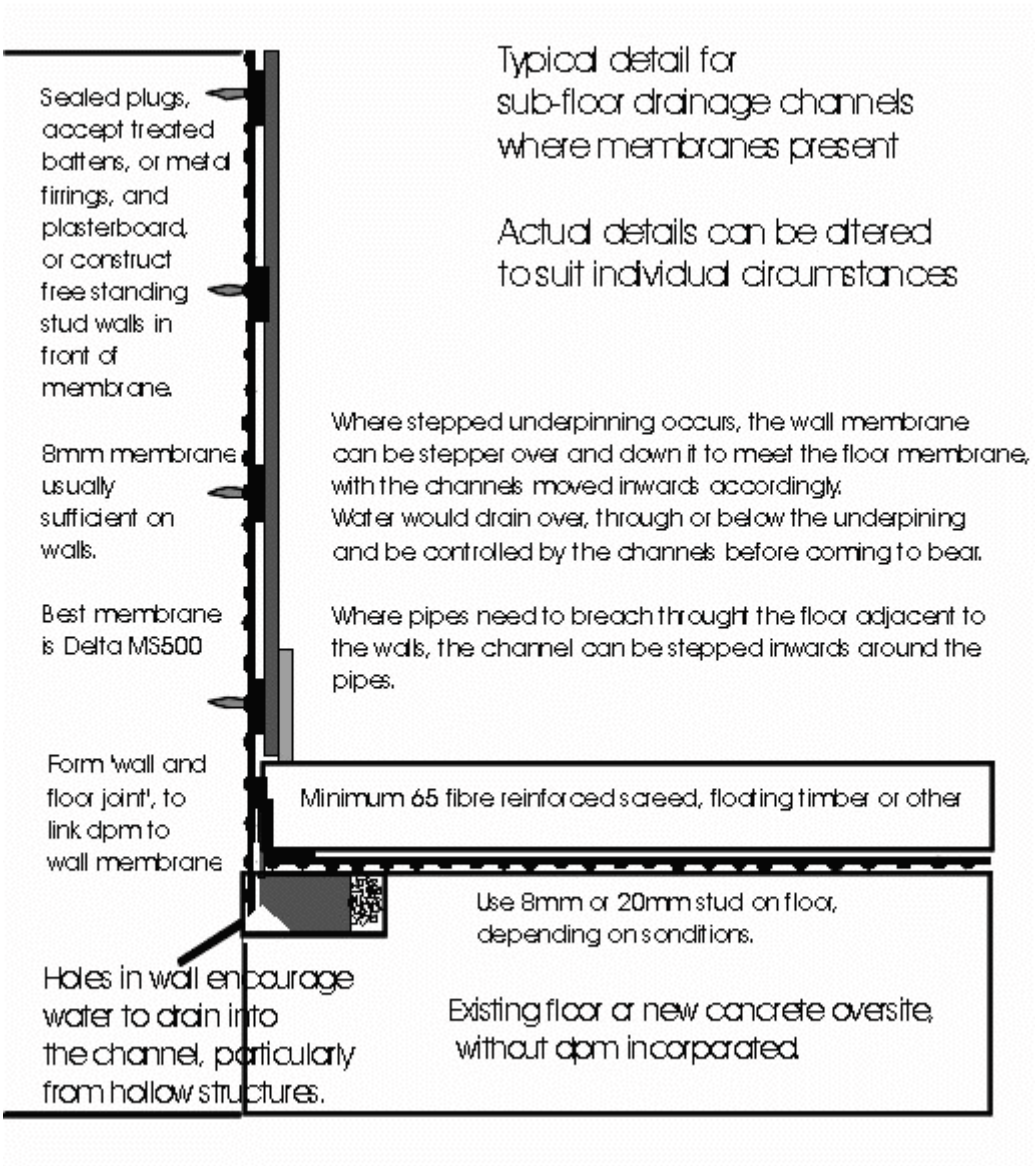


Use of drain channel and steel flashing to protect damp course, where external surface level is above the internal DPL.

2.8 Internal protection

Where the DPL is below the eternal surface level there is often a problem with water penetration, this is mostly found in basement situations. The following show some methods of reducing the effect of such problems.

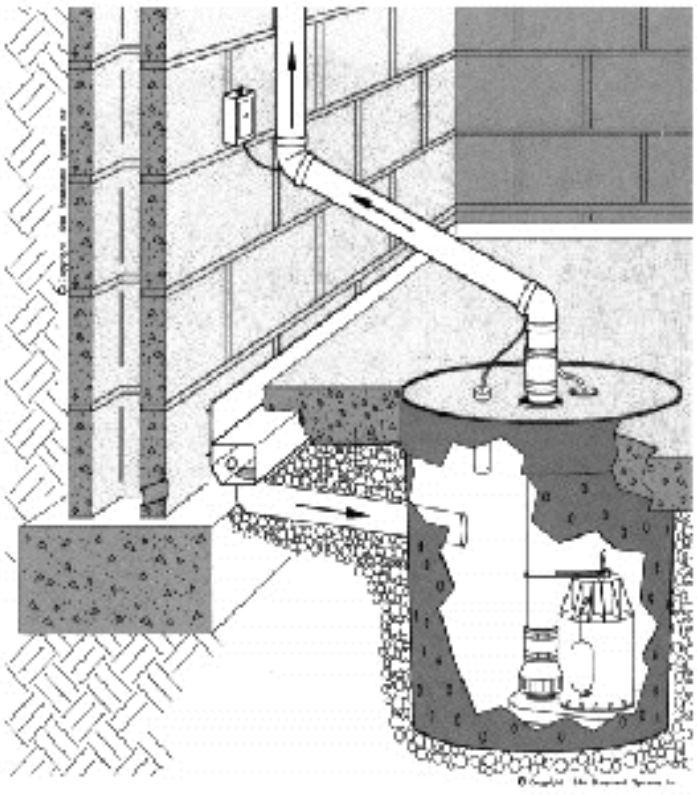
2.8.1 Wall Membrane



This system can be effective in situations where personnel or damp sensitive equipment or materials are in the room. It can be expensive to use as new floors are required.

2.8.2 Basement Drain

This system is used mainly in basements where personnel and damp sensitive equipment or materials are not normally present.



Drainage of basements or rooms where wall membranes are not used

Appendix A – Bedding Materials

Aggregates used for pipe bedding and sidefill must conform to BS882, or be air-cooled blast furnace slag (BS1047), or be lightweight aggregates (BS3797).

Pipe dia. (mm)	Max Particle Size (mm)	Recommended bedding
100mm	10mm	10mm single size
100-150mm	15mm	10mm single size or 14mm single size or 14-5mm graded
150-300mm	20mm	10/14/20mm single size, or 14-5mm graded, or 20-5mm graded

Appendix B – Reference

- BS 65 - Vitrified clay pipes, fittings and ducts
- BS EN295 - Vitrified clay pipes and fittings
- BS4660/5481 - flexible uPVC pipes
- BS8005 - 'Sewerage' - Guide to construction of new sewers
- BS8301 - 'Building Drainage' - BS code of practice
- Building Regs 1990 (Scotland)
- Building Regs 1991 England and Wales especially Part H
- Building Regs 1994 (Northern Ireland)
- European Standard DIN 19580 - Linear Drains (there is no British standard)
- Sewers for Adoption - 4th ed. Design and construction guide for developers

Note 1: Building Regulations are revised periodically, the latest 'Approved' documents are available for downloading from the Communities and Local Government website www.communities.gov.uk.

Note 2: Health and Safety regulations and free guidance is available for downloading from the HSE website www.hse.gov.uk. Paid publications are available from www.hsebooks.co.uk.