

# Drainage

The purpose of a drainage inspection is to ensure that buildings in which sanitary fixtures and sanitary appliances using water-borne waste disposal are installed, are provided with an adequate plumbing and drainage system to carry foul water to appropriate outfalls; and if no sewer is available, an adequate system for the storage, treatment, and disposal of foul water



**Code clauses: B1, B2, E1, F5, G12-13, G14**

## Inspection requirements:

Type	Minimum requirements
Drainage	<p>This inspection may occur at any time throughout the building process</p> <ul style="list-style-type: none"><li>• prior to backfilling the drains</li><li>• all bedding material in place</li><li>• drains laid and on test</li><li>• building foundations must not be undermined</li><li>• Drainlayer must be on site for this inspection and provide a fully dimensioned drainage plan</li></ul>

### General information:

A drainage inspection maybe conducted at anytime throughout the development, sometimes it is done before building works are commenced but this usually only happens if there are site constraints. The approved plans and building consent documentation must be on site for an inspection to be approved.

### No plan, no inspection

The most common problem with drainage is that it will not be as per plan, either the system has been changed from say G12 NZBC to AS3500 or the Drainlayer decides it is easier to change the layout due to the nature of site. It is fair to say that most designers do not understand AS3500, which is preferred by Drainlayer and so tend to design to G12 NZBC.

It is crucial that the Drainlayer provide an as-built at the time of the inspection in order that the layout maybe confirmed:-

- drainage as-built plans must detail the drains as-laid and show dimensions
- drainage as-built plans must be provided at the time of the inspection

### No as-built, no inspection

Always review the Drainlayer's registration and ensure this is recorded along with his name and address on the inspection record.

### Testing of drains

All drains must be on test at the time of the inspection and should not be back-filled, however partial back-filling maybe acceptable in inclement weather conditions to prevent the pipes becoming displaced.

Drains maybe either smoke, water or air-tested. Where a gradient is questionable use your level to determine the fall. Minimum falls must be maintained to prevent blockages. It is good practice to record the gradient on the inspection record along with the pipe material and size. G13 NZBC states that drains laid at less than 1:60 grade need to be checked with a verifiable levelling device i.e. Dumpy or laser.

### Water test

A water test essentially is where you cap off the drain and fill it with water. Once fill it is just a matter of observing it for 5 minutes to ensure that it is not leaking. If it does not maintain its level, then it fails the test.

This test method is limited to a maximum of 1,000 metres and a maximum of 6.0m of head, the minimum amount of head is 1.0m.

### **Smoke test**

Smoke tests are generally only conducted on commercial premises where multiple stacks are involved. Cap off each stack (leaving the top most vents for each stack open) and fill with smoke. If smoke escapes from any of the joints, then it fails the test. This method is not very common.

### **Air test**

The most common way for testing a drain is where all outlets are capped and a special fitting (called an air-test plug) with a rubber hose fitted to it, is plugged into the end of the line. The Drainlayer then physically blows air into the drain via the hose. After blowing air into the drain the tube is quickly placed it into a bottle containing at least 300ml of water. Typically, an old clear plastic bottle is used for this purpose.

The water will bubble up and when it stops bubbling, it has reached its pressure. If the water goes back up the tube, then it is indicating a leak. This test should be observed for about 2 minutes.

Note that if the water continues bubbling, this could be because of the sun heating the hose.

Water is  $\frac{1}{2}$  a pound per foot, so will hold  $\frac{1}{2}$  a pound of pressure when a successful test has been completed.

### **Cross-connections**

Always check that the drain is discharging to the correct outfall, sewer or stormwater. Manhole lids are generally coloured red for sewer and blue for stormwater. The most critical element is to ensure that cross-connection does not occur. If you are not sure that the correct drain has been identified, get the Drainlayer to tap on the manhole lid while you are at the other end of the line and listen for the echo (it will travel to you).

**If the drains are not on test, no approval can be given**

### **G13 NZBC**

Wherever possible PVC pipe should be used; however, in older parts of the city, clay or concrete pipes maybe found. All PVC pipes should be joined using solvent based primer; usually coloured pink, and the joint maybe glued. The layout should be simple with minimal changes in direction to prevent blockages.

“NZS 7643 Code of Practice for the installation of unplasticized pvc pipe systems” covers the requirements for jointing of pipes. Connections must be made using oblique or sweep connections maximum with a maximum angle of 60 degrees.

All pipes must be laid on a granular base with a maximum particle size of 20mm, this is important because it provides support for the pipes when the trench is back-filled. The granular fill must be compacted before the drains are laid. Failure to insist on appropriate bedding can see the pipe become stressed and damaged, particularly when the ground is expansive clay, which is subject to shrinkage and expansion. In some circumstances excavated soil maybe used, refer to Appendix D, NZS 7643 Code of Practice for the installation of unplasticized PVC pipe systems for further information.

Pipes must be protected from damage. Pipes penetrating through concrete or masonry elements shall be either wrapped with a flexible material, or passed through a sleeve or duct, to permit free movement for expansion and contraction. Pipework in or under a concrete slab must be installed in a manner to achieve a 50 year durability.

Pipes buried under ground must have protection from the loads imposed on them, to ensure adequate protection the following clearances are required: -

Cover – G12		Location
600mm		Residential driveways and similar areas subjected to occasional heavy traffic
450mm		Gardens, lawns or other areas not subjected to traffic
Cover – AS3500		Location
Cast iron	Other	
300mm	500mm	Where subject to heavy vehicular traffic
300mm	450mm	Where subject to light vehicular traffic
Nil	300	Gardens, lawns or other areas not subjected to traffic

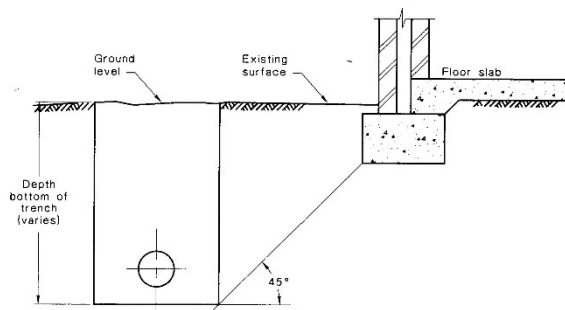
If these clearances are compromised, the drain must be protected from damage, in the following manner:

- 100mm reinforced concrete in areas subject to heavy traffic
- 75mm brick or concrete paving in areas subject to light traffic
- 50mm brick or concrete paving in other areas

The minimum diameter for a drain is 100mm although 80mm pipes can be used if the drain is receiving discharge from a vented waste stack only. Where there is insufficient fall to a drain such as below ground level in basement situations, a pump maybe installed. In this scenario, pumps must be fitted with a warning device (alarm) and carry signage. The pump should be located as close to the fixture as possible and the holding tank fitted with a vent.

All drains must be vented to minimise the build-up of foul air. Every main drain and any branch drain longer than 10m must be vented, the diameter of the vent being 80mm minimum.

The trench should not be left open for more than 48 hours and should not undermine the building foundations. Whatever the depth of trench, that is the distance the drains must be away from the building, i.e. 45 degrees, this is known as the angle of inference.



The 45-degree inference line is taken from the bottom of the foundations, for example if foundations are 450mm deep and the trench is 1.2m deep then the trench must be located a minimum of 750mm away from the building.

$$1.2\text{m} - 450\text{mm} = 750\text{mm}$$

The measurement is always taken from the underside of the footing.

Drains must be laid to allow easy access for maintenance and the clearance of blockages, with the fitting of access, inspection points or cleaning eyes.

Drains located under buildings must be laid straight and of even gradient with a 25mm separation between the pipe and the building foundations. The drain must also have 50 mm clearance from the top of the pipe to the underside of the slab, and junctions beneath the building joined at an angle of not more than 45-degrees.

Access points must be provided in the following locations:

- immediately prior to drain outfalls
- immediately inside the boundary of the property served
- at the junction of every drain with another drain except that no access point is required where the branch drain is less than 2.0 m long and only serves a gully trap
- every change in horizontal direction of greater than 45°
- every change in gradient greater than 45°
- at intervals (on straight lines) of no less than 50 m where rodding points are used or 100 m where access chambers, inspection chambers or inspection points are used

- within 2.0 m outside the building where a drain enters or exits from under a building

### **Connection to public drain**

When connecting to the public drain it is important to ensure that wherever possible all private drainage is within the property boundaries and that cross-connection does not occur. However, Auckland Council has numerous situations where private drainage is located outside the property boundary; in these instances, the work is subject to Development Engineering approval and a maximum distance of 30 metres from the site in question.

If the drain or lateral is not located where shown on the plans, it is important that an amendment is obtained so that Council records can be amended / updated. Where the connection is close to the dwelling and the depth exceeds the angle of inference, protection of the drain and foundations must be considered.

### **Gully traps**

All gully traps must be constructed to prevent the ingress of surface water and foreign bodies likely to cause a blockage. Gully traps must also be located within the legal boundary of the land on which the building is erected, and the overflow level of the gully dish must be no less than:

- 25 mm above paved surfaces, or
- 100 mm above unpaved surfaces and
- grating that will allow surcharge
- a minimum outlet pipe diameter of 100 mm
- a water seal depth of at least 65 mm
- at least one discharge pipe discharging to the gully trap to avoid water seal evaporation or a hose tap installed above
- waste pipes that discharge to the gully trap should be arranged to permit easy cleaning of the gully trap
- waste pipe outlets located at least 20 mm above water seal level, and at least 20 mm below the grating
- the top of the water seal no more than 600 mm below the top of the gully dish, and
- adequate support from bedding and backfilling with:
  - concrete no less than 75 mm thick surrounding the entire gully dish and which is separated from the building foundation, where the gully trap is likely to be damaged, or
  - compacted bedding material
  - a minimum of 600 mm clear access space above the gully dish for cleaning purposes

Every building used for housing must have at least one gully trap, positioned so that the top of the gully dish is no less than 150 mm below the overflow level of the lowest sanitary fixture served by the drainage system. This must be located in a visible position and is installed so that surcharge cannot enter into or under the building.

The most common problem with gully traps is that when installed they are too low, when conducting a drainage inspection discuss and determine finished ground levels and have the Drainlayer install a riser if the level is too low. It is much easier for this to be done now, rather than be picked up later at the final inspection.

Another problem occurs when pipes are fitted in a manner that prevents the grate from becoming dislodged in the event of a blockage. If pipes penetrate the back of the dish they must be sealed to prevent water getting in behind the trap. Silicone or concrete is not adequate; refer to G13 for approved details. If the gully trap is located more than 3.5m away from the fitting (fixture) it serves, an air-admittance valve must be installed. Within the fixture discharge pipe but not more than 3.5m from the crown of the fixture trap.

## **AS3500**

Drains must be laid to an even grade, straight and have no lipped joints or internal projections. They must be continually supported, be protected against damage and watertight. Connections to the public line may not be less than DN100. The minimum size of a main drain is 100mm and a branch drain is 65mm, provided that no soil fixtures are connected to it.

The minimum gradient is:

- 1:60 for 80 -100mm diameter
- 1:40 for 65mm diameter

The main drain must be provided with an inspection shaft in or near the point of connection to the sewer that is not subject to flooding. Inspection shafts must terminate at or near the ground and be fitted with an air-tight removable cap suitably sealed. The shaft must be protected from damage in an accessible position.

## **Venting**

Vents are required in the following situations: -

- at each end of any drain incorporating a boundary trap, provided that the downstream vent is located within 10m of the boundary trap riser and no other fixture is connected between the trap and vent
- upstream end of any drain not incorporating a boundary trap
- upstream of any branch drain to which a fixture trap or floor waste gully is connected, if the distance to the weir exceeds 10m
- upstream of any branch drain to which 3 or more WC's are installed
- along the line of a vented drain where 10 or more WCs are installed

## **Unvented branch drains**

The maximum length of an unvented branch drain is: -

- 2.0m for WC's with DN80 discharge pipes
- 2.5m for all other fixtures

Unvented drains discharging to gullies may receive discharge from waste fixtures provided that the combined length of the unvented drain and fixture discharge pipe does not exceed 10m.

## **Gullies**

Gullies are used to provide relief in the event of surcharge or provide disconnection between waste discharges and the remainder of the sewage installation.

Gullies must be: -

- self cleansing
- supported on a 100mm bed of concrete
- have the top of the gully protected from damage by means of a concrete surround (minimum width of 100mm around and 100mm deep below ground)
- be protected with haunching – haunching must extend 25mm above paved surfaces or 100mm above unpaved surfaces
- have a grating to relieve surcharge
- have a permanently maintained water-seal provided by
  - discharge from a waste fixture or floor waste gully
  - water from a tap located over the gully
  - discharge from a waste stack no > 5 floors in height (discharging below the grate but above the water seal)

Note that WCs and surface or roof water must not discharge into a gully.

### **Disconnecter gullies**

Disconnecter gullies maybe located inside a building provided that the gully riser extends to floor level and is sealed with a removable lid. It must also be vented with a DN50 vent pipe branching from the riser pipe or the fitting. The vent must be installed so that it has a grade of 1:80, has a grating and terminates at least 75mm above the ground surface and does not have any fixtures or appliances connected to it.

### **Overflow relief gullies (ORG) – these are only mandatory on household units**

At least one ORG or disconnector gully must be installed on a drain except where the lowest fixture is located on a floor that is 3m or more above ground surface level at the point of connection to the sewer.

ORG's must be located external to the building, within the property boundary and located in a place that is both accessible for cleaning and visible so that discharge is noticeable. The ORG must have clear access for more than 2m above the top of the gully grate and not be enclosed.

Where it is not possible to locate an ORG external to the building it may be located inside a building providing that: -

- the riser extends to floor level and is sealed with a removable lid
- has an overflow pipe the same size as the gully riser installed so that it has a grade of 1:80, and
- has a grating and terminates at least 75mm above the ground surface in the open air
- no fixtures or appliances maybe connected to the overflow pipe

A minimum height of 150mm must be maintained between the top of the ORG riser and the lowest fixture connected to the drain. The minimum height between the top of the gully riser or the invert of the overflow pipe and the surrounding ground level shall be 75mm except where the gully riser is located in a paved area where it must be finished to a level that does not allow water ingress.

### **Floor waste gullies (fixture traps)**

Fixtures discharging to a FWG must be located in the same room as the fixture, except for a tundish receiving minor discharge from a hot water cylinder or similar, which must have a maximum length of 10 meters. Basins and drinking fountains discharging to a FWG must have a trap fitted immediately adjacent to the outlet of the fixture. Each fixture connecting to a floor waste gully must be connected via a single waste pipe at a gradient of 1:40.

FWG must be fitted with a removable grate and a riser no less than DN80 at floor surface level, unless the sole purpose of the FWG is to control water spillages where a DN50 outlet and riser maybe used.

The maximum length for an untrapped waste discharging into a FWG is 1.2m and a trapped waste 2.5m, and the maximum height of the riser from the water seal to the grate is 600mm. Note that kitchen sinks, dishwashers and washing machines cannot connect into a FWG as food scraps may cause blockages and or problems with foaming may occur.

### **Inspection openings or rodding eyes**

Except where inspection chambers have been provided all drains must be fitted with inspection openings as follows: -

- as close as possible outside the building on each branch drain connecting one or more WCs but no further than 2.5m
- at intervals of no more than 30m except where waste fixtures only are connected
- on the downstream end of any drain passing under a building except where waste fixtures only are connected
- immediately upstream of the upper bend of a jump-up

The size of the opening shall be no less than the size of the drain it serves and fitted with an air-tight removable cap in an accessible location.

## **Jump-ups**

A jump-up is a vertical section of drain joining two drains at different levels. Drains must be joined at grade to each other at an upstream angle of not more than 60 degrees. Either a sweep junction or an oblique junction should be used for this purpose.

## **Fixture discharge pipe sizes**

- FWG 50 -100mm
- Kitchen sink 50mm AUS or 40mm NZ
- Shower 40 - 50mm
- WC 80 - 100mm

## **Disused drains**

Where a drain or part of a drain is no longer required, it shall be disconnected from the foul water drainage system at the junction with the live drain or at the property boundary. The live drain shall be sealed by either:

- a purpose made junction sealed with a tight-fitting plug that is fixed securely in place and does not protrude into the live drain, or
- sealed with a purpose made cap, plug or stopper

## **Disused septic tanks**

If a septic tank becomes obsolete, it must be removed and or emptied and filled with compacted granular fill. It is important that a drainage as-built is provided showing the exact location of the disused septic tank so that future building projects will not be compromised when and if anyone ever decides to build in that location.

## **Cess pits or sumps**

Cess pits are provided to remove contaminants from the surface water run-off only and must be located so as to collect stormwater runoff from driveways, retaining walls and subsoil drains.

## **Downpipe locations**

When carrying out the drainage inspection, check the location of downpipes. Ensure that the downpipes have been evenly located around the building and that the run between downpipes does not exceed the permissible length. Generally, this is around 9.0m but will depend upon the type of spouting used. Note that Designers try to avoid placing downpipes at the front of a building for aesthetic reasons.

If additional downpipes are required, this can be treated as a minor amendment however if the number of downpipes is reduced a formal amendment will be required.

## **Detention and retention**

Stormwater detention tanks are specifically designed and engineered to receive and temporarily hold large amounts of stormwater to protect areas from flooding. Detention facilities can keep existing drainage systems from exceeding capacity. New sites and development, which typically increase impervious surfaces and thus increase velocity of run-off, use detention basins to mitigate the effects of flooding.

Storage facilities can be either constructed above ground or placed below ground as a vault. Buried vaults can be prefabricated concrete, corrugated aluminium, polyethylene, or fibreglass structures. Design and performance criteria for stormwater detention and water quality treatment can be found in Metro Waters quality manual.



### Detention vs. retention:

Detention is the short-term storage of stormwater the objective of a detention facility is to regulate the runoff from a given rainfall event and to control discharge rates to reduce the impact on downstream stormwater systems. Retention is permanent storage of stormwater until it is lost through percolation, taken in by plants, or through evaporation.

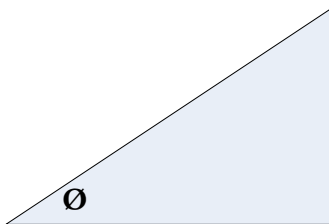
### Gradients

Percentage	Degrees	Ratio
5%	3°	1:20
3.35%	2°	1:30
2.5%	1.5°	1:40
1.65%	1°	1:60

### The method of calculating angles is based on the SOHCAHTOA formula

Tangent of  $\emptyset = O/A$   
Therefore  $A = O/\tan \emptyset$

If the ratio is known (i.e. A) then divide  $O = 1$  by the known ratio figure A.



**Opposite**

That figure is the tangent of the angle.

To find the angle, select  $1/\tan \emptyset$  (being the inverse of the tangent)

# Residential final

The purpose of a final inspection is to ensure that all work has been completed in accordance with the approved plans and that the purposes and principles of the Building Act have been achieved.

This ensures that buildings are safe and sanitary, contribute to the well-being of users, and are constructed in ways that promote sustainable development



**Code clauses: B1-2, C1-4, D1, E1-3, F1-2, F4-5, F7, G1-13, H1**

## Inspection requirements:

Type	Minimum requirements
Final	<p>Owner or agent must be on site</p> <ul style="list-style-type: none"><li>• all work described in the building consent has been completed</li><li>• all painting and decorating complete including floor coverings</li><li>• all landscaping completed including decks, steps, paving and driveways</li><li>• any conditions of consent met</li><li>• all documentation received</li><li>• all amendments approved and uplifted (if required)</li></ul> <p>Electrical and or gas</p> <ul style="list-style-type: none"><li>• energy works certificates are required on completion of all work</li><li>• bottles holding more than 9kg of gas to be located outside</li><li>• all gas bottles to be a minimum of 1.5m away from opening windows or drains</li></ul>
Vehicle crossing	All work complete, crossing re-instated, no damage to footpath or berm

## General information:

This is the final inspection and probably one of the most important as it is the last time we will be on site it is critical that this inspection is undertaken fastidiously.

If you haven't already done so take a few minutes and review the file checking both inspection records and documentation. Make sure all necessary documentation has been provided, identify any outstanding issues and prepare for inspection.

In most cases you will need the following equipment: -

- thermometer
- tape measure
- ladder and torch for ceiling access
- mirror for checking hard to get to places
- screw driver

Start on either the inside or outside and undertake the inspection methodically. Open the plans up and check the site plan, each elevation and floor layout.

Ask yourself, if this was your home would you be happy to accept the workmanship and level of compliance, if the answer is no, do not sign off the job.

## Site etiquette

Before entering the house, remove your shoes and ask the homeowner / occupant if it is alright to access all rooms, as someone else maybe in the house and it is important that you do not place yourself in a compromising situation.

In most circumstances this will be the first time you have meet the owner as all other dealings will probably have been with the contractor. It is always courteous to introduce yourself and explain what you are checking when you are inside their home. You should do this regardless of whether you start on the inside or outside.

Do not enter the property if a child is home-alone and a parent or guardian is not present. In this situation contact the homeowner / occupant by telephone and explain that they must be present for the inspection.

If you damage something inadvertently, contact your Team Leader immediately for advice before speaking to the homeowner / occupier, if possible.

Take notes and use your checklist as you go around the building. Do not rely on your memory and do this at the end of the inspection because you might forget something.

### **Interior of building**

Walk around each floor / level checking that the floor plan matches the on-site layout. Ensure any changes have been captured by either the minor or amendment process. If not, these must be addressed now.

### **Bathrooms and ensuites:**

Review the file and check that the linings have been installed as per plan; if the shower or floor is tiled certificates for the waterproof membrane will be required from both the manufacturer (for the product) and the installer (for the application of it).

Turn the shower on and direct water at the sides, turn it off and check to see if the sealant has held. If leaks have been identified these will need repairing. If the shower is free-standing and drains to a floor waste, turn the shower on and check to make sure the fall is appropriate, and water is contained.

If a shower cubicle has been installed check across the top of the shower to make sure it has been sealed, you can use your fingers or a mirror for this purpose.

Check the junction of the floor and wall linings to make sure that it is either coved if vinyl or sealed with a flexible sealant if tiled. Check that a bead of sealant has been fitted around the junction of all vanities and baths. Note that a floor waste must be provided if the bathroom adjoins another household unit, however in this situation the floor does not need to be graded.

If a WC is installed in a bathroom, it is important to check and make sure the shower nozzle cannot reach the WC (from a back-flow point of view). Check that a non-return valve has been fitted on all shower heads if this is the case.

When a spa bath, bidet or shower over a bath is installed it may be necessary for a backflow prevention device to be fitted, this is because a submerged inlet in a bathtub allows bath water to be sucked back into the mains line and can contaminate other outlets in the house. The type of device fitted would generally be a double check valve backflow prevention device. Refer to commercial section for further information on backflow devices.

A test report from a suitably qualified person must be provided verifying that the backflow prevention device has been correctly installed. Note that a compliance schedule is not required for backflow devices in residential situations.

All glazing in wet areas must be safety glass; under no circumstances should film be recommended or approved. All overhead glazing, joinery and shower doors or glass walls / returns on baths must be safety glass. If the glass does not carry an "S" mark, then it does not comply with NZS4223. (All safety glass must be permanently etched). If the bathroom has been refurbished, the glazing must be upgraded to comply with the Building Code.

If the bathroom does not have natural light and ventilation, mechanical extraction fans must be fitted. The light and fan must operate at the same time i.e. be connected to the same switch. All extraction fans must be ducted to the exterior of the building; this should be noted and checked when inspecting the ceiling space.

Check the location of windows in relation to permanent fixtures; if an opening window is installed above a permanent fixture it is likely that the distance to fall will exceed 1.0m, as such a restrictor should be fitted. (Note, children can climb onto the WC, bath or basin easily and access the opening)

Carpet is only permissible in an ensuite and must be laid over 3 x coats (minimum) of polyurethane. It will be necessary to check with the manufacturer as to how many coats of polyurethane will be necessary to achieve compliance, generally speaking it will take 3-5 coats, but this must be confirmed by both the flooring and paint manufacturers to determine if the products are suitable for this environment. Written confirmation will be required confirming that the correct number of coats has been applied before signing off on this aspect.

In all other situations, carpet is not permissible in wet areas. If cork tiles or in-laid flooring has been placed over the floor, waterproofing must be installed under the flooring.

### **Toilets (WC's)**

WC's must be secured to the floor either by a bead of sealant or screw fixings. The floor covering must extend under the pan to provide an impervious membrane, it may be necessary to remove screws to check this.

WC's must have an overall width of 750mm including 200mm either side of the pan. A clearance of 400mm is required in front of the pan where the door opens out from the toilet or 200mm if it opens in. In this situation the distance is measured from the front of the pan to the leading edge of the door.

Always flush the WC to ensure that the water seal is maintained, and that water does not splash up over the rim. Some imported fittings are notorious for this and present a health risk. If the WC

is isolated, a hand basin should be provided for hand washing purposes, this maybe in an adjacent bathroom.

If the WC does not have natural light and ventilation mechanical extraction fans must be fitted. The light and fan must operate at the same time i.e. be connected to the same switch. All extraction fans must be ducted to the exterior of the building; this should be noted and checked when inspecting the ceiling space.

### **Laundry**

The walls and floors of laundries are required to have an impervious finish for cleaning purposes. Check the junction of the floor and wall linings to make sure that it is sealed with a flexible sealant or alternatively covered 75mm minimum. Check that a bead of sealant has been applied around the junction of the wall to tub and that the tub unit has been secured to the floor and wall.

Laundries must have a minimum width of 1250mm and a minimum working space of 800mm in front of the tub or machine. The tub must be capable of holding a bucket of 400mm diameter and 200mm depth and be fitted with a cold water supply.

The washing machine must be provided with cold water supply, a discharge pipe, a water trap, and an adjacent 10 amp socket outlet. Note that a laundry space must be provided in all household units designed for 2 or more people.

If the laundry does not have natural light and ventilation mechanical extraction fans must be fitted. The light and fan must operate at the same time i.e. be connected to the same switch. All extraction fans must be ducted to the exterior of the building; this should be noted and checked when inspecting the ceiling space.

The most common non-compliance issue with laundries is that the floor is not covered with an impervious membrane. This generally occurs when a laundry is installed in an attached garage.

## **Kitchen**

Kitchens must be provided with a bench having a minimum surface area of 1200mm width and 500mm depth. A working space must be provided in front of the bench and stove sufficient to allow the doors to freely open plus 800mm. Benches must be easily cleaned and durable with a hot and cold water supply available. Storage space must also be provided for food, by way of a cupboard or refrigerator. Permanent connections must be provided for cooking purposes if the property is supplied with gas or power.

The walls and floors of kitchens are required to have an impervious finish for cleaning purposes. Check the junction of the floor and wall linings to make sure that it is either coved if vinyl or sealed with a flexible sealant if tiled or other floor covering. Check that a bead of sealant has been fitted around the junction of the wall to sink and that the sink unit has been firmly secured.

If a dishwasher is installed the minimum waste size is 50mm, if the distance from the fixture to the gully trap exceeds 3.5m an air-admittance valve must be fitted to the trap. Waste disposal units are not permissible where the property is serviced by an on-site effluent system.

Extraction fans either re-circulate or remove contaminated air. If vented the contaminated air must be ducted to the exterior of the building. Under no circumstances should extraction fans discharge into the ceiling space as fat build-up will eventuate in fire. The grill must have closable flaps or a hood if mounted on the wall.

Ovens must be installed in accordance with the manufacturer's specifications and achieve minimum clearances between combustible surfaces.

## **Equipotential bonding**

Equipotential bonding is required in accordance with NZBC G9 where all of the following conditions are likely to exist:

- electricity is provided within a building
- the water supply pipe is metallic
- building users are able to make contact with exposed parts of metal water supply pipe, or any metallic sanitary fixtures connected to it, and
- the metal pipe is in contact with the ground, and forms a continuous metallic link from the ground to those parts of the pipe exposed to building user

Earth bonding conductors shall be:

- made of copper and have a cross-sectional area no less than 4.0mm<sup>2</sup>,
- sheathed with insulating material coloured green, and
- fixed at intervals of no greater than 300 mm with aluminium cable fixings

## **Bedrooms, offices, hallways and other spaces**

Check the floor plan versus the actual floor layout to ensure that it has not changed. Check that the windows are providing sufficient light and ventilation for the space: -

- 10% of the floor area is required for light, and
- 5% for ventilation

Check glazing is correct and floor coverings are fitted. If a child's bed is located next to a window on an upper storey, recommend that it be moved or alternatively that a restrictor be fitted. In this situation, restrictors cannot be enforced but the homeowner should be advised of the risks this situation presents.

## Opening windows

All opening windows located within 760mm of the floor and where there is a danger of a fall of more than 1.0m to the exterior, must be protected in the following manner:

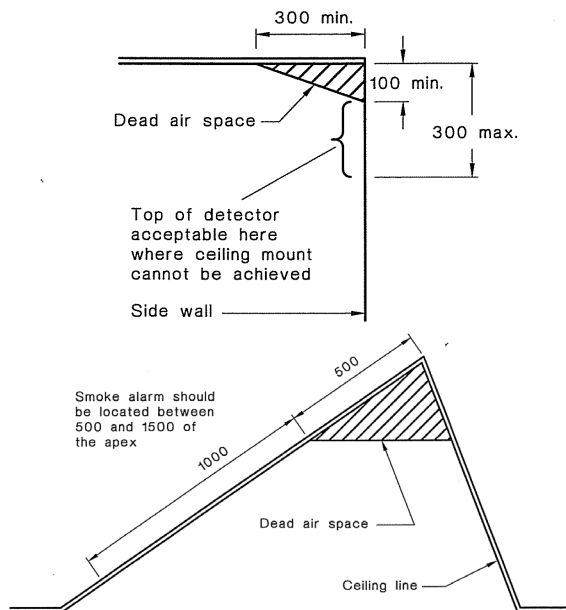
In buildings <b>not likely</b> to be frequented by children under 6 years of age		In buildings <b>likely</b> to be frequented by children under 6 years of age	
Opening <b>less</b> than 1.0m in width	Lower edge of opening at a height of 760mm above floor level, or restrictor fitted to limit opening dimension to 460mm	Opening <b>greater</b> than 1.0m in width	Lower edge of opening at a height of 1100mm above floor level, or 1100mm high barrier installed to protect opening

## Smoke alarms

Smoke alarms are required to be fitted in all new residential households and in any addition or alteration to a residential property, which includes but is not limited to applications that include the installation of solid fuel heating, swimming pools and outbuildings. Smoke alarms must be fitted with both a hush facility and test button.

A hush facility is a button on the smoke alarm which silences the alarm for a limited time after activation. A test button will confirm whether the sound is audible i.e. that the battery is working correctly (and is not flat).

Smoke alarms must be fitted in each bedroom or alternatively they can be located so that they are within 3.0m of all bedrooms. Smoke alarms also need to be located so that an alarm is given before the escape route from any bedroom becomes blocked by smoke. This means that installing an alarm in a bedroom does not provide adequate protection if the hallway (egress path) itself is not fitted with an alarm. Alarms are also required on each level of all escape routes.

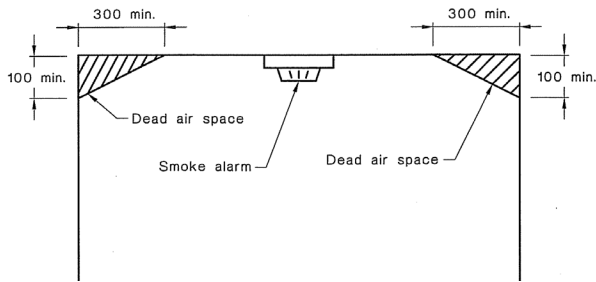


### Flat ceilings

Smoke alarms need to be situated on (or near) the ceiling for optimum detection of smoke in a fire situation.

### Sloping ceilings

Alarms must be located on the high side of ceiling where the slope is  $> 1:8$ .



In **stairwells**, smoke alarms must be located so that rising smoke in the stairwell is not restricted from reaching the alarm by a door or obstruction, (alcove, vaulted ceiling, beam, etc).

Smoke alarms must be at least 300mm clear of any light fitting and not located in a dead air-space.

AS 1670.6 gives instructions for the physical location of smoke alarms. Observance of the manufacturer's instructions is important to ensure smoke alarms are mounted correctly.

### Internal stairs and landings

All stairs must be installed so that a minimum head height of 2.0m is achieved. Landings are required at the top and bottom of every flight of stairs except where there is a fall of less than 600mm in which case the landing can be omitted. If a landing is provided the minimum length is 900mm.

Stair	Maximum pitch	Maximum riser height	Minimum tread width
Service, minor private	47	220	220
Secondary private	41	200	250
Common & main private	37	190	280
Accessible	32	180	310

Riser height and tread depth for all steps in any one flight must be uniform with an allowable tolerance of  $\pm 5$  mm. The triangular opening formed by the riser, tread, and bottom rail of the barrier on a stair shall be of such a size that a 150 mm diameter sphere cannot pass through it

If 3 or more steps are present a handrail must be fitted; handrails must be graspable and provide sufficient room to prevent knuckles touching any adjoining surface. The height of a handrail is 900mm minimum and 1.0m maximum and is measured vertically, from the pitch line or stair nosing.

A barrier must be provided to landings where there is a fall of more than 1.0m.

- detached dwellings and stairs and ramps and their landings 900mm within household units of multi-unit dwellings
- balconies and decks, and edges of internal floors or mezzanine floors 1000mm

Heights are measured vertically from finished floor level (ignoring carpet or vinyl, or similar thickness coverings) on floors, landings and ramps. On stairs the height is measured vertically from the pitch line or stair nosing.

If glazing is installed at the bottom of a flight of stairs, the glazing must be safety glass.

### Ceiling space

The ceiling space must be checked regardless of whether or not insulation has already been sited, this is because insulation may well have been fitted at say pre-line when light fittings, etc were not yet in place. Each ceiling space within different levels of the building must be accessed and inspected. Manholes must be provided for each level of the building, additionally access maybe provided through an external wall into a roof space. The minimum size for an access panel is 600mm x 500mm.



Insulation must be installed so that it fits neatly within the cavity formed by the truss or ceiling joists, it must not cover light fittings. Where downlights are installed a cone must be fitted over the fitting to provide protection and allow air-flow. Similarly, insulation must be kept clear of flues and other heat sources in the ceiling space. Note that it is a requirement under NZS4246 that a label is fixed to the roof truss or access hatch, denoting the R-values of the insulation that has been installed.

If ducting is installed, the ducting must be laid straight and not be superfluous, i.e. coiled up. Ducting must be secured around the extraction unit and discharge via a grille outside the building envelope, usually via the eaves.

Electrical cables and pipes should be neatly clipped and supported on framing.

If water storage heaters are located in the ceiling space the maximum capacity is 150 litres. The water storage heater must be supported on a framed floor and be seated over a load-bearing wall and requires a minimum of 350mm clearance to the roof above. The floor must be a minimum of 1.2m square and 20mm thick and be nailed at 300mm c/s.

A safe tray must be fitted under the unit and seismic restraints are required. The ceiling access must be large enough to allow the cylinder to pass through it both at installation and replacement.

### **Attached garages**

If the garage is attached to the house and forms part of the thermal envelope it must be insulated, this includes the exterior walls and ceiling space above. If the garage is not part of the thermal envelope but there is a habitable floor above, the ceiling space must be insulated.

Whilst it is not necessary to install smoke alarms in garages, it is recommended that they be installed where they are attached to the house.

If the garage contains a laundry space, the floor and walls of the space must be lined with an impervious covering to allow for cleaning. (Refer section on laundries above)

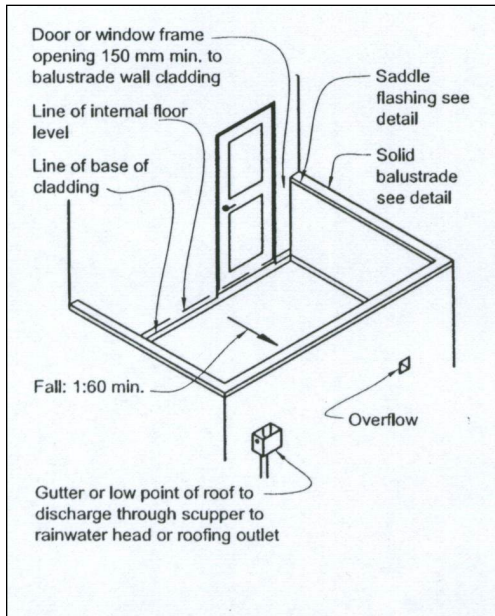
Garage door rebates must be formed in a manner that prevents surface water entering the interior of the building or damaging framing and linings. The most common fault with garages is that ground levels are built up too high and the jamb and framing of the opening is damaged as a result of water ingress. These must be formed in a manner to protect both the framing and cladding.

### **Balconies / parapets on upper levels**

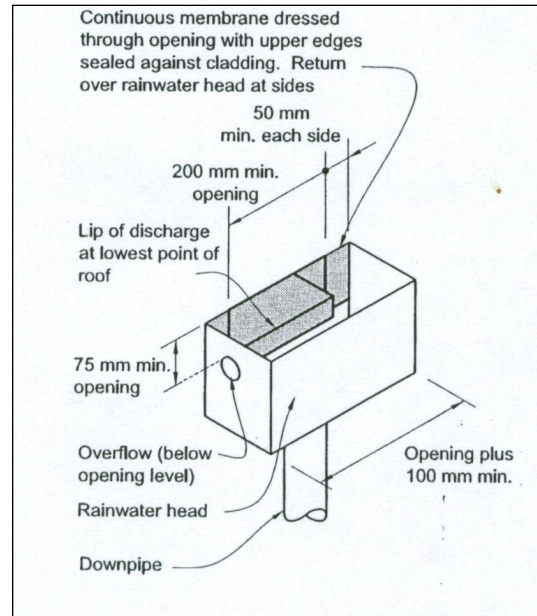
Balconies and parapets are probably one of the most at risk weathertightness features and must be thoroughly inspected. If the barrier or parapet has been formed with a solid barrier the horizontal surface must be fitted with a 15 degree slope and capped with a metal capping.

Under no circumstances can handrails or balusters be mounted directly on top of the horizontal surface of a barrier or floor as this places too much stress at the point of attachment and will result in damage to the membrane. All such fixings must be on a vertical face. The height of a barrier is measured vertically from finished floor level and must be a minimum of 1000mm high.

All gutters must be a minimum of 300mm wide and 75mm deep and fitted with at least 2 outlets and an overflow. Outlets must be protected from infiltration of debris by fitting a grate over the top of them. Overflows must be installed at least 50mm below flood level and located in a visible position so as to warn of potential problems. Overflows must be 1.5 times the size of the outlet as per NZBC: E2 (8.5.10).



Balcony showing outlet and overflow



Detail of outlet through wall

If the discharge point is through a parapet or balustrade then the scupper must be 200mm wide and 75mm high and formed with a lip to shed water away from the cladding.

Balcony floors must be fitted with at least one outlet and one overflow installed at least 50mm below flood level and located in a visible position so as to warn of potential problems. Outlets must be protected from infiltration of debris by fitting a grate over the top of them.

Finished floor / roof levels must be maintained to prevent flooding and damage to claddings: -

- 35mm minimum clearance from the bottom edge of the **wall** cladding to **roof** cladding or finished deck level
- enclosed deck - 100mm step down from **inside floor** to the **finished deck** surface
- cantilevered deck - 50mm step down from **inside floor** to the finished deck surface but only if deck surface is **timber-slatted**

The floor must have a 1:30 slope formed to drain water away from the building. If a cavity system has been installed check to ensure that vermin proofing has been installed.

## Building exterior

Walk around the building carefully checking each elevation to ensure it matches the on-site layout. Ensure any changes have been captured by either the minor or amendment process. If not, these must be addressed now.

## External stairs / pergolas

All external stairs and pergolas must be constructed to withstand a life of 15 years. It is essential that a 12mm air-gap is provided between the cladding and the decking or pergola to prevent problems with moisture ingress due to friction between the two structures.

All bolts passing through timber must be fitted with a 3mm x 50mm x 50mm square washer and all fixings must be of appropriate durability. All such penetrations must be appropriately detailed on the plans demonstrating weathertightness (air-gaps, flashings, seals, etc).

Barriers on external stairs must be at least 1.0m high and where a landing is provided it must be a minimum of 900mm long. Landings are required where there is a height difference of 600mm or more.

If 3 or more steps are present a handrail must be fitted, handrails must be graspable and provide sufficient room to prevent knuckles touching any adjoining surface. The height of a handrail is 900mm minimum and 1.0m maximum and is measured vertically, from the pitch line or stair nosing.

Riser height and tread depth for all steps in any one flight must be uniform but are permitted to have a tolerance of  $\pm 5$  mm. The triangular opening formed by the riser, tread, and bottom rail of the barrier on a stair shall be of such a size that a 150 mm diameter sphere cannot pass through it

Steps and landings must be constructed of materials that are fit for purpose and be slip resistant.

In residential situations an access route is defined as one which the general public have access to and includes walking surfaces such as decks, patios and steps leading up to the main entrance. These surfaces must have a mean coefficient of friction of not less than 0.4. Refer to D1: Access for acceptable surfaces.

Note figures from the Accident Compensation Commission show that many of the accidents that happen in a home are a result of someone slipping or falling from decks and steps.

### Ground levels

The finished floor level to ground level for claddings is:

Cladding	Paved	Unpaved
Brick veneer	100mm	150mm
Other claddings	150mm	225mm

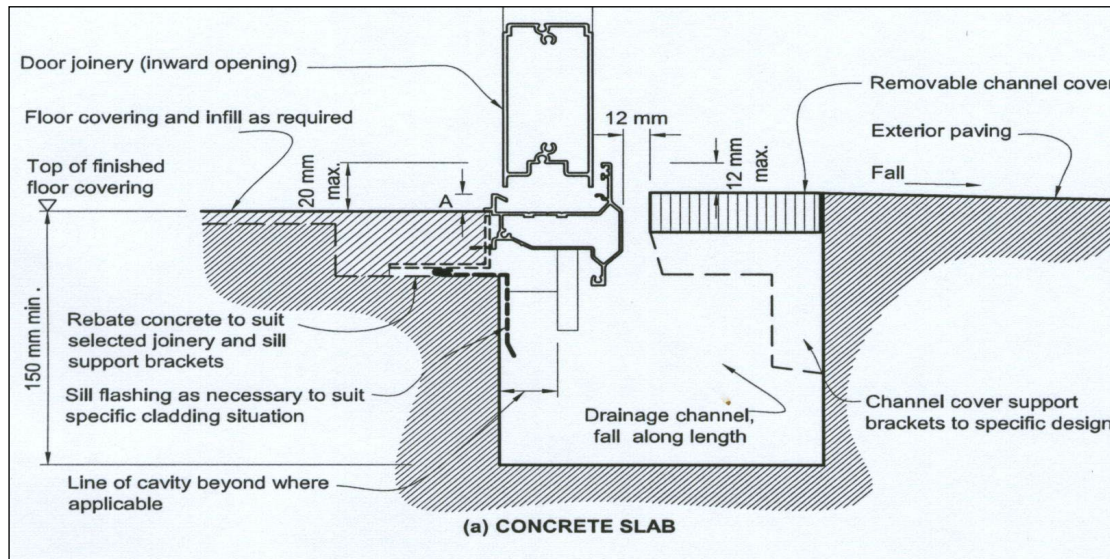
Under no circumstances may finished floor to ground level distances be compromised.

Where the site is sloping, provision for drainage on the downhill slope must be provided either by way of a retaining wall with drainage in behind or a cut-off drain. Where the site is sloping and provision for a cut-off drain has been made the minimum clearance between the land and the cladding is 450mm.

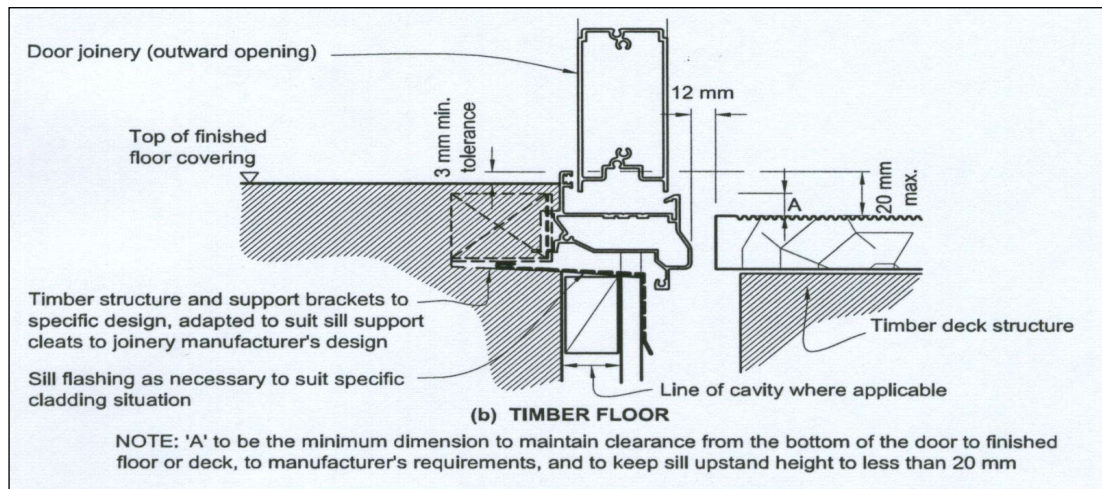
Where provision for level access is required from a concrete floor slab to exterior paving E1/AS1 provides for a drainage channel to be installed between the building and the paving to drain water.

The channel must have a minimum depth of 150mm, a maximum length of 2.0m and a fall of 1:200 along the length of the channel to a drainage outlet.

## Drainage channels



### Concrete floor



### Timber floor

The channel should be fitted with a removable grate with continuous gaps of 12mm. Paving must fall away from the building at a slope of 1:40. Although the acceptable solutions state the maximum length of the channel should be 2.0m, however most garage door openings will exceed this. The length of the channel maybe increased at this point to suit. However, make sure that water cannot enter the garage or the framing either side of the opening. In all other situations, the maximum length is 2.0m. All other systems are alternative solutions and require formal approval via an amendment.

Using your mirror check to make sure the underside of the jamb and cladding at this point have been sealed and painted to protect the timber and cladding.

## Retaining walls

If retaining walls have been constructed on site and are not part of the building consent application, the maximum height permissible is 1.5m without a surcharge. Check the drawings and height of any retaining walls to confirm that this is the case.

When checking retaining walls ensure that a cess-pit has been installed to take surface water runoff and that the drain is shown on the as-built plan.

If consent was not required for the retaining wall but one has been installed, it is good practice to note this on the inspection records. When making your notes, identify where the structure is located and what you have observed. It would also be prudent to take a photo for record-keeping purposes.

Finally, when checking retaining walls you must consider the location of the retaining wall in terms of access and safety from falling. If the retaining wall is on a driveway, a barrier must be installed. Similarly, if it supports land and paving leading to the main entrance of the house and there is a fall of 1.0m or more a barrier complying with the provisions of F4 will be required.

## **Wall cladding**

Review the file and check that the claddings as specified have been installed as per plan. Compare each elevation checking ground levels, cladding type and window sizes and openings. If there are any changes whatsoever these must be dealt with via a formal amendment.

Undertake a thorough check to ensure that the building is weathertight. All penetrations must be sealed with a durable flashing and sealant. Flashings must deflect water away from the cladding.

All waste water and vent pipes should be firmly fixed at 1.2m maximum c/s; brackets should be placed over a rubber washer or flange to cushion the impact between the two materials, all fixings should be appropriate for the environment and installed with sealant to prevent water ingress. The pipe should be installed with a PVC flange sealed against the cladding and the junction between the pipe and flange sealed.

All meter boxes (gas and electrical) must be flashed with the flashing extending across the top and down the sides of the appliance to shed water away from the cladding.

If alarms and electrical wiring for lights, etc have been installed, these too must be flashed in a similar manner and all fixings inserted into sealant to prevent water ingress. Where electrical cables are installed through polystyrene the cable must be sleeved to prevent plasticiser migration. (PVC electrical cables undergo plasticiser migration when in contact with polystyrene. This causes the polystyrene to shrink away from the cable and cable insulation to become brittle).

If monolithic claddings have been used, the plaster must be finished and painted behind the fascia. Where spouting from a lower storey is located adjacent to an upper storey wall, ensure that the spouting and cladding have a minimum 20mm clearance to allow for drainage.

Where pergolas or decks have been affixed to the cladding these must be installed in a manner which provides for a 12mm air-gap. Note that a building consent is not required for decking if it is less than 1.0m in height or pergolas if they are less than 10m<sup>2</sup> in area.

If consent was not required, it is good practice to note whether pergolas and decks have been installed if they have not been detailed on the plans. When making your notes, identify where the structures in question are located and what you have observed. It would also be prudent to take a photo for record-keeping purposes.

## **Roof cladding**

If you cannot get access to the roof, stand back from the property and inspect for damaged tiles or roofing and take note of whether TV aerials or satellite dishes have been installed. Sometimes on 2 or more storey houses it will be possible to view or access the roof from an upper storey window; in any event, access should be provided so that all flashings and falls on roof parapets, roof decks, and gutters can be checked and confirmed.

If you cannot access the roof during the final inspection, you must note this on the inspection records and discuss the reasons for this with your Team Leader before approval can be considered.

Valley gutters must not be used on roofs with a pitch of less than 8 degrees or 12.5 degrees if the gutter is 160 - 250mm wide, changes in direction are not permitted. Roofing should overlap the valley gutter by 100mm and have a clearance of 50mm above the gutter.

Where a concrete tile discharges into an internal gutter the tile should overhang at least 50mm and have a clearance of 50mm to the bottom of the gutter. If the gutter is located beside a parapet or wall, a 100mm clearance is required between the roof cladding and the cladding on the wall.

Where profiled metal roofing discharges into an internal gutter the roofing requires a 50mm overhang and the gutter must be 300mm minimum wide and 70mm minimum deep.

Internal gutters must be installed with a fall of 1:30; seams should be avoided in a gutter but if installed are not permitted within 1.0m of the drainage outlet. Where the roof is > than 40m<sup>2</sup> ventilation will be required to prevent heat build-up in the void below.

Drainage outlets must be placed clear of any structural members and installed in a position to achieve maximum catchment. The minimum size outlet is 75mm diameter or if rainwater discharges into a rainwater head via a scupper, the minimum width must be 300mm.

If discharge is through a parapet or balustrade then the scupper must be 200mm wide and 75mm high and formed with a lip to shed water away from the cladding.

All internal junctions must be supported using a 45° timber fillet to relieve stress to the membrane and be extended a minimum of 150mm up the face of the wall. All gutters must be provided with an overflow installed at least 50mm below flood level.

On eaves and verges, the membrane must be dressed over the substrate which must extend at least 50mm over the wall below and be secured, capped or over-flashed to prevent moisture ingress. Refer to figure 61 in E2/AS1 for further details.

All flashings should be dressed down into the tiles or corrugations of the roofing material. All roofing material must extend out over the spouting in a manner that will prevent wind driven rain getting into the roof cavity.

All roof penetrations must be flashed with durable and compatible components; sealant is added as a secondary measure only, the flashing or boot being the primary mechanism for achieving weathertightness.

Membrane roofs must have a fall of no less than 2 degrees; note this is more than the Acceptable Solutions require however this is Councils policy. Under no circumstances may a downpipe discharge onto a membrane deck or roof.

## **Downpipes**

Downpipes must be evenly spread around the building to ensure rainwater is safely transferred from the roof into the drainage system. Depending on the type of spouting used, the maximum run between downpipes is 9.0m but will depend on the manufacturer's requirements. If internal fascia has been used this will need to be significantly increased to ensure that water is safely removed. Note that whilst the provision of overflows helps this does not redress the problem.

Many problems with leaky buildings can be attributed to a lack of downpipes resulting in water spilling from the spouting into the eaves and making its way back into the framing cavity. The minimum size downpipe is 75mm.

Where downpipes discharge from an upper roof to a lower one, a spreader must be fitted. A maximum catchment area of 25m<sup>2</sup> only, is permissible. **Under no circumstances** can the spreader discharge water into roof laps. The spreader must be capped at either end and holes positioned to discharge into the pan or trough of the roof cladding.

**Under no circumstances** can the downpipe discharge water into membrane decks.

Note that if a spreader is used on a concrete tile roof, the tiles must be laid over a 1.0m square of building paper.

### **Gully traps – G13 NZBC**

Every building used for housing must have at least one gully trap positioned so that the top of the gully dish is no less than 150 mm below the overflow level of the lowest sanitary fixture served by the drainage system, which must be located in a visible position and installed so that surcharge cannot enter into or under the building.

All gully traps shall be constructed to prevent the ingress of surface water and foreign bodies likely to cause a blockage. Gullies must be located within the legal boundary of the land on which the building is erected, and the overflow level of the gully dish must be no less than:

- 25 mm above paved surfaces, or
- 100 mm above unpaved surfaces, and

Gullies must also have:

- a grating that will allow surcharge
- a minimum outlet pipe diameter of 100 mm
- a water seal depth of at least 65 mm
- at least one discharge pipe discharging to the gully trap to avoid water seal evaporation
- waste pipes that discharge to the gully trap should be arranged to permit easy cleaning of the gully trap
- waste pipe outlets located at least 20 mm above water seal level, and at least 20 mm below the grating
- the top of the water seal no more than 600 mm below the top of the gully dish, and
- adequate support from bedding and backfilling with:
  - concrete no less than 75 mm thick surrounding the entire gully dish and which is separated from the building foundation, where the gully trap is likely to be damaged, or
  - compacted bedding material
  - a minimum of 600 mm clear access space above the gully dish for cleaning purposes

### **Overflow relief gullies (ORG) – AS3500**

At least one ORG or disconnecter gully must be installed on a drain except where the lowest fixture is located on a floor that is 3m or more above ground surface level at the point of connection to the sewer.

A minimum height of 150mm must be maintained between the top of the ORG riser and the lowest fixture connected to the drain. The minimum height between the top of the gully riser or the invert of the overflow pipe and the surrounding ground level shall be 75mm except where the gully riser is located in a paved area where it must be finished to a level that does not allow water ingress.

Gullies must be: -

- self cleansing
- supported on a 100mm bed of concrete

- have the top of the gully protected from damage by means of a concrete surround (minimum width of 100mm around and 100mm deep below ground)
- have a grating to relieve surcharge
- have a permanently maintained water-seal provided by
  - discharge from a waste fixture or floor waste gully
  - water from a tap located over the gully
  - discharge from a waste stack no > 5 floors in height (discharging below the grate but above the water seal)

Note that WCs and surface or roof water may not discharge into a gully. Waste water discharge pipes must either discharge into a gully trap or a discharge stack; WC's must discharge directly into a drain.

### **Discharge stacks and vents – G12 NZBC**

A discharge stack may serve as a vent if the distance from the water trap to the stack is 1.5m for 80mm diameter and 6.0m for 100mm diameter pipes. A discharge stack may also serve as a fixture vent so long as the fixture vent is the top most connection to the stack.

Where 2 branch drains enter the discharge stack at the same level a Y junction with a 90° angle must be used. Where 2 branch drains enter the discharge stack at different levels they must not be connected within the restricted zone (within 200mm) and be fitted at a 45° angle to the stack.

Fixtures discharging to a gully trap must be independently vented. Vents must be connected to the discharge pipe between 75mm – 3.5m of the gully trap and terminate outside the building no less than 900mm from any opening in the building.

Where the discharge pipe is greater than 3.5m to the gully trap an air-admittance valve must be fitted, which cannot be smaller in diameter than the vent pipe that it serves.

Air admittance valves shall be installed in an upright (vertical) position at least 100mm above the weir of the fixture trap and in a location that is accessible for maintenance and inspection. It must be protected from likely damage and installed so that adequate air can enter the valve. Ventilated openings shall be provided for air admittance valves installed within a wall space, with the free area of the openings being not less than 1.5 times that of the vent pipe.

Other fixtures may be vented to: -

- a vertical or graded fixture vent pipe
- an ascending graded or vertical fixture vent pipe connected to a branch vent pipe, a discharge stack vent or a relief vent

The connection must be made no less than 50mm above the overflow level of the sanitary fixture it serves. Fixture vent pipes and branch vent pipes must extend upwards from the point of connection to the fixture discharge pipe to the open atmosphere, or to an air admittance valve, with a gradient of not less than 1:80. Where terminating to the open atmosphere vent pipes must be fitted with a cowl to prevent birds and vermin entering the pipe.

In order to prevent any foul air entering the building vents must terminate

- 3.0m above ground level
- 600mm above and 3.0 m below and horizontally of any window openings
- 150mm above any roof
- 3.0m above, below and horizontally of any deck, which provides pedestrian access
- 600mm above any eave
- 5.0m in any direction of an air-intake

### **Discharge stacks and vents – AS3500**

Under AS3500 there are two types of ventilated systems.



- **Fully vented system**  
this is where each fixture is independently vented, except traps permitted to discharge to a FWG (note that a discharge pipe on a FWG will already be vented)
- **Fully vented modified system**  
each branch or discharge pipe connected to a stack is vented and some individual fixtures trap vents are omitted (this occurs when 2 or more fixtures discharging to a pipe or vent are vented by one or more group vents)

Discharge pipes must be 40mm diameter minimum and cannot be less in diameter than the fixture it serves. WCs must have a minimum vent size of 80mm and have no more than 2 WC's connected to it.

### Trap vents

Trap vents are required in the following circumstances: -

#### Basins and bidets

- the vent must be connected between 75mm and 600mm from the crown of the fixture (no change of direction is permitted)

#### Other fixtures

- the vent must be connected between 75mm and 1.5m from the crown of the fixture except that where an S-trap is fitted, or a bend is fitted to a P-trap, the connection must be 300mm from any bend at the base of the vertical section

A stack vent may serve as a trap vent for a fixture provided that: -

- the fixture is the highest connected to the stack
- the distance from the weir of the trap to the stack complies with the requirements listed in the 2 paragraphs above
- loading in fixture units are not exceeded

### The minimum size of a trap vent is: -

Fixture trap	Vent
40mm	32mm
50 – 100mm	40mm

Trap vents must extend upwards above the flood level rim of the fixture and vent to the open air.

A single vent pipe maybe used for two or more fixtures if: -

- a P-trap is used
- the discharge pipes are connected at the same level they are fitted with a Y junction at a 90° angle or a junction with opposed sweep entries
- the vent pipe is sized for the larger trap
- the distance from the weir does not exceed 75mm and 600mm for bidets and basins and 75mm and 1.5m for other fixtures

### Branch vents are sized as follows: -

Size of branch discharge pipe	Size of branch vent
40	32
50	40
65	40
80	50
100	50
150	80

Branch vents must be connected above the flood level rim of the highest fixture connected to it and vent to the open air.

### Relief vents

Relief vents must be installed on any stack where one or more floors separate the floor levels of the highest and lowest branch pipe connected to the stack or where a stack is offset at less than 45° to the horizontal.

Relief vents must be connected to the stack below the lowest connection at an angle of 45° and extend upwards to the open air. The minimum size of a relief vent is 40mm but should be no larger than the stack it serves.

### Venting of stacks

Vents must continue upwards to the vent cowl undiminished in size and be installed at a minimum grade of 1.25% so that condensation or other liquids that form in or enter the vent will drain to the system.

Vents shall terminate in the open air and in a location not less than: -

- 600mm above any opening that is within 3.0m horizontally of the vent
- 150mm above the roof
- 3.0m above any deck which provides pedestrian access that is within 3.0m horizontally of the vent
- 2m above or 600mm below any chimney or similar opening that is within 3.0m horizontally of the vent
- 5.0m in any direction of an air-intake
- 600mm above the eave, coping or parapet that is within 600mm horizontally of the vent

Where a vent is connected to a graded section of a discharge pipe it must be connected downstream of the fixture or trap.

### Location of vent pipes

Pipes must be located so that they: -

- do not impede the operation of a door, window or other aspect relating to the operation of a building
- have adequate protection from damage
- are as close as practicable to the wall of the building
- are at least 100mm away from any electrical cable
- are not less than 50mm clear from any other pipework
- are not located above a potable water storage tank

## Waste storage

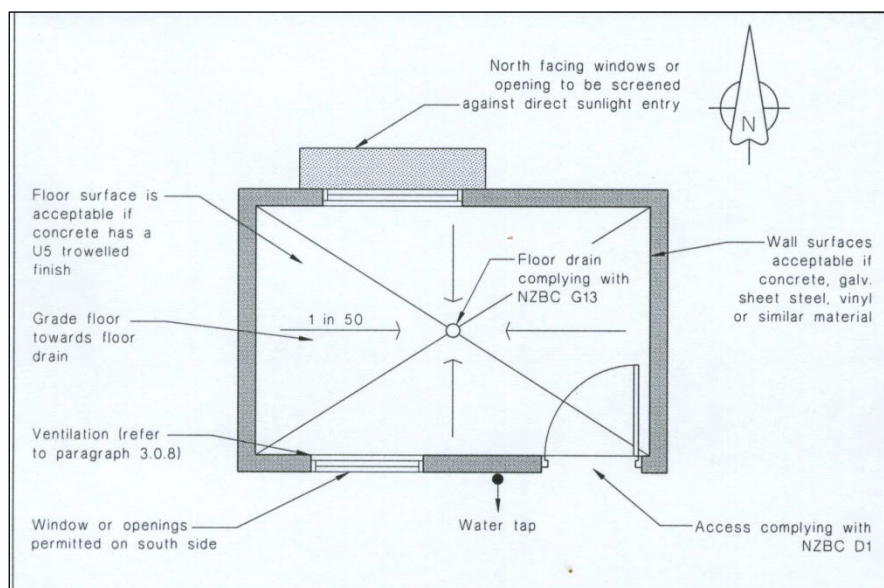
Individual units which form part of multi-unit developments are checked in accordance with the residential checklist. In addition to a normal residential situation, multi-unit developments require a space where waste / rubbish can be stored.

Examples of trade waste include:

- storage of garbage in apartment buildings

The facilities must provide for the safe and hygienic collection, holding, treatment and disposal of the waste:

- interior surfaces impervious (floor drain and tap for washing down the space)
- space totally enclosed and separated from habitable spaces
- space well ventilated (natural or mechanical ventilation provided)
- space protected from high temperatures and direct sunlight, which could hasten purification – no direct sunlight from the north
- space screened or enclosed to reduce visual impact
- access for building occupants complies with D1, and
- access for rubbish collection vehicles complies with D1



## Other issues

Multi-unit developments may also include other items such as lifts, public telephones, reception areas, etc. Refer to commercial section for this information.

## Solid fuel heating

Refer to solid fuel heating section for this information.