DESIGN RIGHT

Designing a domestic plumbing system

Considering the key requirements of a plumbing system early in a house design can lead to a smoother consenting and building experience, fewer call-backs and happier clients.

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WHEN BRANZ arranged inspections of 200 new houses under construction, some of the most common problems involved plumbing. In over a third of the houses, there were framing cut-outs to accommodate pipes that were larger than permitted in NZS 3604:2011 *Timber-framed buildings*.

Cladding penetrations for pipes that were not properly sealed to the wall underlay – a potential weathertightness risk – were also among the top 10 defects.

Plan well to avoid problems

Poor planning can lead to problems with both compliance and quality, such as:

- the maximum length of unvented discharge pipes may be exceeded
- valves and hot water cylinders may end up being difficult to access
- discharge pipes may have insufficient fall because of a high invert level at the outfall
- there may be difficulty in achieving minimum discharge pipe gradients or installing floor waste gully traps because of insufficient depth in floor joists
- pipework may need to be surface mounted because wall framing is not deep enough to allow concealment
- plumbing fixtures may be located with the waste outlet directly over a joist, bearer or beam
- pipe runs may be long and complicated to navigate non-penetrable building elements such as steel beams
- pipe and drain noises may be heard in living and sleeping areas.

Basic requirements

For hot and cold water supply and sanitary plumbing, systems must:

- provide water when needed at a flow rate that allows all fixtures and appliances to work correctly
- ensure that the potable (drinkable) water supply remains potable
- not harm occupants – for example, through hot water services scalding or exploding.

The overarching requirements are set out in the New Zealand Building Code, in particular, clauses G12 *Water supplies* and G13 *Foul water*.

The key plumbing standard is AS/NZS 3500 *Plumbing and drainage*. A new version was published in mid-2018 but is getting a long roll-out – the older 2015 version must still be used until the new version is referenced.

Design and planning pointers

Thinking through a few key areas in the early stages of design can make the rest of the process run more easily:

- Group wet areas (bathrooms, toilets, laundries) together for shorter pipe runs, easier discharge pipe venting and fewer exterior wall penetrations. Locate wet areas on an upper floor above wet areas on the ground floor.
- Design waste and discharge pipe systems to run in the same direction as floor joists to reduce framing cut-outs.
- Consider specifying 140 mm wall framing instead of 90 mm. While typically done to ➤

What not to do – unreinforced cut-out in timber framing.

Another bad job with an unreinforced cut-out in the wall framing.

fit higher grades of insulation, deeper framing also allows more flexibility with plumbing. For example, services that would otherwise be surface mounted may be concealed in the wall with deeper framing.

- Calculate the depth of floor joists required to allow for good pipe gradients and to accommodate required fixtures, such as floor waste gully traps.

Think about the water supply layout

Problems can be avoided by good planning of the cold and hot water supply layout:

- Keep pipe runs as short as possible. Pass pipes close to fixtures to minimise the number of branches and unnecessary elbows, tees and joints. Having longer pipe runs and more fixtures will reduce flow rate, increase heat losses and increase use of materials.
- Specify mains water point of entry into the building through a utility space such as a garage or laundry.
- Locate the water heating system close to where hot water is required to reduce the length of pipe runs to fixtures – longer pipe runs require more water to be drawn off before hot water is discharged. Specify a separate point-of-use water heater (such as a continuous-flow heater) for fixtures more than 6–10 m from the main water heater.
- Where possible, avoid setting water supply pipes under concrete floors. Pipework installed in locations that are difficult to access, such as under a concrete floor, must meet a minimum 50-year durability under the Building Code. Many pipe and fixture manufacturers will not guarantee 50-year durability in this situation. Maintenance is impossible, and degradation will be undetectable.

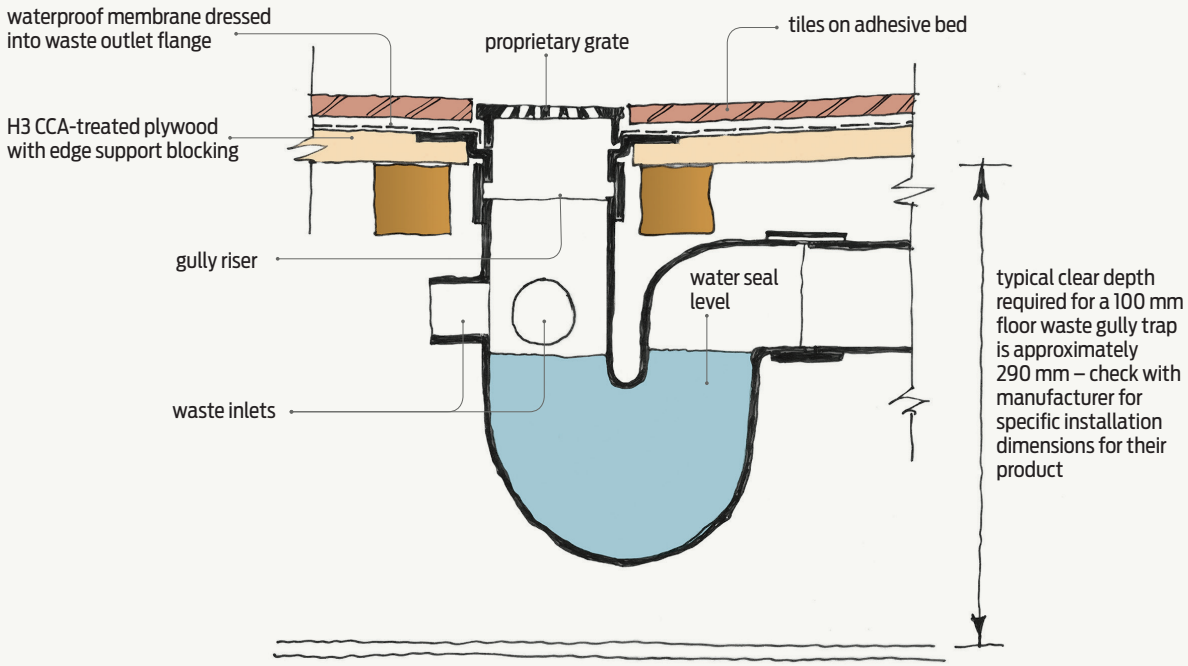

Figure 1 **Floor waste gully trap.**

- Avoid running pipes over or near bedrooms and living areas to reduce the risk of noise problems.

Gradients and floor joist depth

Check the invert level of the connection at the property boundary to ensure that sufficient fall can be incorporated within the site.

The minimum permitted gradient for any graded 100 mm discharge pipe is 1:60. To find the actual fall in mm per metre required, divide 1,000 by 60 (16.6 mm/m). Make allowance for bends, junctions and fixtures such as floor waste gully traps.

For example, if a 100 mm discharge pipe offset between floors is required to travel 3.5 m to a toilet, how much clear space is required?

DN 100 mm pipe outside diameter	=	110 mm
3.5 m travel @ 1:60	=	58 mm
Allowance of offset bends	=	100 mm
Total	=	**268 mm**

Looking at the joists supporting an upper floor, standard 250 mm joists would not be deep enough. The space required may be significantly greater if a floor waste gully is specified.

Remember, this is just the minimum. It is best to design gravity discharge and sanitary pipelines at greater than the minimum gradients. Increasing the gradient can significantly increase the load-carrying capacity of a sanitary or discharge pipe. The pipe will also run cleaner due to the higher water velocity, meaning less maintenance and reduced potential for blockage.

Floor waste gully traps

Floor waste gully traps (Figure 1) are prudent in all bathrooms, especially on upper floors, but again, sufficient depth for them must be considered

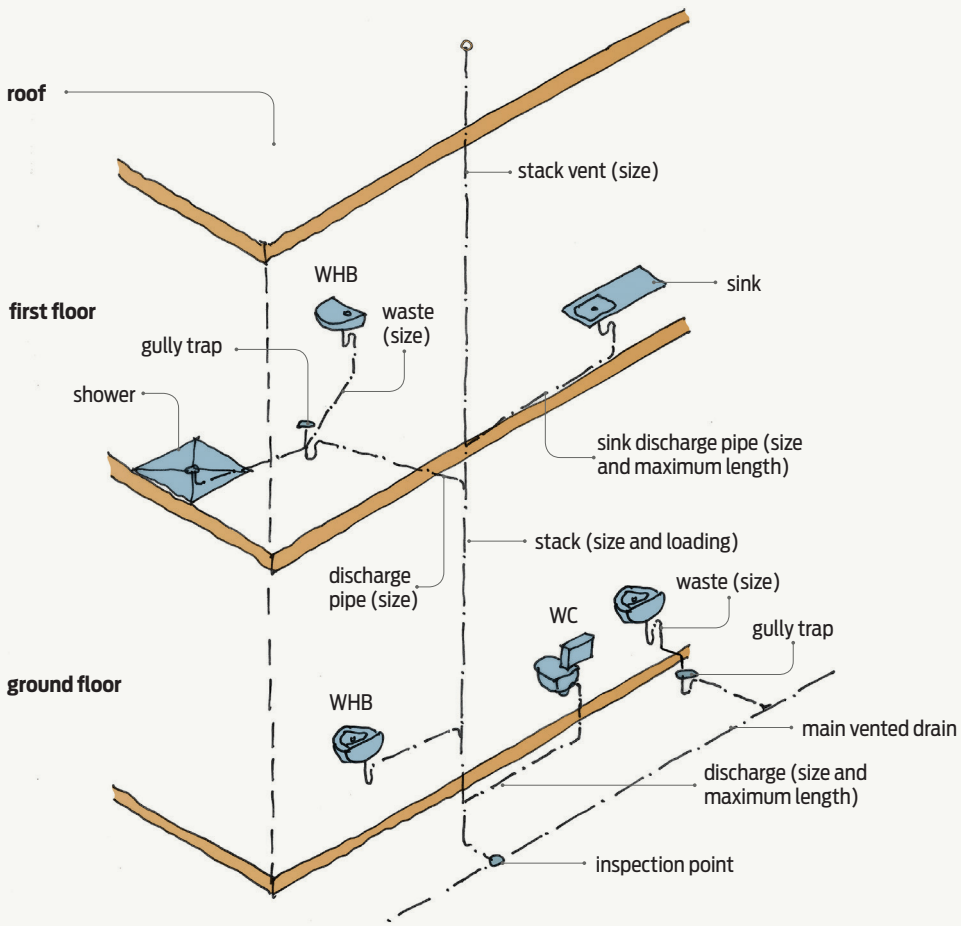

Figure 2 **Schematic drawing showing sanitary plumbing vent in a 2-storey house.**

at the design stage. The clear depth required for a 100 mm floor waste gully trap can be around 200–350 mm. Check with the manufacturer.

These traps act as a floor drain while also receiving connections from wastewater fixtures in the same room. The rules around positioning and sizing these traps are set out in AS/NZS 3500.2. Advantages of floor waste gully traps include:

- fewer connections needed to the discharge pipe
- shorter length of wastepipe
- overflow protection
- easy cleaning.

Drainage, sanitary plumbing and venting a 2-storey house

Upper-floor plumbing fixtures normally discharge to a soil stack. The single stack option (Figure 2) is the simplest and most economical to install. Each fixture discharge pipe connects to the stack. There are restrictions on the length of individual pipes, so distant fixtures must be vented separately. The stack should be straight without offsets, with a few fixtures relatively close to it.

Fully vented systems and modified versions can be specified if fixtures are more widespread but are likely to have higher material and labour costs.

Include maintenance access

Access points must be planned for and installed in sanitary plumbing systems at points where blockage is likely, such as discharge pipe junctions or at the base of a stack where it meets the drain. Proprietary rodding points, access covers and clean-out fittings can provide a neat flush-finished access point.

Plan the work sequence

Once all the decisions are made, carefully planning the sequence of work is also important. For example, exterior wall penetrations must be formed before the wall cladding is installed so they can be correctly finished to the wall underlay with flexible flashing tape. If necessary, a sleeve can be installed first, with pipes installed in the sleeve later.