

# Water Leaking at the Basement Wall

Addressing the Universal Building Issue





## Introduction

Australia's diverse built environment is under heavy pressure from population and economic growth. The majority of Australians—nearly two thirds—dwell in major cities and other urban areas.<sup>1</sup> As of 31 December 2022, Australia's population was 26,268,359 people; an almost 2% increase from the previous year.<sup>2</sup>

With rising urban densities, building height restrictions and owners looking to add value to their property, the inclusion of basements and other habitable below-ground spaces in new builds is quickly becoming common practice throughout Australia. Due to this trend, there is now a greater demand for effective waterproofing design and installation solutions that will ensure the success of projects for all parties involved.

Water leaking at the basement wall, including the wall and wall-to-slab footing junction, is an all-too-common issue in modern buildings. It is a significant pain point for building owners and occupants from both a health and economic perspective as this type of water ingress can contribute to sick building syndrome, the growth of mould and mildew, damage to stored equipment and decreased property values stemming from decay and concrete cancer.

Architects, designers and specifiers can improve the quality and longevity of new builds by understanding the root causes of basement wall leakage and the latest design solutions that can help prevent the issue from occurring in the first place.

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Basements walls are surrounded by soil and earth that is constantly shifting and expanding as it absorbs rainwater from the ground, making them particularly prone to bowing, cracking, and leaks.













## What causes basement walls to leak?

Around 90 per cent of leaks occur because of workmanship in the application of membranes. Conventional basement structural walls consist of reinforced concrete or masonry and are subject to unavoidable cracking due to concrete shrinkage and/or inadequate structural design.

The crack widths and the cold joints at the wall-footing junctions are required to be no more than 0.1mm without membranes to avoid leakage, which is unrealistic to achieve in practice. The inadequate structural design may cause additional flexural cracks which can occur because of unaccounted ground water pressure on the walls.

Typically, ground water moves with the terrain, and seasonal and annual variations in water tables are common. Heavy rains, or an abundance of water from higher elevations, can cause the water table to rise. The rising water table is one of the main factors exerting extra pressure onto basement walls if not allowed by the design engineers.

In determining the maximum estimated groundwater table position, the designer must take into account issues such as one-off rain events, blocked or not maintained AG lines, increasing water table position due to climate change and other related factors over the life

of the structure. This is why basement walls must receive membrane systems directly bonded to the earth face of walls and the wall-footing slab junction.

The wall surface finish plays a major role in the bonding function of membranes, which can result in gaps between membranes and the basement wall. The bonded sheet membranes are commonly used on the earth face of the reinforced concrete walls, particularly when the ground water table position is considered. These applications will be vulnerable to problems, for example cases such as where a sheet membrane is attached directly over the sheet piling or shotcrete wall with the structural basement wall poured hard against the sheet membrane, which results with no bonding between the sheet membrane and concrete wall.

The waterproofing failure of these applications can be unavoidable since sheet piling or shotcrete wall will move independently to the building structure, creating a gap between the structural wall and sheet membrane. Even a pin hole in the membrane causes a leakage, which will be impossible to locate. This is the reason why seasoned specifiers require a bonded sheet membrane system (called full tanking) directly onto the earth face of the structural basement wall.

# Consequences of water ingress at basement walls

## Decay and concrete cancer

Property damage in the form of decay and concrete cancer is a common issue caused by basement water leakage. The term “concrete cancer” is used to describe the rusting of steel reinforcements within concrete. As concrete is porous, water can penetrate its surface and corrode the steel inside. The risk of water penetration increases if there are existing cracks or gaps in the wall joints.

When the steel expands as a result of the corrosion, the surrounding concrete cracks, allowing more room for water to enter. Over time, as the cancer spreads, the concrete will degrade, reducing the structural integrity of the structure.

According to research from Curtin University of Technology, corrosion may be costing the Australian economy more than \$30 billion annually, much of it avoidable.<sup>3</sup> In its final stages, concrete cancer can cause enough degradation that a structure may be considered beyond repair and should be demolished and rebuilt.

## Property damage

Water damage incidents account for almost a quarter (24%) of all home insurance claims, according to leading insurance provider QBE.<sup>4</sup> Areas like basements frequently sustain water damage as a result of flooding and water leakage. Any equipment or valuables stored in the basement can also be damaged by water.

Building materials, such as plasterboard and timber, are porous. The performance and structural integrity of such materials is impacted when they are exposed to excess water and moisture. Water damage will spread further throughout a property the longer it is left unattended. In addition to repair costs, there could also be significant replacement costs in the case of flood-inundated buildings.

## Sick building syndrome

As a result of pressure, air rises naturally from the house’s lower levels into the upper levels. When the air in the basement is too humid or full of chemical or biological contaminants, such as those that enter the interior via a basement leak, it can cause “sick building syndrome”.<sup>5</sup> The term “sick building syndrome” refers to situations in which occupants experience acute health and discomfort effects due to the conditions inside the building.

## Mould and mildew

Basement mould is often the result of a source of moisture, with basement leaks typically the primary cause. After a flooding event, buildings are often demolished not because of structural damage but because the resulting conditions mean that mould and mildew cannot be removed.

Moulds produce allergens and irritants that may cause adverse health reactions, including rashes, asthma attacks and headaches. Many of the species of mould that may exist in a basement are cytotoxic, neurotoxic, and immunotoxic, which means there is the potential to cause cell damage and impair the nervous and immune systems.<sup>6</sup>

## Compliance considerations

Under the National Construction Code (NCC) 2022, a building is to be constructed to provide resistance to moisture from the outside and moisture rising from the ground (see Clause H2F2). The NCC does not make a specific reference to a standard for below-ground waterproofing, but the British Standard—BS 8102—is a good starting point.<sup>7</sup> Under this standard, no water penetration or moisture is acceptable for habitable spaces.

In this respect, local councils’ requirements vary, but there is a trend in which councils are starting to require zero water ingress. Accordingly, habitable spaces, storage areas and critical equipment rooms in basement areas should be designed for zero water ingress under any circumstances to ensure there are no issues with building compliance or safety.

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## Solving the universal building issue

As we have explained, various factors, such as poor construction or hydrostatic pressure, can cause basement leaks either through the wall or where the wall meets the floor. Rather than remediating the problem after it has occurred, it is better to prevent it by ensuring proper wall design, construction and waterproofing practices are followed.

Dincel Structural Walling is a permanent polymer formwork system that quickly and easily snaps into place to construct all types of structural walling. When filled with ready-mixed concrete, this innovative system provides a waterproof, strong and durable protective barrier for residential, commercial and civil applications, including basements.

As a more effective and affordable substitute for conventional building materials, the industry has widely adopted Dincel's superior permanent polymer formwork system.

The new Dincel Waterproof Warranty, which includes the Dincel Wall, the Dincel Water Stop (DWS) accessory, self-compacting concrete, and an injection system, can provide up to 50 years of leak-free performance. Dincel's own construction experts supervise and manage the installation process from footing construction to resin injection. The Dincel Waterproof Warranty is also applicable to habitable spaces under fully submerged basement conditions.

## How the Dincel Waterproof Warranty helps the design and construction industry

Dincel's latest innovation offers waterproofing with DWS at the wall-footing slab junction in addition to Dincel panel joints. Dincel applies injection resin to seal the wall to the footing/slab junction after the completion of all structural works. Any leakage is visible and can be locally attended to with re-injection with no responsibility to the building owner. If property is sold, the warranty is transferrable.

In another Australian first for permanent polymer formwork, Dincel has been proven compliant with the liquid tightness requirements of AS 3735:2001 without the use of waterproofing additives in the concrete infill and with only cold joint protection.

Dincel Waterproof Warranty comes with Air Void Free Warranty as a default. Air voids can cause structural,

fire, acoustic and durability non-compliance. Dincel Waterproof Warranty means Dincel Wall panel joints or Dincel Wall-footing slab junctions are waterproof. The Dincel Waterproof Warranty requires that only Dincel Academy trained and authorised expert contractors install all aspects of the waterproofing system.

Not only is the Dincel waterproof system less costly and quicker to install than the only viable alternative (i.e. full tanking or application of a membrane or coating to the inside or the outside of the structure), if there is an issue with water leakage only one entity is accountable—Dincel. The point of water ingress is easily identifiable and re-injection from either side of the leak to stop any leak can occur without disturbing the structure.

## REFERENCES

- <sup>1</sup> Australian Bureau of Statistics. "Built and natural environments." ABS. <https://www.abs.gov.au> (accessed 19 July 2023).
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- <sup>3</sup> Curtin University. "Research shows corrosion costs the local economy." CU. <https://www.curtin.edu.au/news/media-release/research-shows-corrosion-costs-the-local-economy> (accessed 19 July 2023).
- <sup>4</sup> QBE Insurance. "Water damage insurance claims remain high despite more Aussies working from home." QBE. <https://www.qbe.com/au/media-centre/press-releases/water-damage-claims-remain-high> (accessed 19 July 2023).
- <sup>5</sup> Basement Health Association. "Understanding Sick Building Syndrome." BHA. <https://basementhealth.org/understanding-sick-building-syndrome> (accessed 19 July 2023).
- <sup>6</sup> Alexander, Helen. "Can basement mold make you sick?" Live Science. <https://www.livescience.com/can-basement-mold-make-you-sick> (accessed 19 July 2023).
- <sup>7</sup> Note that a revised BS 8102 was updated in 2022 to reflect newer materials and practices.

All information provided correct as of August 2023