White Set Plaster Report

A report by Master Painters & Decorators Australia into problems with white set plaster walls in the Western Australian building industry

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Executive Summary

The Western Australian building industry urgently needs to address a serious problem that has emerged over the past eight years.

The problem is the frequent occurrence in new homes of white set plaster walls that are soft, crumbly or easy to crack instead of being hard and durable.

This affects at least 2000 new homes every year. The six-year period allowed for complaints about new work means Western Australian builders could be liable for defective white set plaster in a minimum of approximately 12,000 homes at any given time.

Homeowners and builders tend to think painters are responsible for the problem because they are last tradespeople to touch the wall. The result is that registered painters with high levels of skill and training are having to deal with unfounded accusations of poor workmanship.

White set plaster walls are defective for a variety of reasons unrelated to anything painters do. When a defect occurs, it is often impossible to narrow the range of possible causes down to just one.

The problem is causing financial hardship and disruption for homeowners, builders and painters. In addition, many builders and painters are having to defend their reputations while engaging in protracted and expensive legal battles.

Master Painters and Decorators Australia (MP&DA) initiated the formation of the White Set Plaster Committee to investigate the problem. The Committee included representatives from MP&DA, the WA Building Commission, the WA Solid Plastering Association, building industry associations and suppliers.

The Committee conducted tests that compared the performance of paint and plaster products from three manufacturers under controlled conditions.

After considering the test results and all the factors that contribute to defective white set plaster, MP&DA has developed a comprehensive list of recommendations.

Contents

What is a white set plaster wall?

A white set plaster wall is internal wall system that consists of:

- a brick wall (the brick is often referred to as the ‘substrate’)
- a layer of cement render
- a layer of lime plaster (the ‘white set’)
- a coat of sealer
- two finish coats of paint

The construction and finishing of a white set plaster wall involves three skilled trades – bricklaying, plastering and painting – and the result should be a very smooth, hard and durable surface.

Unless all the tradespeople involved follow the correct techniques at every step in the process, failures will occur.

The white set plaster wall problem

In Western Australia, over the past eight years, many homeowners and industry professionals have complained about white set plaster walls being soft, crumbly or cracking easily.

The degree of failure is variable. Sometimes, the paint and plaster will pull off the wall with Blu-Tack, adhesive tape or even a Post-it Note. The plaster may also crush, dent or crack when pressed with a finger, break off when a vacuum cleaner bumps it, or crumble when someone drills a hole to hang a picture.

One thing all of the problems have in common is that they are not apparent by visual inspection of the finished plaster. In other words, the plaster appears smooth and aesthetically pleasing, feels hard and appears to be the result of a professional job.

Because the last tradesperson to the work on the wall has been the painter, the natural response of homeowners and builders is to say the fault lies with the painter. As a result, painters are dealing with accusations that they have applied paint to plaster that was too wet.

The scope of the problem

The white set plaster wall problem is almost completely restricted to Western Australia. In other states, almost all new houses have either brick veneer walls or solid walls lined with plasterboard.

Information from the building industry suggests there is defective white set plaster in at least 10 per cent of all new Western Australian houses. This equates to a minimum of 2000 new houses every year with the problem.

The *Building Services (Complaint Resolution and Administration) Act 2011* allows homeowners to complain about defective work for up to six years after practical completion.

This means Western Australian builders are liable for white set plaster defects in an estimated minimum of 12,000 houses at any given time.

Why white set plaster fails

Any one instance of defective white set plaster may be the result of one or more of the following causes.

Incorrect ratio of plaster to lime

The white set plaster is mixed on site by the plasterer. The mix consists of lime, plaster and water. Too much lime will create a soft plaster that is weak and therefore likely to fail.

Plasterers do not carry scales with them and although the manufacturers include instructions on the packaging, plasterers typically rely on personal experience and judgement to achieve what they believe is the correct mix. On site, plasterers need to mix 40 kg of plaster with 75 kg of lime, add the right amount of water and use the mixture within about 70 minutes.

Over-mixing the lime and plaster mix will also contribute to a weaker product.

Incorrect moisture content in the render

The render absorbs water from the plaster mix. This creates suction that is essential for a strong bond between the plaster and the render. Render that is too wet or too dry will result in too little suction.

If the render is too dry, the plasterer should wet it before applying the plaster. Sometimes they don't wet it at all or don't wet it enough. If the plaster dries too quickly, the chemical reaction between the plaster and the lime will not work properly and the mixture will be powdery.

The render may be too wet because it has absorbed moisture from bricks that got wet before the roof went on, or simply because it hasn't been given enough time to dry. Weather conditions such as humidity and wind will affect the drying time.

Incorrect moisture content in the plaster

If plaster is too wet, the sealer coat will not adhere properly. This will lead to paint blistering or peeling and when it does, plaster may come off with it.
If the plaster is too dry, it will be weak and will crack.

Insufficient compression of the plaster

White set plaster should be trowelled (i.e. smoothed over with a trowel) three times to compress it and ensure a smooth, hard and strong surface.

Plaster being too thin

The white set plaster should be a minimum of three millimetres thick to give it strength and so it can absorb, and bond to, the paint. If the plaster is too thin, the paint goes through the plaster into the render.

The West Australian Solid Plastering Association *Specifications Guide for Solid Plastering* stipulates the following process:

> *Application of the finishing material shall be applied in three (3) continuous layers to a minimum three (3) mm of thickness.*
>
> *(1) A thin scratch coat- make sure surface is completely covered and any minor depressions are filled.*
>
> *(2) An application coat- good second coat of one to two millimeter in thickness, being the body of final finish.*
>
> *(3) Laying down coat- with plaster on the trowel the flattening and filling of any minor blemishes to the wall surface.*

Additives in plaster

Additives such as Calair are products that make bricklayers' mortar easier to work with. These products 'fatten' the mortar by creating small air bubbles. Although they are not intended for any other use than bricklaying, some plasterers use these additives in white set plaster. When the plaster dries, the air bubbles create millions of small voids that weaken the plaster.

Uneven brickwork

Uneven brickwork means the cement render will have inconsistent thickness. This leads to uneven rates of drying and may mean the render has cracks or other imperfections.

Lack of cement in the render

Too little cement creates a render that lacks strength and is prone to failure.

Excessive lime in the plaster mix

Too much lime creates a soft plaster that has reduced cohesive strength and is prone to failure.

Industry practices that contribute to the problem

Although it is difficult to quantify, there is compelling anecdotal evidence that 'real world' factors are the underlying cause of poor practices that lead to failure in white set plaster. They include:

- A trend for builders to sell painting as part of the home package price. This may result in walls being painted while still too wet for paint to adhere. In contrast, when a homeowner arranges painting separately after the purchase, the walls have more time to dry.

- The pressure on builders and building supervisors to control costs and finish jobs quickly. This causes them to impose time and cost constraints on plasterers. In order to comply with these constraints, plasterers may do one or more of the following:
    - render the walls while the bricks are still too wet
    - plaster the walls while the render is still too wet
    - apply plaster in layers that are too thin
    - float the plaster fewer than three times

  Any of these on its own will contribute to a substandard white set plaster wall. When they occur in combination, the result will be worse.

- A tendency for builders to lock up houses sooner than they would have done in the past, which is another result of the pressure to finish jobs quickly. A locked-up house prevents air from flowing freely and drying out the walls.

- Skill shortages caused by the mining boom.

- Poor supervision. This may the result of time pressures, skill shortages or both.

- Modern home designs that lack the ceiling and wall ventilation of older homes. Reduced ventilation means less air flow, which means walls take longer to dry.

- Working practices. Typically, one team of tradespeople will float the wall and another team will set the wall. This means each team is paid to complete its part of the job and has no interest in the quality of the finished wall. In addition, they may use different batches of render or plaster, within the same house, therefore providing a variable quality of finish.

Testing for defects in white set plaster

Defects in white set plaster usually only become apparent after the wall has been painted. Usually, there is no way to tell whether white set plaster is defective just by looking at it.

This means the only real way to find out whether a white plaster wall is defective is by destructive testing. This is usually inappropriate in a new home and is also expensive.

As the following table shows, there are a number of ways to test whether a white set plaster is suitable for painting. None of them, however, meet all three criteria of being conclusive, suitable for on-the-job of testing and recommended in *AS/NZS 2311:2009 Guide to the painting of buildings*, which is the recognised standard for the painting industry.

Test	Comments
Applying and removing clear sticky tape to test for powdery plaster.	This is recommended in *AS/NZS 2311:2009 Guide to the painting of buildings* for unpainted surfaces only. It should not be used to confirm the soundness of a plaster wall as a whole. There is no objective measure or guideline for this test.
Applying and removing strong packaging tape to test for strength	This is recommended in *AS/NZS 2311:2009 Guide to the painting of buildings* for unpainted surfaces only. It should not be used to confirm the soundness of a plaster wall as a whole. There is no objective measure or guideline for this test.
Scratching with fingernails or a hard object to test for hardness	This is recommended in *AS/NZS 2311:2009 Guide to the painting of buildings* for unpainted surfaces only. It should not be used to confirm the soundness of a plaster wall as a whole. There is no objective measure or guideline for this test.
Using a durometer to test for hardness.	This test is not practical for a general painter because the cost, which should not be their responsibility, is prohibitive.
Using a moisture meter to test for moisture content.	There is no standard for the acceptable level of moisture. The unofficial guideline is 10 per cent but factors such as the type of measuring device and its calibration can affect the result.
Using pH test strips to indicate whether the plaster has cured sufficiently.	These are inconclusive because they measure surface pH only.

Treating a defective white set plaster wall

There is no safe and satisfactory treatment for a defective white set plaster wall.

While it is possible to strengthen white set plaster by using a phosphoric acid wash, the result will always be sub-optimal.

In addition, phosphoric acid is a dangerous chemical and using it introduces an additional time-consuming step into the process to fix a defect that should not exist.

The consequences of defective white set plaster

The consequences of defects with white set plaster are expensive and far-reaching. They are often also extremely disruptive to the lives and finances of the homeowners who generally discover they have a problem some weeks or months after they have moved into and furnished their new home.

The only way to rectify a problem is to completely remove the white set plaster from the wall and then apply a new white set. Then, the wall will need to be repainted after the appropriate drying time.

There may be storage costs while furniture and other possessions are moved out of the house, or even the cost of a rental property.

In the event of a dispute, the homeowner may take legal action against the builder, who in turn may take action against the painter or plasterer. The cost and time involved in defending those actions, may take months or years and create additional stress on all parties involved.

If the builder dies, becomes insolvent or goes out of business within six years of completion of the home, the homeowner will need to claim on Western Australia's mandatory Home Indemnity Insurance (HII), which the builder should have arranged. However, HII does not apply to some multi-storey multi-unit developments and retirement villages that are intended to be leased.

The White Set Plaster Committee investigation

A White Set Plaster Committee consisting of representatives from the, Master Painters and Decorators Australia, WA Building Commission, Builder Associations, Plastering association and other building industry stakeholders including suppliers investigated the reasons why white set plaster walls fail and to recommend changes to the building industry that will eliminate the problem.

The committee met formally on five occasions between June 2014 and March 2016. During 2015, it conducted the tests described below.

The test process

The tests were conducted at the Jandakot premises of MPA Skills and were designed to objectively compare the performance of plaster and paint products from different manufacturers.

The purpose of was to confirm whether the current recommendations in Standards Australia *HB 161-2005 Guide to Plastering* and *AS/NZS 2311:2009 Guide to the Painting of Buildings* were sufficient.

A cement rendered wall was divided into five vertical panels that were plastered with white set plaster mixed with different proportions of lime and plaster as follows.

- Panel 1 – as per the ratio typically seen in problem sites with soft white set plaster
- Panel 2 – as per the ratio in Standards Australia *HB 161-2005 Guide to Plastering*
- Panels 3, 4 and 5 – as per the instructions provided by the three manufacturers

The wall was then divided horizontally into seven sections across the five panels. Six sections were painted with two primers each from three manufacturers. The seventh section was a control that had a phosphoric acid treatment. This meant there were 35 different surfaces including five control surfaces.

Two coats of a standard water-based acrylic were applied over the primer coats and control.

Then the whole system allowed to cure for 30 days before testing.

Four tests were conducted on each of the 35 different surfaces;

- Testing for durability by applying a 50 mm high-strength packaging tape over an incision, leaving it on for less than a minute, then pulling it off. This was a good empirical indicator of the cohesive strength of the paint and white set plaster composite.
- Testing for hardness with a durometer.
- Testing for moisture content with a moisture meter. This did not indicate that Panel 1 had soft plaster.
- Testing for pH. Again, this did not indicate that Panel 1 had soft plaster.

The test results

The test results confirmed that adhering to the guidelines in Standards Australia *HB 161-2005 Guide to Plastering* would result in a strong white set plaster wall.

- Panel 1 had the highest failure rate.
- For two out of the three plaster manufacturers, the lowest failure rate was when the white set plaster was mixed according to their instructions.
- Mixing plaster and lime according to Standards Australia *HB 161-2005 Guide to Plastering* and the West Australian Solid Plastering Association *Specifications Guide for Solid Plastering* produced a reasonably hard white set plaster with any of the three manufacturers' products.
- The control phosphoric acid treatment created a hard and durable finish with all ratios of plaster and lime.
- Testing for moisture content and pH were no indicator of hardness/softness or likelihood of failure.

Recommendations

After giving consideration to the results of the tests conducted by the White Set Plaster Committee, current circumstances in the building industry and the factors that contribute to defective white set plaster, Master Painters and Decorators Australia strongly recommends that:

- **The building industry develop a standard wording for a written statement that a builder must sign each time he asks a painter to paint white set plaster walls. The statement will say the builder accepts responsibility for the walls being free of defects and in the right condition for painting, and that the builder indemnifies the painter against any problems that may occur with the plaster after painting.**

- **The Building Commission adopt the plastering practices in Standards Australia *Guide to Plastering HB-161 2005* as the installation standard for the building and construction industry in Western Australia.**

- **The Australian Building Codes Board, after considering the findings of the White Set Plaster Committee, give priority to developing an Australian Standard for white set plaster walls to be called upon by the National Construction Code. This standard should include the plastering practices in Standards Australia *Guide to Plastering HB-161 2005* and the West Australian Solid Plastering Association *Specifications Guide for Solid Plastering*.**

- **The industry conduct a review of *AS/NZS 2311:2009 Guide to the Painting of Buildings* and replace the ambiguous and unclear information it contains in regard to methods for testing the soundness of white set plaster.**

- **The Building Commission introduce a more rigorous complaints process so that the wrong parties will no longer be subject to incorrect and costly claims relating to defects in white set plaster walls.**

- **Building, plastering and painting associations and relevant training providers develop and implement education and awareness programs for builders, building supervisors, contractors, tradespeople and new home buyers. These programs should address the processes involved in the construction of white set plaster walls, the factors that affect their performance and the correct procedures for painting them.**