



Plasterboard ceiling failures

The aim of this Industry Bulletin is to alert builders and ceiling fixers as to the importance of ensuring that gypsum plasterboard linings are installed in accordance with the manufacturer's specifications and the requirements of AS/NZS 2589:2017 Gypsum linings – Application and finishing.

Ceiling collapse can cause serious injury to any occupants and also damage the contents of the room. There are generally little to no warning signs that are easily noticed by home owners that a ceiling is under stress or about to fail. Homeowners expect that ceilings once installed will remain in place for the life of the home.

Background

The Building Commission recently conducted inspections of homes where large areas of plasterboard ceiling sheeting have spontaneously collapsed. In all circumstances it was apparent that the plasterboard ceiling sheeting had not been installed in accordance with AS/NZS 2589 and the plasterboard manufacturer's specifications. Whilst the cause of the failure may have resulted from several contributing factors, the one constant factor in all cases was noted to be poor application of adhesive. The 'one third fixing method' was adopted as the preferred method by industry in 2007/2008 to overcome known concerns with the conventional fixing method in use at that time.



Image 1 Full ceiling collapse to a home

Standards for plasterboard linings

Australian and New Zealand Standard AS/NZS 2589:2017 sets out requirements for the application and finishing of gypsum linings for both wall and ceiling situations in residential and commercial construction applications. Further, each plasterboard manufacturer provides guidelines on how to install their products. Generally the manufacturer's recommendations for installation for gypsum linings mimic the requirements set out in AS/NZS 2589:2017. The Building Commission refers to AS/NZS 2589:2017 along with

the applicable manufacturer's recommendations and any contract requirements when assessing installation compliance and performance of gypsum linings.

The Association of Wall and Ceiling Industries (AWCI) have produced a set of trade guidelines and information, to provide designers, builders, contractors and home owners with information on the wall and ceiling industry, including design considerations, installation, finishing, inspection, and troubleshooting. In Western Australia these guidelines can be obtained by contacting AWCI on email adminwa@awci.org.au.

Plasterboard installation

There are numerous requirements regarding the installation of gypsum linings, however upon review of ceiling failures, the Building Commission found the following issues to be the ones that require an improved level of supervision to ensure plasterboard sheeting installed over timber framing, remains securely fixed over the life of the building.

Ceiling framing members

- On completion of the ceiling framing checks need to be carried out to ensure the framing is installed true and flat. Undulations in the ceiling joists are not to exceed 4mm over a 1.8 straight edge for 90 per cent of the ceiling area, remainder 5mm for a Level 4 finish.
- Bowed or twisted ceiling joists need to be straightened or replaced to ensure they provide a flat surface and continued serviceability.
- The securing of the ends of joists must be sufficient to restrict later lateral movement. Poor connections between the joist/trimmer and wall plates can allow for future movement.
- Provide sufficient ceiling trimmers where primary joists change direction or at the wall end or in corners in order to ensure maximum permissible spans are not exceeded. Manufacturer's recommend a maximum centre spacing of 300mm between fixings (only screws or nails no adhesive) at the ends of the sheets when using a cornice finish.
- Avoid strutting beam deflections below the bottom edge of the ceiling joists that can place pressure on the ceiling sheeting.
- Ensure full edge support (framing) around all openings, including air conditioning vents.
- Ensure ceiling joists are suitable to receive adhesive. (For example, remove any dirt, if the timber framing is treated ensure adhesive is compatible with the relevant treatment system and framing is not wet or damp as the adhesive may not bond).

Fastening systems

- Ensure correct mechanical fasteners are used. It has been noted that 25mm long screws are being used to secure plasterboard sheeting to softwood substrates, whereas table 2.9.1 of AS/NZS 2589:2017 specifies a screw length of 30mm (see note 1 below table 2.9.1). It is also important to ensure the heads of mechanical fasteners are not being overdriven through the paper component of the plasterboard.

- Ensure the adhesive being used complies with AS2753. This information can normally be found on the manufacturer's product technical data sheet.
- Ensure correct amount of adhesive is placed on ceiling joists. In all ceiling failures viewed by the Building Commission it has been evident that insufficient adhesive has been used in a large percentage of the placements. AS/NZS 2589:2017 specifies a daub size of 25mm in diameter and 15mm high be applied to the framing member. The adhesive daub should fully spread across the framing member and be easily seen on both sides of the joist member after installation of the plasterboard sheeting.
- Ensure correct placement of adhesive daubs so that there is a minimum of 200mm separation from fasteners and board edges with a maximum distance of 230mm centres between adhesive daubs. Fasteners must not coincide with the adhesive.
- Ensure sufficient pressure is applied between the plasterboard sheeting and the ceiling framing as insufficient pressure can lead to a lack of bond between the adhesive and the sheeting. Where the Conventional method of fixing is utilised, ensure the plasterboard is firmly held against the framing member until the adhesive has sufficiently dried. The one third fixing method appears to provide the required pressure to hold the sheeting firmly in place.
- Adhesive daubs are only to be applied directly prior to the installation of the sheeting. The application of adhesive daubs to large areas of ceiling framing left to skin over before the sheeting is installed, will restrict the bonding of the adhesive to the board surface.

Note: When using a combined adhesive/fastener method of attachment AS/NZS 2589:2017 allows for either a "conventional spacing" or a 'one third spacing' system. The AWCI advise that the one third method of fixing has been accepted and adopted by the contracting fraternity and AWCI members as the preferred method of fixing. In all instances of ceiling collapse investigated by the Building Commission, the fixing system used was found to be the conventional spacing method.

Installation of equipment within the roof space post ceiling installation

- Ensure that the weight of ceiling insulation does not exceed the maximum total load specified by the plasterboard manufacturer, for the given wind classification. Plasterboard manufacturers specify around 2kg per square metre as a maximum insulation load placed directly onto 10mm thick plasterboard sheeting where the board is located in a N1 and N2 wind zone with 600mm spacing between joists.
- Air conditioning and ventilation equipment including flexible ducting is to be fully supported up off the ceiling framing and sheeting. (Refer AS4254:2012 parts 1 and 2 Ductwork for air-handling systems in buildings). Where ceiling framing members are cut or removed to enable the installation of air conditioning components, additional framing members will be required to be installed.

Installation of fittings onto the ceiling sheeting

- Heavy fittings such as ceiling fans, large light fittings are to be fixed to the ceiling framing and not supported by the plasterboard sheeting.

Environmental considerations – heat, ventilation and condensation

The design of a house requires consideration of a number of factors to ensure satisfactory long term performance of plasterboard ceiling linings. Adequate heat, ventilation and condensation control is required to be considered in the design process as specified by plasterboard manufacturers, so that heat and moisture do not affect the adequacy of the ceiling framing, linings and components.

High levels of moisture in a roof space can lead to joint peaking, nail popping, sagging ceilings, movement and rotting of framing timber and mould growth. When a ceiling loses one or two fixing points, this places additional stress on the remaining fixings which are not designed to restrain the additional load, and consequently can lead to ceiling failure.

The roof space above the ceiling requires sufficient air movement to enable re-evaporation of any moisture that occurs naturally or through the operation of ventilation and air conditioning systems by the occupants.

Where moist air is exhausted into the roof space from rooms such as bathrooms, laundries and kitchens, consideration must be given to the adequacy of the ventilation of the roof space. Exhausting this air to the outside of the building in all instances can help minimise any detrimental effects moisture laden air may have to the ceiling linings. Loose fitting duct covers installed over exhaust fans need to be positioned properly and adequately secured to ensure adequate operation.

Supervision and quality control

To ensure a sound long term quality installation is achieved, every part of the ceiling installation needs to be carried out to the required standard. (Note: these standards are a minimum standard and by choice can be exceeded). These requirements are clearly set out by the plasterboard manufacturers and are well referenced in AS/NZS 2589:2017. Once the plasterboard sheeting has been installed it is very difficult to assess the long term adequacy of the fixings and it has been shown that any small inaccuracies can lead to a catastrophic event that could cause serious injury to persons and great inconvenience to the home owner. The cost of the ceiling repair, relocation of the occupants and replacement of damaged household goods may fall to the builder when the cause is confirmed to be through poor building practices.

Note

This guide relates to internal residential ceilings constructed using gypsum plasterboard and not external ceilings or ceilings constructed from different sheeting materials. External ceilings including garage ceilings are required to be constructed differently to internal ceilings as they are subject to different environmental conditions depending upon the buildings location and design.

Disclaimer

The information contained in this bulletin is provided as general information only and should not be relied upon as legal advice or as an accurate statement of the relevant legislation provisions. If you are uncertain as to your legal obligations you should obtain independent legal advice.

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