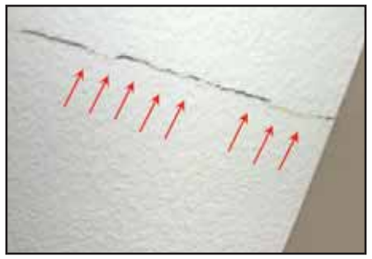
Technical Q & A

Cracking Between Drywall Joints

Why proper installation is critical to avoiding this condition.

by Agron Gjinolli, P.E. & Larry Wainright

One question that we periodically receive from builders and truss manufacturers pertains to potential causes of cracks in the drywall ceiling that run perpendicular to metal plate connected wood floor or roof trusses. These cracks are typically characterized by their appearance in the center of taped joints running parallel to the drywall panel tapered edges and/or factory seams (see photo). These cracks are primarily observed at the seams of drywall ceiling boards installed in large areas. The cracks may actually tear the drywall tape and may continue to grow over time. Furthermore, the width of the crack may vary cyclically as the seasons change.



Drywall "ridging" is the opposite phenomena to cracking and is characterized by the appearance of a small hump approximately 1/8" to about 3/8" wide, usually running along the taped joint of ceilings with longer spans. Ridging is caused by compression of the edges or ends of the finished and decorated gypsum board. This compression happens when the edges and/or ends expand during alternating periods of high and low humidity and temperature extremes.

Sometimes, both cracking and crowning appear at the same location: cracking is most common in wet months and ridging typically occurs in drier months. These problems seem to be more prevalent in homes that are built more quickly and with floor plans that provide larger open areas.

Question

Two years ago, I moved into my new home that was built during a long, cold winter. Soon after moving in, I noticed a crack appearing in the joint between two gypsum panels in the ceiling of our great room. Several repairs later, the crack continues to appear each summer. The drywall installer insists that it was a problem with the framing; the framer insists it was the drywall installer or maybe the trusses are faulty. How can this issue be resolved, and what can be done to prevent this from happening on future projects?

Answer

As is often the case, there are no "one-size-fits-all" solutions to this issue. The most obvious is to reduce and eliminate the causes of gypsum ridging/cracking (GRC). An important initial step is to properly install the gypsum product, especially in harsh climates where greater seasonal fluctuations in humidity levels occur. There are also a few remedial options that have been demonstrated to work and eliminate the incidence of GRC even when previous repairs were unsuccessful. We'll discuss these options later in this article, but first let's look at some of the factors that are known to contribute to the GRC problem.

The Gypsum Association recognizes the potential for GRC occurring due to the improper installation of gypsum products, especially when installation takes place in cold or wet conditions. To better educate installers of these products, they have published GA220-06, *Gypsum Board Winter Related Installation Recommendations,* which provides the following recommendations

- Joint treatment installation should not be installed to cold and damp surfaces, provide proper room temperatures (between 40°F and 50°F) and ventilation. Interior temperatures should be maintained at not less than 50°F for a minimum of 48 hours and the gypsum board should be completely dry before taping and finishing.
- Subsequent finishing and texturing should not proceed until previous applications are completely dry.
- The use of Propane gas-heaters is not recommended, as these temporary heat sources introduce excessive amounts of moisture into the building by their combustion and exhaust processes.
- Care must be taken when a vapor retarder is required. It is recommended that foil backed gypsum board or vapor retarder faced mineral or glass fiber insulation batts be used. When a polyethylene film vapor retarder is installed on ceilings behind the gypsum board, it is important to install the batt or blanket ceiling insulation BEFORE the gypsum board; when loose fill insulation is used, install the insulation IMMEDIATELY after the gypsum board.

In addition, the Technical Services Information Bureau (TSIB) of the Western Walls & Ceilings Contractors Association (WWCCA) states the following additional factors contributing to GRC:

- Control (expansion) joints not installed per ASTM C840.
- Use of inadequate joint compounds. In hot, dry weather a short length of joint and setting type joint compounds with shorter setting time is recommended to prevent fast drying. In wet, humid weather a setting type compound with specific drying rates based on the actual temperature and humidity should be used. In cold weather provide heat but avoid the excess localized heat that can cause joint compound to dry "too-fast" and cause cracking. Do not apply joint compounds in to cold and damp surfaces.

Proper installation of the structural framing used to support the gypsum board is also very important for minimizing the potential for GRC. The following is a list of framing issues that have been reported as contributing to GRC:

- Misaligned studs and headers around doors and windows. Joints need to be tight and with no gaps between the jack studs and the headers. Similarly, headers need to be tight against the top plate of the wall or the cripple studs above the header.
- Double top plates must be properly attached so there are no gaps between the plates.
- Gaps between the studs and the plates.
- Studs that vary in length causing uneven plates, or gaps.
- Long runs of walls or ceilings with no interruptions from intersecting walls of changes in slope. Expansion or contraction of the framing and gypsum due to changes in moisture and/or temperature is more pronounced over these longer runs and can result in cracks or ridges in seams.
- Crooked framing: Often not noticed until drywall is being attached or taped, or trim is being attached.
- Poor insulation installation. A poor insulation job can make drywall difficult to attach. Overstuffing of wall cavities, improper attachment of insulation can lead to excessive stresses in the gypsum joints.
- Use of wet lumber. Wet lumber will shrink as its moisture content reaches equilibrium with the surrounding environment.

A basic understanding of the various causes of GRC will help all parties involved in the construction project to work together to help minimize these problems.

The expansion/shrinkage of wood members in a truss is sometimes blamed as the cause of GRC. In reality, the longitudinal expansion/shrinkage of the wood

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at a glance

- Two common conditions that impact drywall are known as cracking and ridging.
- These conditions can be caused by temperature and humidity changes or insufficient framing techniques.
- The Gypsum Association and the Drywall Finishing Council have provided guidelines for trades working with gypsum board.

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caused by seasonal changes in temperature and humidity is tiny and insufficient to cause GRC under typical construction environments. For example, in Las Vegas the equilibrium moisture content of wood varies from 8.5 percent in January to 4.0 percent in June. Under these conditions, the amount of shrinkage between two fasteners spaced 12" apart would be 0.00325", the thickness of a piece of paper. Similarly, in more arid weather conditions where the equilibrium moisture content of wood can vary from 12 percent in winter to 4.0 percent in summer, the amount of shrinkage in a 12" long piece of lumber would be 0.0058".[1]

While some factors that cause GRC cannot be avoided, the GRC can be drastically reduced. The Gypsum Association (www.gypsum.org) and the Drywall Finishing Council (www.dwfc.org), offer the following recommendations.

- Significant improvement in preventing ceiling tape joint cracking and/or ridging was observed at homes that maintained the recommended environmental conditions prior, during and after application of the joint treatment.
  - Gypsum board must be thoroughly dry and at ambient temperature before application.
  - The relative humidity within the structure must be controlled before, during and after gypsum board application.
- Gypsum board must be maintained at a minimum temperature of 50°F and be dry for at least 48 hours prior to the application of drywall joint compounds, textures, and paints or coatings.
- Drywall attachment must always proceed from the center of the panel to the ends and edges. Drywall must not be attached at the corners first and then left to hang prior to the field being attached.
- A control joint or intermediate blocking must be installed where framing members change direction. Back-blocking of gypsum board joints is beneficial in preventing GRC. This is an additional cost, however it costs less than call-backs and disappointed customers.
- Control joints in interior ceilings without perimeter relief must be installed so that linear dimensions do not exceed 30' and total area between control joints do not exceed 900 sq. ft.
- Special attention to the use and placement of control joints and maintaining recommended environmental conditions before, during, and after application are all important factors in minimizing the effects of extreme weather conditions.
- Provide extra ventilation for any activities that create high humidity after the gypsum board is applied, such as the pouring of concrete basement floors.
- In cold weather, inside temperature shall be maintained between 50°F and 70°F. When portable heaters are used, the extra humidity that they produce must be removed.
- Concrete surfaces must be aged at least 60 days prior to the application of drywall joint compounds, drywall textures, paints or coatings.
- Resilient channels are recommended to avid the potential for GRC issues. Ceiling construction using resilient channels between the drywall and the framing appeared to produce the most reliable way to reduce the occurrence of ceiling cracking and ridging even in the cases when previous repairs failed.

Failure to observe these requirements, particularly in areas with extreme weather conditions, will have the potential to create a call back situation that is not always solved easily. SBC

To pose a question for this column, call the WTCA technical department at 608/274-4849 or email technicalqa@sbcmag.info.

[1] The amount of longitudinal shrinkage in a 12'-long 2x_ Douglas-Fir lumber where the difference in equilibrium moisture content between winter and summer is 8%, can be calculated using the simple formula:

$$\Delta L = L \text{ (inches)} \times \text{(Longitudinal Shrinkage Factor)} \times \text{(\% Change in Moisture Content)} = 12" \times 0.00006 \times 8 = 0.00576"$$

Longitudinal Shrinkage Factor is approximately 0.003% to 0.0067% for every 1% change in MC. Longitudinal Shrinkage Factor for Douglas-Fir lumber is approximately 0.006%.

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