Centerline Ceiling Cracking and Crowning on Drywall

by Michael D. Lundt, SE

From 1996 to 1998, the construction industry in Arizona, California and Nevada experienced one of its greatest problems with "unexplained" drywall cracking and crowning.

While ceiling joint cracking and ridging or crowning have periodically been reported as early as 1993, the unusually wet winter of 1996-1997 coincided with a dramatic increase in centerline ceiling cracking. The "unusual" ceiling cracking resulted in concern expressed by homeowners and builders alike.

Interestingly, the subsequent dry summer season that followed paralleled with a reported increase in tape joint crowning. Finally, builder and homeowner frustration reached a peak in 1997 when repairs made the previous season recracked in the winter and displayed crowning again the following summer. The construction industry, having few answers for the frustrated homeowners, was forced to take matters into its own hands.

The construction industry organized a modest voluntary budget and a large voluntary group that was used to begin fairly comprehensive research to determine the causes for the cracking and crowning. The hope was to learn enough to minimize the adverse cosmetic affects rather than simply rely on unproven varying-sometimes contradictory-opinions for a solution. Unknown to the building industry in California and Nevada, similar research and testing had already been started in 1996 by

Dr. Bob Milner and hi team at Monash University in Melbourne, Australia, where similar problems had also been reported. The research work from both groups has led to a good understanding of the causes for the cracking and crowning and has resulted in methods of remediation with good success.

Research Findings

Besides the work done by Mimer at Monash University, individual builders, material suppliers and subcontractors in California and Nevada combined resources and compiled as much data as the resources would permit. The data gathered included the following:

- Drywall dimensional studies in atmospheric controlled chambers.

- The review of years of dimensional stability testing for lumber.

- The instrumentation of at least two completed residential structures built with construction methods and materials similar to homes found to have experienced joint cracking and crowning problems.

- Drywall joint movement studies to quantify the movement required to produce a visible joint crack.

While drywall construction methods in Australia are different from those in the United States, the results and research completed in Las Vegas led to results very similar to those reported by Mimer in an article written by Dr. Wayne Sherman entitled, “Causes and Prevention of Plasterboard Peaking and Cracking”, in the January/February 1999 issue of Build.

Results and Causes

The following results were observed:

- Moisture fluctuations change some building material dimensions. The moisture content of the drywall and lumber in residences constructed during the summer months and subjected to the increased humidity during the winter were observed to have an increase in moisture content. The increase in moisture content caused all of the construction materials observed to expand, however, the framing lumber increased in length to a much greater degree than did the drywall. When the drywall was secured to wood, the differential increase in dimension caused tension to occur in the drywall, which literally pulled the drywall tape joints apart.

- The observed affects were visually reversible and repeatable. When the same

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structural system discussed above was constructed during the more humid winter and spring seasons and passed through the dry summer months, the materials were observed to shrink Since the lumber reduced in length to a much greater degree than did the drywall, compression occurred in the drywall and produced crowning at the tape joint.

- The greater the humidity extremes, the greater the observed problems. The tests found that the greater the seasonal humidity swing (summer to winter or winter to summer), the worse the cracking and crowning problems became.

- Temperature fluctuations were found to play little role. While summer to winter temperature fluctuations played some role in the movement (primarily in the drywall), the effect was generally immediate (within 24 to 36 hours after initially conditioning the home) and small (less than 20 percent of the overall movement required to generate a tape joint crack was caused by temperature).

- While the use of kiln-dried lumber in trusses produced some benefits, the use of kiln-dried lumber did not ensure that cracking and crowning would be prevented.

- While not practical in typical West and Southwest construction, there was some benefit to avoiding construction during the humidity extremes (very low humidity or very high humidity).

- Resilient channels work. Ceiling construction utilizing resilient channels between the drywall and the framing seemed to produce the most consistent reduction in the incidence of tape joint cracking and crowning, even when past repairs failed.

- Conditioning homes prior to the application of the tape joints was found to be of significant benefit.

Conclusion

Extreme fluctuations in seasonal humid-

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ity levels affect the dimensional stability of many building materials typically used in the construction of a home. Since framing lumber was found to be affected by moisture to a much greater degree than drywall or taping mud, lumber movement was understandably found to be the single greatest contributor to the cracking and crowing problem. When the field testing demonstrated the taped drywall joints are seasonally placed in tension or compression, it became much easier to discuss prevention and recognize valid repair methods.

Prevention is best accomplished by controlling the extremes in humidity (a recommendation generally considered impractical with year-round construction unless the home is preconditioned as recommended by the drywall industry). Selecting lumber, being careful to avoid lumber more reactive to large humidity swings, also help prevent problems. Finally, the use of resilient channels to isolate the drywall from the lumber movement has proven effective not only as a remedial tool, but as a preventative tool in new construction.

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About the Author

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