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How Much Curl is Acceptable in Modular Carpet and Vinyl Flooring Products

The body of this article was written by Sim Crisler, an associate of LGM and an expert in carpet tile and vinyl flooring materials. Sim is a chemist and was with Milliken Carpet for 33 years. We have added information to this issue and included vinyl flooring in it as well.

Archived on our website: [Sim Crisler's Article – Volume 47 – March 2012](#)

<https://lgmandassociates.com/wp-content/uploads/2012-03-CFR-Volume-47-How-Much-Curl-is-Acceptable-in-Modular-Carpet1.pdf>

Essentially every manufacturer that participates in the commercial market has at least one modular carpet – also known as carpet tile - product in their offering. Each of these manufacturers has discovered (sometimes painfully) that modular carpet – if it is to be successful - is not simply broadloom carpet cut into pieces but rather must be engineered literally from the floor up to be a modular product.

Planar stability or flatness has been and continues to be a significant issue for every manufacturer of modular carpet. This has been the case from the inception of this type of product. Modular carpet by definition is carpet shipped and installed as small pieces. Each piece must be capable of performing as a unit and must be engineered to be not only flat, square and stable but to also to be able to at least equal if not exceed all of the performance criteria required of carpet sold in roll form. Since each module will have four cut edges that will be butted to the cut edges of adjacent modules with none of the seam sealing or other edge protection that is required on broadloom carpet, it is imperative that tuft bind strength be excellent and that the product be cut perfectly square. Failure to achieve this will lead to fuzzy and frayed edges with use and gaps between the carpet tile.



Carpet Tile—Edge Lift



Carpet Tile—Not Cut Square

An inherent lack of planar stability whether it manifests itself as curl – defined as edges and corner of the product lifting off the substrate – or cup – defined as areas away from the edges of the module lifting – is a potential job site failure waiting to happen. These product deficiencies not only create visual issues for the end use customer but are a source of potential safety issues as well.

Planar stability issues are typically caused by differential tension levels within the product. Modular Carpets are complex multilayered constructions. The top layer is the carpet itself which, in today’s market is typically a tufted construction of some sort. The selection of the primary backing used to create the base carpet that will become modular carpet is very critical in obtaining planar stability. If the primary backing is not sufficiently stable to withstand the normal stresses associated with the manufacturing processes used in the creation of modular carpet without becoming elongated or compressed or both, curl or cup will happen over time as the primary tries to return to its original undistorted state. Below the primary is an adhesive or binder layer of some sort that secures the tufts and imparts the desired physical properties to the face. Below the binder layer the product can take a number of forms. In some cases, a layer of the backing material is applied directly to the binder. This backing material may be one of several different chemistries. The majority of modular carpet today uses some type of thermoplastic material as the backing material. A stabilization element – typically a non-woven Fiberglas fleece – is then introduced to the composite with another layer of the backing material applied. This last layer is the portion of the module that contacts the floor. Typically, this layer would be embossed to serve as the floor contact surface of the module.

In some cases, a polyurethane cushion is created as part of the process and bonded to the stabilization element. The cushion typically would have as its outer layer a felt or fleece made up of a part of the process and bonded to the stabilization element. The cushion typically would have as its outer layer a



Luxury Vinyl Plank
End and Edge Lift
Planar Stability Issues



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Lewis G. Migliore—President

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felt or fleece made up of a combination of different fibers depending on the properties desired. Regardless, this is a complex multilayered product. Any differential tension between any of these layers has the potential to create a finished product that is inherently curled or cupped. This type of differential tension can also apply to vinyl tile and plank.

Another potential source of planar stability issues is the composition of the backing material. This is true with both PVC and the other lower melting olefinic thermoplastics that comprise the bulk of the products available in the market today. All these chemistries lend themselves to the introduction of “recycled content” from either postindustrial or post-consumer sources. It is a fairly simple process to re-melt the reclaimed material and introduce it into the process stream along with the virgin material. If the process and raw materials used to obtain “recycled content” introduce elements into the structure of the backing that expand and contract in response to environmental variations that are routinely encountered by all flooring products, then the product is a ticking time bomb waiting to fail. This material will curl regardless of how well the installation contractor prepares the substrate and executes the installation.



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Some manufacturers seem to have taken the position that manufacturing modular carpet with an inherent tendency to cup or curl is not a problem. All that is needed is to engineer an adhesive that permanently secures the curled or cupped modular carpet to the substrate. The operating assumption being “Don’t worry about the curl. We’ve got our “Snot on a Screen Door Super Dooper 1000” adhesive. We’re going to glue these bad boys down so tight that they won’t even be able to think about curling”. To use a quote from a well-known college football coach who appeared on national TV every Saturday morning in the fall “Not So Fast My Friend”. The assumption that it is acceptable or even possible to use adhesive to make planar stability issues go away is fundamentally flawed. If a modular carpet or vinyl flooring product has an inherent tendency to curl, it will eventually curl regardless of the type or amount of adhesive applied beneath it. Two part epoxies, polyurethanes, extremely aggressive general purpose adhesives and even various types of contact cements have been used in an attempt to accomplish this. While these adhesives may make the curl go away for a span of a few weeks or months, the curl eventually reappears. What is left and what the end user who purchased modular carpet in good faith is now stuck with – pun absolutely intended - is an installation of modular carpet that still shows curl, but which requires the modules to be cut into one inch wide strips just to get them off the floor.

It is extremely important to remember a fact at this point that it would appear that many modular carpet manufacturers have forgotten. Adhesives in a modular carpet installation are intended only to prevent lateral movement of the modules. The effort required to peel a module from the floor should not be excessive and under no circumstances should this effort cause damage or distortion in the module being removed. When customers pay a premium for modular carpet, they have every right to expect that the installed product they receive will meet the serviceability and flexibility requirements that they bought and that should be inherent in modular carpet. The end user did not purchase broadloom with a seam every 18”, 24” 36” or whatever size the module might be.

The adhesives mentioned above are extremely aggressive and do indeed provide excellent resistance to lateral movement of the modular carpet. That being said these same adhesives- even when properly applied – often create a situation where it is extremely difficult to use the carpet as a modular product. As stated previously, even with their very aggressive tack levels, these adhesives are completely ineffective in the long term elimination of planar stability issues on products that come from the manufacturer with built in curl or cup.

On a personal note, I have been very closely involved in the development, manufacture and installation of modular carpet – aka “carpet tile” – since this product came into the US marketplace in the very early 70’s. There is very little that can go wrong with this type of product that I have not seen and/or dealt with directly. This most assuredly includes planar stability issues. As a result of having seen literally hundreds of millions of yards of properly engineered modular carpet installed successfully and performing flawlessly, the fact that the subject question is even asked and that a standard for curl in modular carpet should even be considered defies logic. This is comparable to establishing a standard for an acceptable level of rat excrement in baby food.

In the final analysis, the answer to the “How Much Curl is Acceptable” question is “Zero”. Modular Carpet should lie flat, square and stable on the floor as it comes from the box and should maintain that configuration thorough its expected lifespan.

Using this same explanation for vinyl tile and plank or any other multilayered PVC or PVC free flooring product, there should be no acceptable dimensional or planar changes. These product too, should be flat, square and stable. The product layers must be balanced so there is no inherent stress to create physical distortions. These products should not expand or shrink. They should lay flat with no end or edge lifting. Any layer in the product that is not balanced can create a physical change in the product including the application of the polyurethane wear layer. This is true for both glued down and floating floors. And the adhesive for these products will not prevent any physical change from occurring. The forces of stress in the product will exceed the adhesion properties of adhesives. To debunk any mythical comments that a manufacturer makes about adhesive creating changes in the product, this isn’t and never will be so.

Taking this further, acclimation is not always the root cause of any issues with LVT or LVP. Certainly, vinyl will expand (grow) with heat and contract (shrink) with cold. So, out of the box, so to speak, the product is inherently unstable. Which makes saying that you don't have to acclimate a product before it's installed but the space must be acclimated after installation is ludicrous. What do you think is going to happen? The product is going to seek equilibrium and react. And the flooring guy loses.

Just know that modular flooring, whether carpet tile or vinyl tile and plank must be flat, square and stable out of the box and stay that way, without exception. The installation of the product cannot change this. You only need to read industry publications to know that the industry understands it has had, has and will continue to have stability problems with these products. One of the reasons we are seeing a proliferation of new variants of these products. Variants no one knows what surprises lie ahead for them.

Instability in all types of flooring products from carpet tile, vinyl tile and plank and rubber tiles and hybrid materials are one of the biggest problems we deal with, and it seems to be getting worse. This is why it is so important to know the products you're working with, source from manufacturers who control their own manufacturing processes, and know where to get help when you have a problem with these types of flooring or any other flooring related issues.

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