SEMI-RIGID JOINT FILLER PROTRUSION / BULGING

Periodically we receive calls from joint filler installers or facility owners reporting that the joint filler is "bulging" out of the joints or protruding above the floor's surface. Depending upon the degree to which the filler protrudes and the traffic exposure, filler protrusion ranges from a temporary condition requiring little or no correction to a potential repair issue which should be addressed to ensure the long term protection of the floor joints. This technical bulletin explores the potential causes and corrective actions for joint filler protrusion/bulging.

What causes joint filler protrusion?

In basic terms, joint filler protrusion generally results from a narrowing of the joint dimension after the filler has been installed. As joint dimension (width) narrows, installed semi-rigid joint filler is forced into compression. Because semi-rigid fillers are composed of 100% solids and have minimal expansive or contractive movement abilities, filler put into compression "elongates" either downward or upward within the joint. Because semi-rigid fillers are designed to be placed at the full depth of the saw cut, structurally the path of least resistance is at the top of the joint.

What causes joint dimension contraction or expansion?

Through the years much attention has been focused on joint contraction (increase in width), largely because all saw cut joints are designed to contract and to induce a controlled crack in the panel at the joint location. Joints contract (open) during the concrete's drying process as excess moisture needed to mix and place the concrete gradually leaves the slab. This reduction in moisture leads to the panel dimension shrinking, and subsequently causes an increase in joint dimension. If a joint filler is installed prior to substantial concrete shrinkage, the result can be joint filler "separation," a void that remains within the filler or between the filler and the joint walls as the joint opens to a dimension greater than that of the installed filler. Because most filler installations take place prior to substantial concrete shrinkage (i.e. 30 days), filler separation is the most common effect associated with joint dimension changes.

But just as concrete slab panel mass can shrink with a loss of moisture, slab panel mass can also expand in the presence of an increase in moisture absorption (through the base or the surface) or through an "equalization" or redistribution of moisture throughout the slab panel. There are multiple factors that can cause or contribute to slab panel mass increase (and subsequent joint dimension reduction), including:

1. *Higher temperatures or humidity in a non-temperature controlled building or floor area*
2. *Increased moisture migration from below grade and absence of vapor retarder (barrier)*
3. *Reduced ability for moisture migration through surface (coating, densifier or higher ambient humidity) or filled joints in the presence of a vapor retarder (i.e. moisture has no place to go)*
4. *Wide joint spacing/larger panel dimensions (exaggerated dimension change at each joint)*
5. *Slab panel warping/curl relaxation (discussed in detail later)*
6. *Higher shrinkage concrete mixes (high cement content/smaller aggregate)*
7. *Joint filler installation at time of maximum joint contraction (mature floor, cold temperatures)*
8. *Changes in scrubbing operations which lead to reduced or increased moisture availability*

These are just some of the factors that can play a role in determining whether filler protrusion occurs and to what extent. On any given project, one, some or all of these factors may be contributors and it is important to determine the cause and circumstances that lead to the filler protrusion prior to taking corrective action.

METZGER/McGUIRE

P.O. Box 2217 Concord, NH 03302 • Fax: 603/224-6020 • E-Mail: specmm80@aol.com

800/223-MM80

www.metzgermcguire.com

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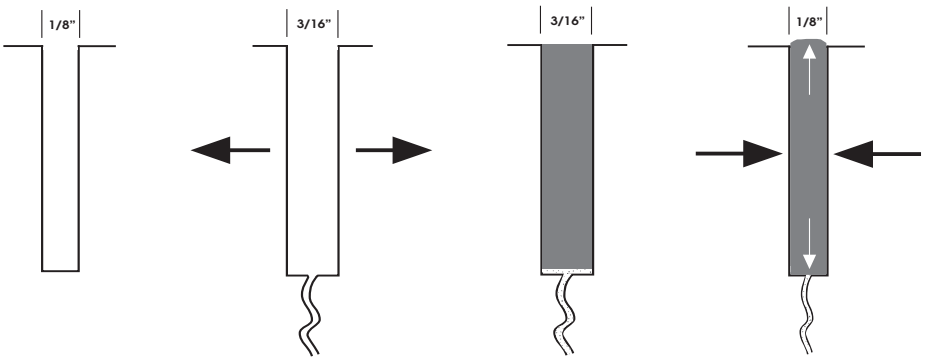
Basic Concept of the Process Which Leads to Semi-Rigid Filler Protrusion



Original saw cut made at 1/8"

As concrete shrinks, slab mass reduced joint dimension widens

Filler placed full depth

Concrete re-expands in presence of moisture, joint narrows, compressing filler

Example of bulged/protruded joint filler

Should Corrective Action be Taken?

Before any corrective action is taken to restore joint filler profile to flush, we suggest having the filler manufacturer or a knowledgeable concrete floor consultant visit the project to determine the cause of the condition and establish whether it is likely to "relax" at some point or whether the condition is more permanent and requires potential correction.

*In general, correction **should be** considered if:*

a. Filler profile is causing interference to material handling operations

b. Filler is being caught and pulled out of joint under vehicle traffic, leading to the condition worsening.

*In general, correction **should not be** performed if:*

a. Filler exhibits only slight "bulge" and is not causing operational interference.

b. Temporary environmental change are identified as cause (i.e. higher humidity levels, temporary increase in controlled building temperature, etc).

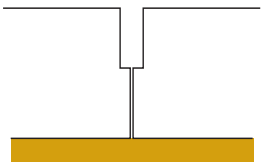
Correcting the protrusion condition is normally as simple as razoring off the protrusion to a flush profile, but depending upon the extent of the protrusion, this may later lead to a concave filler profile (exposing edges) which may also require correction. Corrective action may also be best performed during certain periods of the year (i.e. winter months, when joint dimension is at its widest).

Please contact our technical service department to discuss the conditions on your specific project.

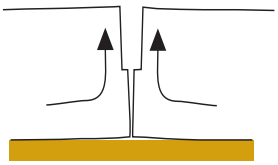
AN ADDITIONAL POTENTIAL CAUSE: SLAB WARPING/CURL RELAXATION

Recently there have been a number of technical papers and articles published by respected industry experts attributing slab warping/curl relaxation as a possible cause of filler protrusion. The basic concept is outlined below, but it is important to note that this may or may not be a contributing factor in the filler protrusion/bulging condition on your project.

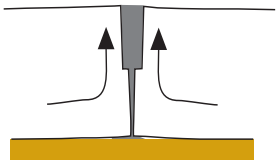
1. Shortly after concrete placement, contraction joints are saw cut plumb to induce shrinkage crack. At this time, panels are still well hydrated with water from placement mix and are resting flat on grade.



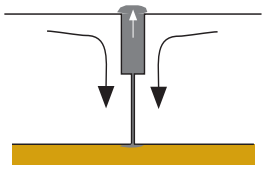
2. As excess moisture leaves slab surface faster than base, edges of panels may curl upwards, "warping" the slab panel (similar to a dried sponge). This may result in a joint exhibiting a very slightly elongated "v" shape.



3. Joint filling installation takes place at the time when the curl is still present, and self-leveling filler assumes the elongated "v" shape.



4. Under certain conditions (i.e. high temps/humidity) slab moisture content may increase or equalize, leading to a "relaxation" of the curled panel edges. During this process the top of the "v" narrows, putting the filler into compression and leading to potential "bulging" or "mushrooming."



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