JOINT FILLER SEPARATION; CAUSES AND CORRECTIONS Technical Bulletin 6

In considering all the technical issues related to the performance of a semi-rigid floor joint filler, none is more frequently identified, discussed and perhaps misunderstood than joint filler "separation." Experienced contractors and designers tend to view joint filler separation as a necessary evil and an inherent product limitation. But some contractors, and many owners, tend to initially view separation as a "product failure," which it simply is not.

Joint filler separation, and the degree to which it occurs on a given project, is nearly always the result of both design factors and construction scheduling. The American Concrete Institute (ACI) addresses the issue in detail in Chapter 9, Section 9.10 of ACI 302.1 R-04 (Guide for Concrete Floor and Slab Construction):

> *"It is advisable to defer joint filling and sealing as long as possible to minimise the effects of shrinkage-related joint opening on the filler or sealant. This is especially important where semi-rigid fillers are used in traffic-bearing joints; such fillers have minimal extensibility.*
>
> *If the joint should be filled before most of the expected shrinkage has occurred, separation should be expected between the joint edge and the joint filler or within the joint filler itself...*
>
> *... Earlier filling will result in greater separation and will lead to the need for more substantial correction;*
>
> ***this separation does not indicate a failure of the filler."***

The purpose of this bulletin is to explain the causes behind filler separation in greater detail, address possible prevention strategies, and provide recommendations for correction if separation occurs on your floor project.

CONCRETE SHRINKS!

Concrete is placed with more water than is needed to activate the cement. This water slowly leaves the concrete via evaporation through the slab surface. As the slab loses moisture content, it shrinks in linear dimension, meaning each slab panel becomes shorter over time.

JOINTS OPEN WIDER

As each panel shrinks, the joints between the panels open wider. The typical rate of shrinkage in a 150mm slab is 3mm in 6m. This means that if you have 5m panels each 3mm saw cut joint will eventually open to almost 6mm, an expansion of nearly 100%. Joints may open less or more depending on many variables (mix design, aggregate size, joint spacing, ambient temperature and humidity, etc.).

JOINTS OPEN GRADUALLY

It would be convenient if all slab shrinkage (and thus joint widening) occurred early in the construction phase, but this is not the case. Concrete shrinks very gradually since only the top portion of the slab is exposed to substantial evaporation. Most concrete experts describe typical slab shrinkage rates as follows:

First 30 Days	**Approx. 20 - 30%**
Next 335 Days	**Approx. 50 - 60%**
One Year Total	**Approx. 70 - 90%**

This means that joint filling on new slabs typically takes place long before the slab ceases its significant shrinkage. It also means that joints will widen after the filler is installed.

SEMI-RIGID FILLERS EXPAND VERY LITTLE

The function of a semi-rigid epoxy or polyurea filler is to protect joint edges from damage inflicted by hard wheel impact and/or heavy loads. To achieve this a filler must be fairly" stiff." We define this stiffness using Shore A Hardness. ACI and PCA call for fillers to have a minimum hardness of Shore A80 (comparable to a very hard rubber). Because of its stiffness, a semi-rigid filler simply cannot significantly expand in a lateral (side-to-side) manner. If it were flexible enough to expand, it would also deflect under load, and thus not provide joint edge protection .

SEMI-RIGID FILLERS WILL SEPARATE

If a filler cannot expand with the joint as it opens, the only alternative is for the filler to separate or "split." When filler separation occurs, it is neither a failure nor a defect, it is doing exactly what it was designed to do.

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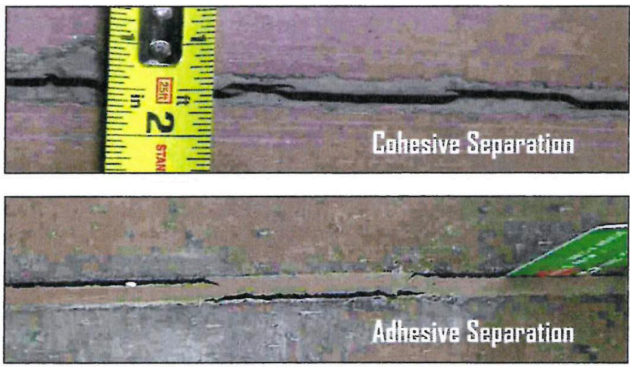
SEPARATION CAN BE ADHESIVE, COHESIVE, OR BOTH

When joints open beyond a filler's expansion capability, fillers separate. They may separate adhesively at their bond with the concrete. Or they may separate cohesively (internally). On the same job you may see both types.



Semi-rigid epoxies will most often separate adhesively, and usually in a leapfrog manner, alternating from side-to-side. Polyureas tend to separate adhesively, and usually on only one side in a continuous split.

FILLER SEPARATION CAN ONLY BE MINIMISED

Since the occurrence of some degree of filler separation is virtually a given in light of today's typical construction schedules, the focus must be on minimising the degree (width) of separation which occurs, rather than on eliminating it altogether. Some strategies for minimising joint filler separation include the following:

1. Reduce joint spacing
2. Use low shrinkage concrete mix design
3. Defer joint filling as long as possible
4. Defer joint filling until HVAC units are operational and / or building is at ultimate operating temperature

Clearly each strategy carries with it certain costs, both financially and in terms of construction scheduling. These costs should be discussed with all interested parties then balanced with the expected return on investment.

MUST SEPARATION VOIDS BE CORRECTED?

It is the consensus of the industry that separation does not necessarily compromise the ability of a filler to protect joint edges if it is "minor." The most common rule of thumb is that edge protection is still adequate if the voids are less than credit card width .81mm. Joints should be monitored to watch for more significant void widths as slabs continue to shrink.

Here are some basic guidelines as to when separation correction or partial replacement should be considered:

1. Separation void greater than .81mm
2. Joint edges exposed by separation show signs of erosion/spalling
3. USDA/FDA regulated facilities where sanitation concerns are present
4. Retail settings where voids are aesthetically obiectionable or create trip hazards
5. Filler has completely lost adhesion and is loose to the touch or is being pulled out of ioint by scrubbers or forklifts/pallet jacks

WHO IS RESPONSIBLE FOR CORRECTING FILLER SEPARATION?

Because the extent of separation which may or may not occur on a given project is an unknown, determining the potential cost of the correction prior to construction is virtually impossible. Since filler separation is a function of slab shrinkage, and is not a failure or defect, responsibility for the cost of correction should be defined in the project specifications and/or prior to the commencement of the joint filling installation work.

CORRECTING SEPARATION VOIDS

Epoxy Filler Options

1. Rake/blow separation voids clear and refill (overfill) with either the same filler or with our faster-setting polyurea **Spal-Pro RS 88**, if faster traffic access is desired. Razor off excess filler flush with surface after cure.

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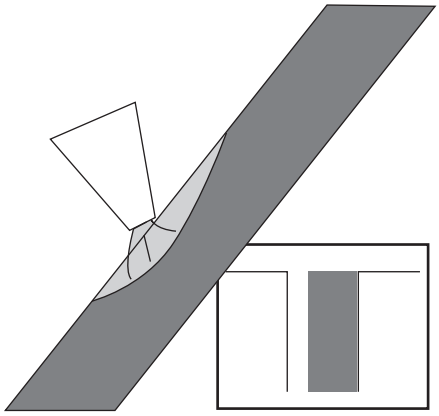
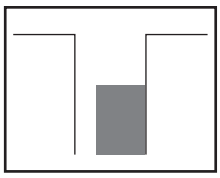


Or

2. Saw out top 12mm of epoxy using dustless concrete saw or crack chaser and refill (overfill) with epoxy or polyurea. Razor off excess filler flush with surface after cure.



While this option may use more filler than filling narrow voids, it may go faster and thus reduce labor time, in addition to leaving a more uniform finished filler profile and color.

POLYUREA FILLER OPTIONS

The best option is typically to refill separation voids with new polyurea filler as in epoxy option # 1. Most polyureas cannot be easily sawn out due to their chemical composition and may revert to a liquid or "strand" like cotton candy. Recently the industry has seen the introduction of some newer blade technologies which initially appear to make sawing out polyurea easier.

If partial removal is required, please contact our technical service department to discuss the best available options for removing polyurea fillers.

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