



A Metzger/McGuire Technical Advisory

## The Myth of "Flexible" Fillers For Industrial Concrete Floors

*We are all familiar with the adage "If it sounds too good to be true, it probably is." As many designers and facility owners have discovered too late, it pays to consider this adage when someone tells you they have a "flexible" filler that will meet **all** the needs of the joints in an industrial floor.*

### *The More Things Change...*

A recent trend among manufacturers of industrial floor joint fillers has been to label and promote their fillers as "flexible" rather than "semi-rigid," even though the characteristics of their fillers have remained unchanged. This trend seems to have developed in response to the industry's desire for a "perfect" filler- one that's flexible enough to stretch with the joint yet durable enough to support the demands of load-bearing lift traffic. If a filler matching this criteria sounds too good to be true, it's because it is. The limitations of semi-rigid fillers haven't changed, just the way they're being sold.

This technical article will discuss the difference between a truly "flexible" filler and a "semi-rigid" filler, and why you need to know the difference.

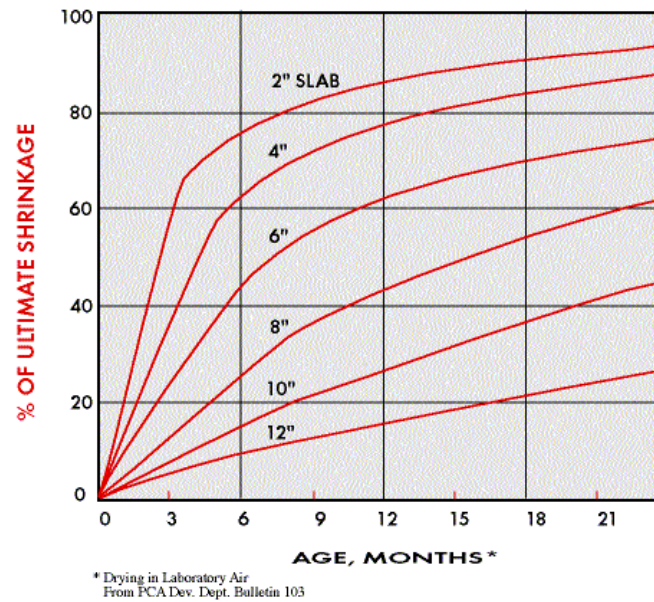
### *Understanding an Industrial Floor*

To understand the criteria for a floor joint filler, you must first understand the floor itself, and its intended use.

An industrial concrete floor is not really one floor. It is a series of smaller floor panels (usually 15'x15' or 20'x20') that are both separated by and connected by joints. There are two basic joint types; contraction (control) joints and construction (formed) joints. Contraction joints are created to prevent/reduce random cracking by inducing cracking along a straight line (beneath the joint). Construction joints are the ends of the pour sequences.

Joints almost always grow wider than they were originally created. That's because concrete shrinks. (See PCA Shrinkage Chart, below). Until all of the shrinkage has taken place, each slab panel must be allowed to shrink without restraint at the joints. Unfortunately, an industrial slab will be subjected to heavily loaded, possibly hard-wheeled material handling vehicles (MHV's) long before all significant shrinkage has taken place.

### PCA Slab Shrinkage Chart



Since MHV traffic creates the need to fill joints in the first place, it follows that joints will often need to be filled prior to ultimate shrinkage as well. What effect the timing of joint filling will ultimately have on the filler itself needs to be considered and predicted. But it's important not to lose sight of the long term function and characteristics of the joint filler you choose. Is it wise to trade off short-term flexibility for long term durability? Can the filler provide you with both properties, one, or neither?

#### *The Ideal Joint Filler*

An ideal joint filler would be a material that would achieve three basic functions;

1. Allow the joints to open without restraint
2. Continue to totally fill the joint as it opens.
3. Protect the edges of the joint from damage (spalling) caused by the passage of hard-wheeled vehicles.

When you read a data sheet for a so-called "flexible" filler, the word flexible would seem to imply that the filler is elastic, and will stretch (expand) as the joint continues to open. In fact, as evidence of its elasticity you may notice (or be told) that the filler has a high elongation of 100%, 150%, etc. Reading further, you will likely find that the filler also claims to be sufficiently rigid to protect and support joint edges in traffic conditions. In other words, this flexible filler allegedly meets all three of the ideal filler characteristics. Here's where the adage comes into play.

#### *The Myth of the Flexible Filler*

##### Avoiding Restraint

There are two ways a filler can avoid slab panel restraint; by stretching with the joint or by separating either adhesively or internally. Flexible fillers imply they stretch (expand) with the joint.

##### Expanding with the Joint

Flexible filler data sheets and the product's representatives are quick to point out their high elongation. But joints don't elongate; they open laterally, side-to-side. Thus, the elongation percentage can be misleading. The real questions to ask are;

1. How much, by percentage, will the joint open.
2. What percentage of opening (expansion) can the filler handle before separation.

A general rule of thumb for conventional slabs is that they will shrink 1/8" in length every 20', in both directions. Therefore, if you start with 1/8" wide joints at 20' centers, each joint may open to an eventual 1/4" width, a 100% expansion. You can reduce this 100% if you use a low water cement mix and closer joint spacing. And if you delay the filling long enough for some of the shrinkage to take place, you can also reduce the amount of expansion that the filler must achieve to perhaps 25%. But can a flexible filler with a hardness of Shore A 75-100 achieve even 25% expansion? The answer is almost assuredly NO.

Look at a data sheet for a highly elastic polyurethane "sealant," a product whose only function is to achieve maximum expansion. These sealants are half as stiff (Shore A 35-45), yet they state they can accommodate only about 30-40% expansion, if they are installed with a controlled depth. The common width/depth ratio is 1:1 or 2:1. Thus, to accommodate 30-40% movement, these soft sealants must be installed only 1/8" to 1/4" deep. If they are installed deeper, this expansion capability is proportionately reduced. Considering the limited expansion of a soft, shallow sealant, can you really expect a twice-as-stiff filler installed 1" or 2" deep to expand 20-30%? No.

### *Joint Edge Protection*

Now we must deal with the third criteria for an "ideal" filler. The flexible filler data sheet says the product will protect joint edges from hard wheel damage. As verification, it cites its hardness of Shore A 75-100. But this raises an important question: if this filler is soft enough to stretch as the joint opens, won't it also deflect under load? The answer is clearly yes, it will.

Consider this; the product manufacturer (or applicator or distributor) is telling you that the product is both hard and soft at the same time. This is the myth of flexible filler, and why they truly are "too good to be true."

### *What ACI and PCA Say*

Since 1978, both ACI (American Concrete Institute) and PCA (Portland Cement Association) have established the standard criteria for joint fillers for industrial concrete floors. They both call for a filler to be a "semi-rigid epoxy with a minimum hardness of Shore A80. First, note that they say "semi-rigid," not "flexible" or even "semi-flexible." ACI and PCA understand that there is a difference. Second, refer to the recently published ACI 302.1R-96 (Guide for Concrete Floor and Slab Construction). This document states that "if the joint should be filled before most of the slab shrinkage has occurred, separation should be expected between the joint edge and the joint filler, or within the joint filler itself." In other words, ACI tacitly acknowledges that a proper, supportive filler won't adequately stretch with the joint. Third, the use of Shore A hardness readings was established in the 1960-70 era (by Metzger/McGuire). At this time, the material handling industry was not producing 10,000 lb. vehicles carrying 5,000 lb. loads on 4" diameter solid wheels. The criteria for joint fillers in future years will need to expand its description to include compressive resistance, etc.

### *Conclusion*

We hope that as a result of this technical article you will view filler claims with a little more caution and skepticism than before. We will continue to provide you with updated knowledge as the floor and filler industry change. But the adage "sounds too good to be true" remains as valid as ever. Please feel free to contact us should you have any questions concerning joint fillers for industrial concrete floors. We will continue to give you the best, unbiased answers we can.