The concept of Industrial Floor Joint Fillers

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METZGER/McGUIRE "LEADING THE WAY IN FLOOR JOINT TECHNOLOGY"

INTRODUCTION

This article is Norton Construction Product's metric version of the article that has long been considered the basis for ACI's and PCA's endorsement of semi-rigid epoxies for joints in industrial floors subject to hard wheel traffic.

FORWARD

The primary function of a floor joint filler should be to fill the joint space and support the joint edges to prevent spalling.

Good floor joints don't just happen. Traditionally, the treatment of joints in industrial and warehouse concrete floors has been either totally ignored or done by selecting the sealant haphazardly. Yet incorrectly treated joints will cause premature deterioration of even the best industrial floor.

In numerous floor inspections across the USA, it has been found that approximately 90 percent of all floors have spalling at the joint edges. (NB. The C & CA reports that joints are also the major problem in Australia). In many cases when the problem is pointed out, one of the following responses is given:

"Don't worry about the joints; the spalling is only minor"

"Forget about the joints; there is no way to prevent them from spalling"

These responses indicate either a lack of knowledge of concrete or an unwillingness to expend a little effort to help the client and the industry.

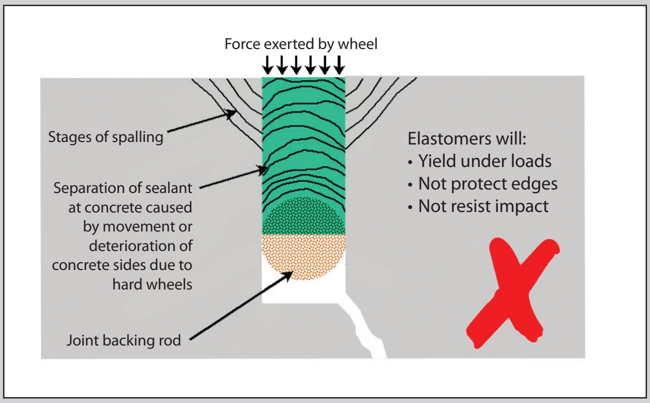
To rebut the first of these common statements, there is no such thing as a minor edge spall; there are only major edge spalls in early stages of development. Spalling never gets better with neglect; it only gets worse

If not corrected when first detected. To rebut the second statement, joint edge spalling is not inevitable. It can be reduced or even prevented if the requirements of industrial floor joints are understood and the filler is tailored to the specific needs.

JOINT MATERIALS IN CURRENT USE

Numerous floor inspections have revealed a wide variety of joint fillers and sealants in use, including paraffin, fiberboard strips, portland cement mortar, asphaltic sealants and even residential grade latex caulks. The two products found most frequently are soft elastomeric construction sealants such as polyurethanes and polysulphides on the one hand and extremely rigid high strength epoxies on the other. All of these products have a common element: They were designed for purposes other than use in industrial floors and were merely put in the floor to fill the joint. They do not meet the unique requirements of an industrial floor joint.

Figure 1 – Elastometric gives no joint edge protection



ELASTOMERIC SEALANTS NOT USEFUL

Elastomeric sealants are relatively soft (Shore A20-45), flexible like rubber bands and may have side-to-side expansion capability of 20-50%. This expansion is achievable only if a width-to-depth ratio of approximately 2:1 is maintained. As the term sealant would apply, their function is to seal joints – against water, wind, dirt, etc. None of these attributes are of much value for new industrial concrete floors supporting hard wheel traffic.

While floors can have small seasonal movement due to temperature changes, the most significant movement a joint will ever encounter is opening due to initial shrinkage of the slab. This shrinkage occurs over a period of more than a year, and it is not unusual to see joints widen from their initial 3mm (saw cut) to 5 or 6mm. These are 66% and 100% moves respectively. No elastomeric can handle the expansion.

Even if one could, it could only do so by being 1.5mm deep (remember the 2:1 depth ratio). Delaying the sealant work to allow some of the shrinkage to occur makes obvious sense. But we have not yet addressed the major shortcoming of elastomeric sealants.

Even if we filled the entire joint with an elastomeric sealant, it would still deflect as hard wheel vehicles cross over. The result would be broken off joint edges, a process called spalling. This brings us to the second common mistake in joint treatment.

HIGH STRENGTH, RIGID EPOXIES CAUSE PROBLEMS

In the construction industry, we suffer from the epoxy syndrome: "harder plus stronger equals better". In most construction applications this equation is valid since the primary function of epoxies is to create an extremely hard structural weld between adjacent surfaces. Unfortunately, this concept is not applicable to industrial floor joints. We want rigidity of edge protection, but we don't want to structurally weld the parts of a slab together since the entire reason for a control joint is to permit shrinkage induced movement and to accommodate the anticipated cracking of the concrete.

If an epoxy with high adhesive and tensile strength is used to fill the joints before they have reached their full width caused by shrinkage and contraction of the concrete, the superior strength of the epoxy will transfer the stress back to the less strong concrete. The likely result will be the development of random cracks in the concrete parallel to the joint lines or elsewhere in the slab. We now have two surface interruptions instead of one.

Another shortcoming of high strength, rigid epoxies is that they may not have high impact or abrasion resistance. If they do not, when they are subjected to the constant pounding of hard-wheeled traffic, some epoxies can become brittle and crack while others may develop surface crazing or dusting. In addition, such rigid materials permit the shock and impact of hard-wheeled traffic to be transferred to the concrete itself and cause the edges and joints to deteriorate.

DESCRIPTION OF A SUITABLE MATERIAL

If we eliminate both elastomeric sealants and fully rigid fillers, what is left? The answer is a unique material to meet the unique needs of new industrial floors. The chart below identifies the criteria of how each can be met. The result is a compromise material, acknowledging the given characteristics of new concrete and adapting to them as best we can.

A description of such a material would be:
"A pourable, non-priming, two component epoxy filler which is field mixed and installed full depth in sawn joints. When cured, the filler would be a semi-rigid, rubber like bar with a Shore hardness of approximately A80-90"

A PERFECT FILLER?

As the word compromise implies, the described filler is less than perfect. No product can be perfect, given the imperfections of concrete itself. Accordingly, filler separations is no more a failure of the filler than shrinkage is a failure of concrete. Separation is normal and to be expected.

Figure 2 – Don't use high strength, rigid epoxies if all drying shrinkage has not yet occurred

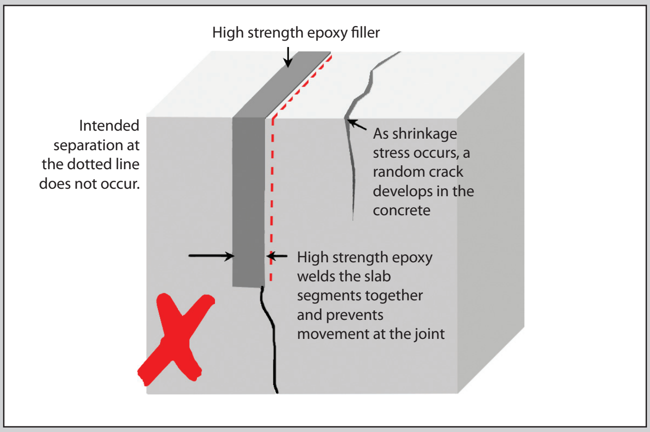
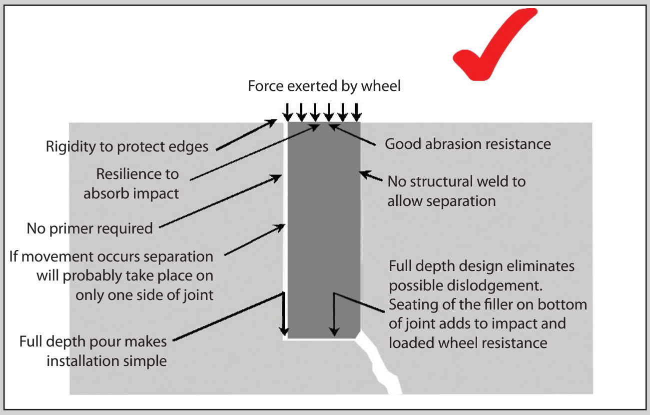


Figure 3 – The semi-rigid epoxy floor joint filler concept employs the basic elements shown



CONCLUSION

The selection of the proper filler is critical to the durability of any industrial floors. Floors have joints, joints will deteriorate unless adequately protected. The ultimate goal of a filler should be to restore the floor to an uninterrupted surface. Semi-rigid epoxies can achieve this to a large degree if they are installed as late as possible and of high quality. Do not be misled into believing that a semi-rigid epoxy can be both expansive and deflection resistant – both hard and soft. As with concrete, there are no miracles yet.

REQUIREMENT OF AN INDUSTRIAL FLOOR JOINT FILLER	HOW REQUIREMENTS CAN BE ACHIEVED
• Good abrasion resistance • Moderately low adhesive and tensile strengths (to prevent structural welding) • Impact resistance (ability to stay in position under loads) • Reasonably simple installation procedures • Eliminate size or shape considerations by making material a pourable liquid that hardens in place • Sufficient rigidity for edge protection • Resiliency to help absorb impact of hard wheels • Prevention of brittleness, crazing and dusting • Controlled cure time to ensure early access (by other trades or owner)	• Use an epoxy • Material is formulated so that adhesive and tensile strength are lower than those of the concrete itself • Fill entire joint, thus allowing base of joint to provide resistance to load forces • Eliminate primer since adhesion is not a major factor • Use hard rubberlike material with Shore A hardness of approximately 80-90 • Use two component liquid filler with chemically induced cure (epoxies usually offer the most controlled cure time)

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