Joints – the Key to Floor Durability

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

This article was written to help the reader understand the critical function joints play in determining the long- term durability of a conventional industrial floor. To achieve this objective, it is necessary to change your perception of what floors are, what joints are, and why floors and joints should always be considered together.

SLABS + JOINTS = SYSTEM

The floor in a typical industrial building is not a "floor" at all. In actuality, it is "many" floors. Consider a 90,000 square metre floor: construction joints at 50 m and intermediate joints at 5 m; making 5 m x 5 m grids. Each joint, by formed edge or induced crack, creates a break in the floor. Thus, there are really 3 600 separate slabs, divided by and linked by joints. Ideally these 3 600 slabs will work in unison as if they were one floor. Joint design and construction alone will determine this.

Joints do more than just break a floor into smaller masses. They also create interruptions in the wearing surface. Since a material-handling vehicle cannot cross the slab without crossing over joints, joints are also transition points. You cannot, therefore, treat floors and joints as separate items. Joints must be considered as an integral part of the "floor system".

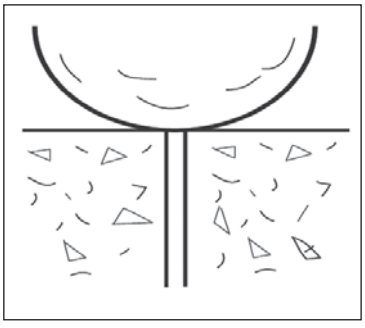
FUNCTION DETERMINES JOINT DESIGN

The function of an industrial floor is to serve as a work platform, supporting the movement of material handling vehicles carrying raw materials or merchandise. Floors that are smooth and interruption-free allow optimum movement and productivity. Joints serve several functions within floors: they are the ends of pours; they induce shrinkage cracks to follow straight lines; they allow for seasonal slab expansion/ contraction; and they provide the linkage between smaller slab segments. To accommodate all these functions, joint design must incorporate the four following principles:

1. Narrowness **3. Load Transfer**
2. Plumbness **4. Protectability**

Narrowness

Narrowness is a common sense issue. Narrow joints offer less exposure to hard wheels than wider joints. Narrow joints cost less to protect, depending on the joint design. Accordingly, we are advocates of 3 mm diamond blade cuts, or the use of early- cut saws such as the SOFF CUT®.



Joints should be kept as narrow as possible.

When considering joint width, consider that the joint will never again be as narrow as the day you create it. This is due to concrete shrinkage. As a rule, most concrete shrinks 6 mm in 6m. How wide a joint ends up will depend on its original width, the mix design, and joint spacing.

Plumbness

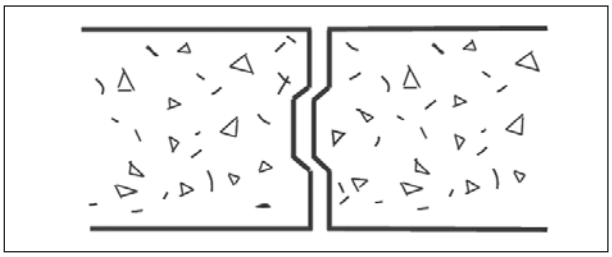
Any joint created out-of-plumb is a potential problem. If the angle is significant, it creates an overhang condition that will soon be broken off by heavy loads. We oppose the use of insert-type control joints for this reason. All too often the inserts end up angled due to difficulty in the insertion of a thin strip into aggregate-loaded concrete (and displacement during subsequent finishing operations). We advocate saw cutting control joints which results in joints are plumb.

Load Transfer

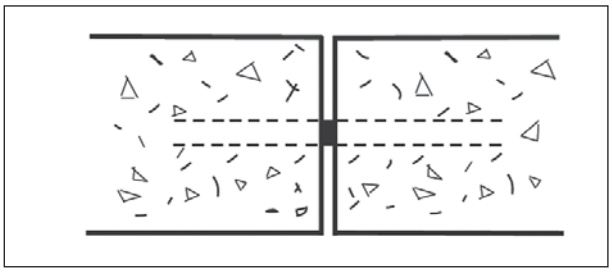
Earlier we stated that the best floor is one where all the small slab segments work together as if one. We are primarily addressing the effects of heavy loads crossing joints. If one slab segment drops under load, the edge of the opposite segment is exposed to wheel impact. Ideally, adjacent segments should work together and support each other. This support, or linkage, is called load transfer.

CONSTRUCTION JOINTS

Construction joints create a total separation between slab segments, and thus each segment may move independently unless we provide a form of linkage for load-transfer purposes. For years, the keyed joint was a common means of load transfer. But keys usually prove ineffective once the joint opens due to



Keyed joint.



Doweled Butt joint

normal shrinkage) or the slab edges curl upward. When either of these common phenomena occur, one or both slab panels may deflect under load and shear off the key, eliminating any load-transfer.

The best assurance of positive load transfer at construction joints is the use of Diamond Dowels. Dowels with proper thickness, length, spacing, alignment, and installation provide the necessary linkage between slab segments. They are best used in conjunction with the BetaStrip Permanent Shutter.

CONTROL JOINTS

The purpose of a control (contraction) joint is to guide the expected shrinkage crack in a straight line by weakening the slab on that predetermined line. A saw cut is the most common type of control joint. Below the joint a crack will form, winding its way around the large aggregate. This is called aggregate interlock, and it is a form of load transfer. Aggregate interlock can be an effective means of load transfer if we take proper precautions. For example, we need to keep the joint from opening too wide. This can be accomplished by using smaller joint spacing (4,5m centres instead of 6 m) and minimizing shrinkage with a leaner concrete mix. Larger aggregate Saw Cut also enhances aggregate-interlock Control Joint capabilities. We stated earlier that a rule of thumb is that conventional concrete may shrink at a rate of 3 mm in 6 m. Thus, for heavy duty floors, the use of PermaSleeve dowel cages should be considered to ensure positive load transfer.

Protectability

A joint is an interruption in the floor surface, and is thus an impact point for hard wheels. Hard wheels will break off the edges of unprotected joints, a process called edge spalling. There is one single best method of preventing edge spalling—fill the joint to restore surface continuity.

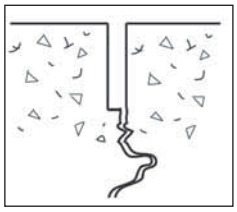
To be effective the filler must support loads without deflecting, thus supporting the joint edge. A saw cut provides the most protectable joint since the filler is in full contact with the edge.

In the past tooled joints were common. But the major problem with tooled joints is that they expose the filler to probable deterioration. The filler flares out at the top and tapers to zero thickness at its outer point. When the joint opens, this thin filler web will be broken off by wheeled traffic. Once that occurs, concrete edge damage will quickly follow.

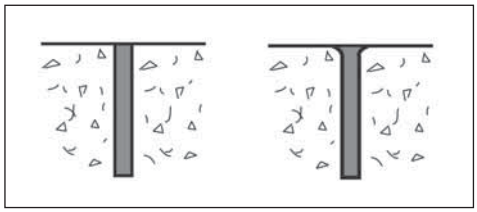
If a joint must be tooled as part of the finishing process, then we recommend coming back later and saw cutting the tooled joint. The cut should be as narrow as possible 3 mm. Saw cutting creates both a reservoir for the filler and helps remove any weak joint edges.

JOINT FILLERS - THE CRITICAL EDGE

The joint filler used to fill your control and construction joints is truly the critical edge in providing and maintaining durable, efficient industrial floors. Having discussed proper joint design, one would think that filling is a relatively simple topic. Not so. But, it is a common sense topic. Much of our literature is



Saw Cut Control Joint.



Avoid tooled edges.

dedicated to educating designers, owners and contractors on how to select the proper joint filler and how to ensure it is installed properly.

UNDERSTANDING INDUSTRIAL FLOOR JOINTS

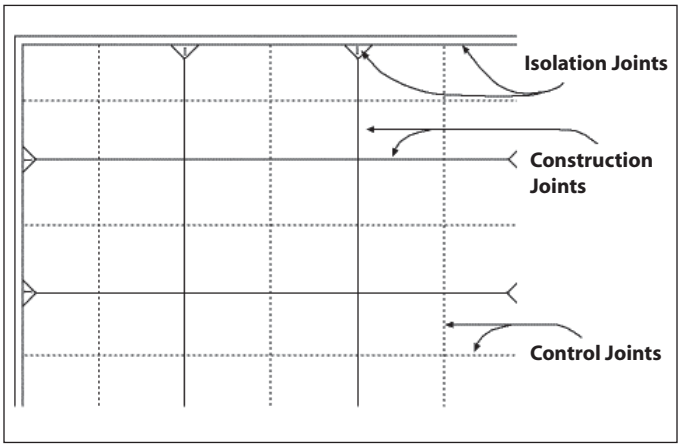
In a typical industrial building floor there are usually three types of joints:

1. **Isolation Joints**
   These joints separate building components (walls from slab, column diamonds from slabs, etc.) Isolation joints are also called expansion joints.

2. **Control Joints**
   Usually saw-cut joints between column lines, these joints help control random cracking.

3. **Construction Joints**
   Usually formed joints, and usually on column lines, these joints are the ends of pour sequences. These joints are sometimes also saw-cut.

A typical floor plan may look something like this:



PROPER TREATMENT OF JOINTS

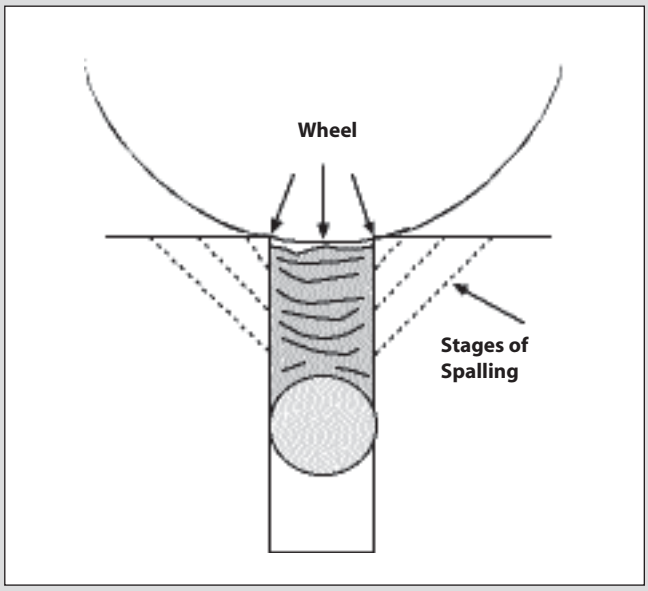
The proper treatment for isolation joints is to seal them with an elastomeric "sealant" such as a polyurethane. These highly flexible materials will expand/contract with the joint as it moves.

The proper treatment for control and construction joints is different. These joints will be subjected to material handling vehicle traffic (forklifts, pallet jacks, etc.). When joints are subject to such traffic, we want to "fill" them, thus protecting the joint edges

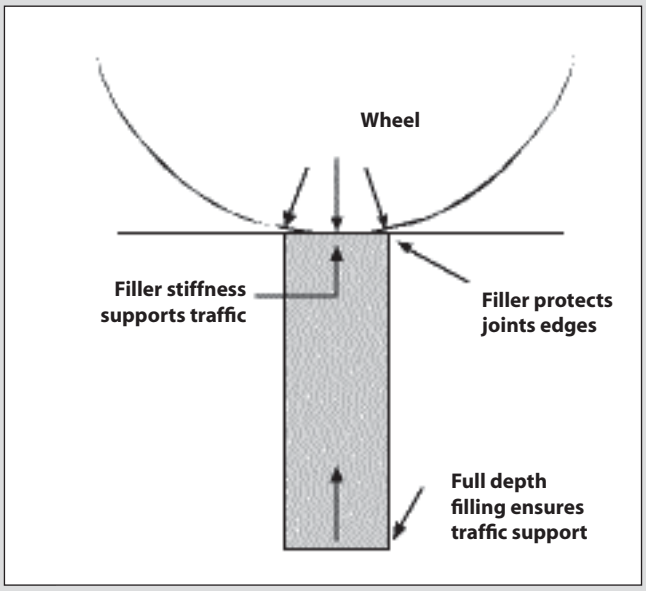
from being broken off (spalled). The proper filler is a semi-rigid epoxy joint filler such as Metzger/McGuire's MM-80 or Edge-Pro XL.

We strongly encourage you to investigate and educate yourself fully on joint filling issues through our literature and contact us anytime you have questions or concerns regarding joint filler selection or installation issues.

Sealants DO NOT support traffic



Semi-rigid epoxy floor joint fillers prevent spalling, when installed properly!



ADDITIONAL TECHNICAL PUBLICATIONS

Available from Norton/CLF

A series of comprehensive technical sheets covering all aspects of joint filler properties and installation;

- **The Concept of industrial Floor Joint Fillers**
- **How to Specify industrial Floor Joint Fillers**

- **The Myth of Flexible Fillers**

Industrial floor joint fillers are sometimes sold on the basis that they can accommodate extreme movement and adequately deflect load. This article examines the balance between movement and load deflection and debunks the myths about products that claim to achieve both.

- **Concrete Floors... Path to Productivity**

Your concrete floor is your primary work surface. Defects in your floor are costing you big $$$ in lower productivity and greater expenses in vehicle maintenance and repair. See how much a defect really costs.

- **Cracks and Deteriorated Joints**

Why did your last floor crack so much? Why did your joint edges deteriorate to the point that your vehicles are suffering excessive wear? Here are the causes, and how you can prevent them.

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