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Problem Joint spalls

Spalls that occur adjacent to joints in floors, slabs, or pavements.

Causes

The direct cause of joint spalling is loading at the joint. The indirect cause is poorly constructed joints that don't adequately support the loads applied to the concrete. The net result is a pavement or floor that will not meet the long-term requirements of the owner.

Metzger (Ref. 1) lists four commonly used joint systems or fillers that can lead to spalling of joints in industrial floors:

- *Left-in-place metal keys.* These products are frequently used to construct shear keys in floors to transfer vertical loads. However, as the concrete shrinks over time and the joints open, a portion of the keyway becomes unsupported. Loading of this unsupported concrete causes cracking and spalling parallel to the joint.

The ACI committee on cracking (Ref. 2) reports that any untied keyway can cause joint spalling. As the joint opens, a cantilever is created (in the upper portion of the female side of the joint) that will ultimately crack and spall.

- *Plastic crack-inducing strips.* If the plastic strips designed to induce shrinkage cracking at joints aren't plumb, they have the same effect as metal keyways. Often these strips end up out of plumb due to concrete finishing. Over time a cantilever is formed on one side of the strip. This cantilever will ultimately fail.
- *Elastomeric joint fillers.* While elastomeric joint fillers may do an excellent job of keeping water out of joints (if the fillers remain bonded), they are too soft to support traffic across the joint. When the joint is loaded, the sealer compresses and there is nothing to support the face of the concrete in the joint.
- *High-strength epoxy fillers.* Using a joint filler with too high a strength prevents the joint from doing what it was originally intended to do—accommodate some movement caused by shrinkage and temperature changes. If the joint is tightly bonded by an inflexible epoxy and the concrete changes volume, a crack often forms next to the joint. The concrete between the crack and the joint is likely to spall.

When dowels are used to transfer loads across joints, they also must be installed properly. If dowels are allowed to bond to both sides of the joint or are bent or misaligned, cracking and spalling can result.

In some climates joint spalling can occur if debris enters a joint while the joint is open in cold weather. When the weather turns hot and the concrete expands, the debris prevents movement and causes a compressive-stress buildup that results in joint spalling.

Joint fillers are too soft to support traffic across joints in industrial floors.

Prevention

The best prevention for joint spalling is to construct joints properly. Measures to take include:

- Avoid the keyway pitfalls described above.
- Install load-transfer dowels parallel to the slab surface and to each other.
- Cut joints as soon after placement as is practical but not so soon as to cause raveling or other damage.
- Fill sawcut joints full depth with a semi-rigid epoxy. After the concrete has had a chance to shrink, make provisions for a second, touch-up filling.
- In superflat floor construction, minimize the number of transverse joints by using more reinforcing steel, and locate construction joints under storage racks.

References

1. Steven N. Metzger, "Better Industrial Floors Through Better Joints," CONCRETE CONSTRUCTION, August 1988, pp. 749–752.

2. ACI 224.3R-95, "Joints in Concrete Construction," American Concrete Institute, Farmington Hills, Mich., 1995.