

## ACPA Answers Cracking Questions

### How cracks form and what causes them?

Early cracking is a complex interaction of a variety of seemingly unrelated factors. When all goes well on a project, cracks form at planned locations where contraction joints are placed in the slab. For most projects, transverse and longitudinal contraction joints are made by sawing the concrete with single-blade, walk-behind saws.

For wide paving (generally greater than 24 ft or 8 m), contractors sometimes elect to use span-saws that are able to saw the full-width in one pass.

Each transverse and longitudinal saw cut induces a point of weakness where a crack will initiate, and then propagate to the bottom of the slab.

New concrete slabs crack whenever tensile stresses building up within the concrete overcome the concrete's tensile strength.



Joints control natural cracking when design and constructed properly.

The tensile stresses develop from restraint of the concrete's volume change at early ages, and restraint of bending from temperature and moisture gradients through the concrete. Early volume changes are associated with the concrete's drying shrinkage and temperature contraction.

In most cases, cracks first appear at large intervals, 30-150 ft (10-45 m), and then form at closer intervals over time. From this experience one may infer that restraint to volume change is the initial factor controlling cracking.

Studies of plain pavements with 15-20 ft (4-6 m) transverse joint spacing support this inference. These studies show that intermediate sawed joints do not crack for several weeks to months after opening the pavement to traffic. However, this may not be true on every pavement, and it may be very difficult to determine whether restraint to volume change or restraint to gradients cause the first cracks.

Unfortunately, some concrete pavements do not crack at the saw cuts and instead crack at unplanned locations. The common terms for these early cracks are 'random cracks' or 'uncontrolled cracks.' There are many reasons that uncontrolled cracks occur, and it is usually a challenging task to isolate the cause(s). However, experience in examining projects has led to identification of some consistent characteristics and causes.

For a list of typical causes of cracking, read ACPA publication *Early Cracking of Concrete – Causes and Repairs* (TB016P). To order, log-in to the ACPA members only section (to receive the member discount) at [www.pavement.com](http://www.pavement.com); call toll-free 1-800-868-6733; or fax requests to 847-966-9666. For questions about cracking, contact [Steve Waalkes](mailto:Steve.Waalkes@acpa.org) at 847-966-2272.