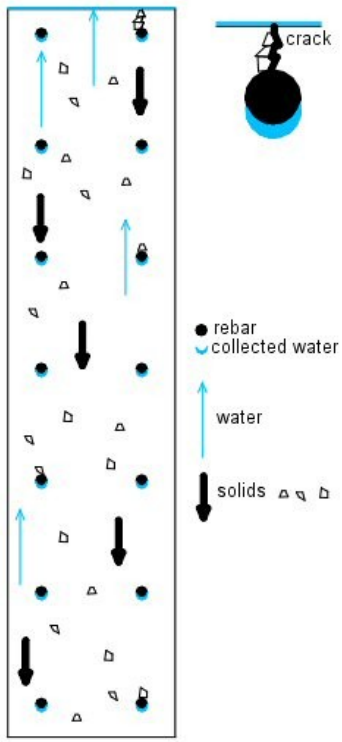
Settlement Cracks in Concrete.

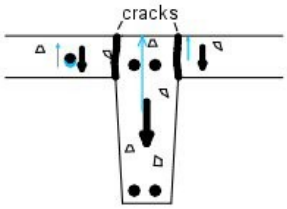
See also our other pages on cracks due to drying and thermal cracking.

When concrete is placed it is vibrated to compact it and remove air. However most concrete mixes (not waterproof concrete) will contain excess water so after the vibrator has moved on there is a tendency for heavy aggregate to sink and water to rise.



In the normally wide zone between reinforcement no structural harm occurs but where aggregate settles on horizontal bars (and any other horizontal obstruction) the settling of the aggregate is arrested while it continues beside and beneath the bar.

A void is created under the bar and, in the vacuum of air, this is filled with water drawn out from the concrete mix.
For the most part the lack of bond beneath the bar to concrete is not sufficient to create a problem (given the safety factor applied by the structural engineer).



But in 2 areas it is of very great concern:

- The topmost bars will be close to the surface and the concrete can crack down to the top bar exposing that bar to weather and corrosion in future. This happens at an early stage so the crack will be between stones and cement grout.

The greater the concrete cover the greater resistance to cracking and the shallower the concrete member the less the effect.

The simple answer, but the timing requires planning, is to go back after the vibrating poker moved on but before the concrete has set and re-compact the surface. On slabs, returning with a vibrating screed bar, tamp or float will re-arrange the topmost layer well enough

- Differential Settlement occurs where the concrete depth suddenly changes.

  Contributing to the effect are water content too high and concrete not designed to be a cohesive mix. Just ordering up a C35 is no guarantee at all that the mix will be cohesive (though a pump mix, with extra sand and cement but extra water as well, unfortunately, could be more cohesive).

  Walls, columns and beams should be poured always but only to the underside level of connecting members yet to be poured.

  Therefore walls, columns and beams are poured only to the underside of the floor going over the top. The floor might be poured on the same day but not until all settlement in deeper sections will have ceased (probably about 2 hours after placing).

Excessive water (more than 50% the mass of cement, see the information on drying Shrinkage) can be reduced by using a Water Reducing Agent and avoided using a Super Plasticiser (such as the waterproof concrete mix we recommend).

A poorly designed, uncohesive mix would let the water rise up through the concrete easily.
A well designed, cohesive mix hinders the movement of water through it.

Control Joints.

The problem with controlling cracking with reinforcing steel is that the concrete has to crack before the steel takes up the tensile strain and restricts the crack width. This still allows ingress of chemicals that might corrode or discolour and over time the joints will craze and break away at the surface.

Modern thinking for industrial floors - where cracks are possibly of greatest nuisance - is to avoid all cracks and therefore control joints. By reducing the extent of all 3 types of cracking it is considered possible not to have any control cracking and to pour up to 4,000m^3 in a day. (source: Advanced Concrete Technolgy. Processes.)

This shows how all concreting can benefit from quality and care.