GANDY AND ROBERTS
CONSULTING ENGINEERS

CONCRETE CRACKING

The expectation of a crack free concrete finish is one of the most common sources of complaint and eventual dispute on building projects.

Concrete is poured as a liquid, and gradually hardens as the result of a chemical reaction called hydration. In doing so, it loses moisture and shrinks. It is in this initial part of its life that concrete is at greatest risk of cracking. There are many variables that influence the likelihood and severity of cracking - some design related (poor detailing, insufficient reinforcement or inappropriate jointing), some construction related (poor preparation, placement, finishing and curing of concrete, poor batching, mixing and quality of constituent ingredients) and some environment related (humidity, wind, temperature).

Whilst most cracking occurs early in the life of the concrete and is due to shrinkage, concrete will also crack when subjected to tensile stresses which exceed its capacity. This occurs in flexural members (such as spanning beams and slabs) and slabs on reactive clay soils. More often than not this cracking is hidden beneath floor coverings, or above ceilings. Cracking of flexural members is not necessarily indicative of a structural problem, but if excessive, there is a good chance that the accompanying deflection of these members is causing greater problems than the cracking itself.

Further discussion is limited to shrinkage cracking, and in that context it is important to define what is a significant crack related defect and what is not. Fortunately The Victorian Building Commission have published a comprehensive guide to construction standards and tolerances which deals with the issue. We rely on this document to define acceptable and unacceptable defects. The exception to this is where a particular finish is desired, and this has been communicated by the client. Under these circumstances further discussion is needed in advance so that all parties are aware of the likelihood of success.

If a client asks Gandy & Roberts to design a polished floor and guarantee that cracking will not occur we will seek to design and detail in such a way that the risk of cracking is minimised, but cannot guarantee that it will not occur. There are just too many variables beyond our control that can cause cracking.

If concrete was free to shrink without any external restraint forces, then cracking would not occur - even in unreinforced concrete. This is an ideal state that cannot be achieved in the real world. The ground on which the concrete is poured, the walls and framing onto and into which the concrete is built all act to restrain freshly poured concrete from shrinking. Cracking is commonly blamed on insufficient reinforcement, but this is a misnomer. Reinforcement does not prevent cracking but it does restrict crack widths, and in sufficient quantity assists in causing many small cracks to appear rather than one large crack. This is usually more desirable, and is a measure of how well controlled the cracking is.

Even the most careful design and detailing cannot prevent concrete from cracking. The engineer has to find the best compromise which is compatible with the desired architectural outcome (ie. the shape and size of the building), and the more functional aspects such as the location of mechanical services penetrations, stair penetrations etc. Generally internal (or re-entrant) corners, long slender shapes and well restrained concrete elements are more at risk of cracking than others.

If the best possible concrete finish is required, there are various ways that the risk of cracking can be minimised. In addition to the best efforts of all concerned, it is important to consider courses of action to deal with a crack should it occur. The simplest repair involves filling cracks with epoxy, but the repair will be visible in a polished concrete floor, which may or may not be acceptable depending upon the desired aesthetic. Alternative floor coverings are an obvious solution, but means abandoning the original intention. More expensive options include pouring the polished concrete elements as screeds within a setdown. This method results in less restraint, and if a crack occurs the screed can always be replaced at any stage.

As with so many things, it is a matter of balancing cost against risk and final quality. The important thing is to make sure that all parties are aware of the risks and are able to make informed choices. We are well aware of these risks, and are happy to discuss strategies for dealing with them. We are also aware that it is preferable to have the conversation before rather than after the problem occurs.